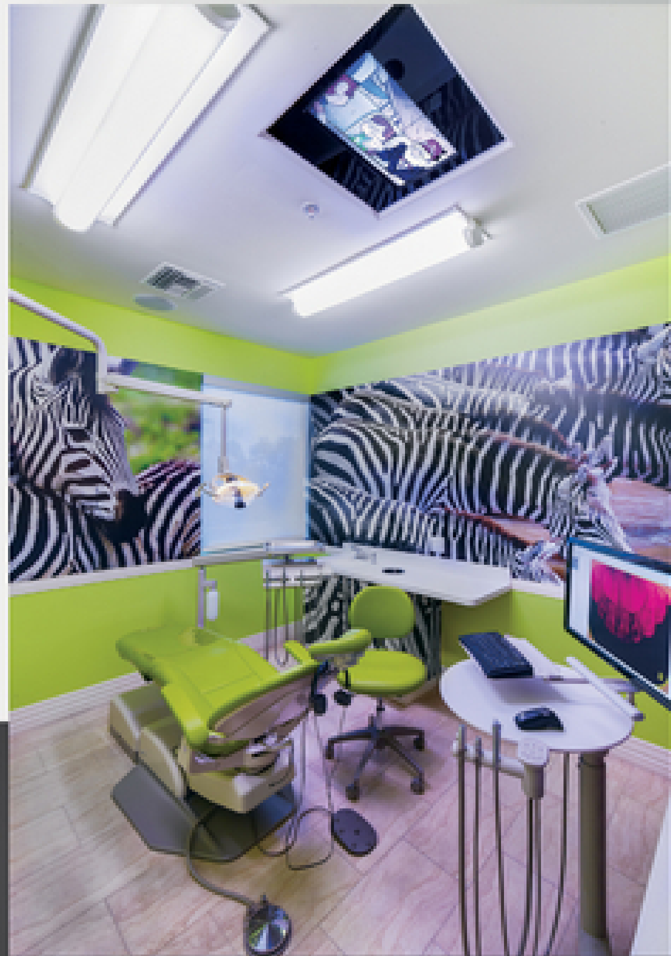
JAIN MALKIN



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FOURTH EDITION

MEDICAL AND DENTAL SPACE PLANNING

A COMPREHENSIVE GUIDE TO DESIGN, EQUIPMENT, AND CLINICAL PROCEDURES

WILEY

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In memoriam to Stuart,
for the many years of enduring patience
and encouragement as I researched
and wrote numerous books,
each time saying it would be the last

And in memory of my Mother,
whose energy and drive, love for the written word,
and intellectual curiosity have shaped my life

Finally, my affection to Gary, whose sense of humor
and commitment kept me going through
this huge endeavor (*that will absolutely be my last book!*)

Contents

Preface

In 1970, I decided to specialize in healthcare design. I spent many weeks at the library researching literature on medical and dental space planning, color and its effect on patients, and the psychological aspects of illness—how do patients and visitors react to hospitals? Why do people fear a visit to the doctor or dentist? What role does lighting play in patient rooms?

Much to my surprise, very little had been written on these topics. I found nothing in architecture or design publications but did come across an occasional article in obscure publications sometimes dating from the 1940s. There were a few articles in the *American Journal of Occupational Therapy* on the effect of the environment on the patient, and there were numerous articles on color preferences of various ethnic groups or cultural taboos with respect to color. A handful of articles on limited aspects of office space planning were scattered in medical or dental practice management magazines and Department of Health, Education, and Welfare publications. Here was a field with few resources and vast potential.

Most medical and dental offices in 1970 were either colorless and clinical or drab and dreary. There was no middle ground. Clinical offices had high levels of illumination, easy-to-clean shiny surfaces, and many medical or dental instruments in view. At the other end of the spectrum were offices designed to be less threatening with brown or beige shag carpet, residential pendant lights, nubby, earth-tone upholstery fabric to conceal soil, and poorly styled wood furniture that appeared to have been rescued from a Salvation Army truck. Dusty plants in macrame hangers often accessorized these unhygienic environments.

I concluded that I would have to do my own empirical research to gather enough data on which to base my design work. I spent the better part of a year visiting hospitals, interviewing staff and patients, and observing how patients were handled. I wanted to see the facility through the patients' eyes. I also visited many physicians and dentists and asked about their practices—what kinds of instruments they used, what size treatment room would be optimal, what kinds of changes would make their offices more efficient, and what critical adjacencies existed between rooms or treatment areas.

I documented my visits with photographs of confusing signage, waiting rooms furnished with Goodwill castoffs, dismal lighting, corridors jammed with medical equipment, and procedure rooms that resembled Dr. Jekyll's laboratory. At the end of my research, I had accumulated over 2,000 photos and reams of notes that I analyzed. From this, I formulated my design philosophy. My dual college majors, Psychology and Environmental Design, provided a theoretical background with which to interpret my findings. The culmination of my 40 years of experience designing hundreds of medical and dental offices has resulted in this book.

A person with no prior experience in healthcare design can study this book and become familiar not only with current economic and practice management issues, but also with medical and dental procedures, equipment associated with each medical or dental specialty, room sizes, traffic flow, construction methods, codes, interior finishes, and more. I have attempted to summarize my research and experience so that others will not have to follow such a laborious course of study in order to become proficient in a field that requires such highly specialized knowledge.

Today, probably more than a thousand architects and designers across the country list healthcare as one of their specialties. In its infancy when I started out, the field

has now reached maturity. No longer concerned with discovering the basic rules and principles, healthcare design specialists can devote themselves to innovation and refining what has been learned.

The first edition of this book was published in 1982 and featured exclusively my own work. However, the second (1990), third (2002), and the new fourth edition (2014) in order to give a broader perspective, include examples of work by other practitioners who are credited under each photo. I thank each of these architects, designers, and photographers for sharing their work.

The fourth edition updates the book on digital technology—electronic medical records, digital imaging, diagnostic instruments, and networked communications—and how these impact the design of medical and dental offices. The rise of mHealth (mobile monitoring and diagnostic devices) enables patients to be monitored in their homes and this has resulted in a frenzy of partnerships between software providers, device manufacturers, and companies that provide secure portals and networks for transmitting the data. Increasingly, people will be wearing unobtrusive sensors and small monitoring devices, some of which may be managed through applications on their cell phones to measure blood sugar levels, blood pressure, heart arrhythmias, and even to warn them two weeks ahead of an impending heart attack.

The milieu in which physicians and dentists practice—the impact of the Affordable Care Act (ACA), Patient-Centered Medical Homes, the baby boomer generation, the large number of uninsured Americans—is presented as a backdrop for understanding the pressures on the healthcare system, and also, implications for facility design. The influence of the ACA on clinic design, especially in primary care, can be seen in team collaboration spaces and larger examination rooms that enable multidisciplinary coordination of care. In primary care, especially internal medicine, the rise of "talking rooms" reflects recognition that patients often need not disrobe and may, in fact, feel less threatened and more comfortable in a setting devoid of medical instrumentation.

A very thorough discussion of the design of endoscopy centers is presented in this edition of the book. This includes a literature review of the risks associated with this rapidly expanding service line related to improper or inadequate cleaning of fiber-optic scopes. As I became aware of the risks, I felt compelled to learn more because people who undergo these procedures are generally unaware of the questions to ask and they (like I, before stumbling upon this research), have no idea how really difficult it is to properly clean a scope. Nor are most of us aware of the serious consequences of inadequately cleaned scopes. Because this is difficult work requiring good technique, the design of the workroom and proper lighting really help or handicap technicians in doing the job well. A functional guide to the design of the scope workroom is something that does not seem to exist. As a result of many interviews and site visits, I am glad to be able to provide this information.

A new chapter on Community Health Centers has been added, and the chapter on Primary Care has been expanded to include corporate health and wellness centers, the concept of direct care, urgent care, and integrative medicine. The patient-centered medical home is explored in-depth. Bariatric surgery has been added to the chapter on Medical Specialties. The chapter on Ambulatory Surgery Centers (ASCs) gives clarity to the interplay of licensing, Certificates of Need, accreditation, and Medicare certification. Whether an experienced practitioner or new to planning ASCs, the wealth of information contained in this chapter will enhance your understanding of economic and regulatory issues, code compliance, patient flow, infection control, and more.

Nowhere have changes in technology been more apparent than in dentistry and diagnostic imaging. These and most other chapters have been totally rewritten. Nearly 100 new or revised space plans, revised space programs for all specialties, and new photos of facilities and equipment have been added to all chapters. New developments in medical and dental treatment are presented along with state-of-the-art equipment. Fabrics and interior finishes representative of recent technological advances are introduced, and an in-depth discussion of LEED has been added to Chapter 13, Construction Methods and Building Systems. The updated lighting chapter acquaints readers

with new types of lamps and fixtures with a large section on LED lighting and innovative solutions to enhance both aesthetics and function.

A change since the last edition of this book is the rigor of regulatory agency review of office-based surgery practices, far more stringent mandatory regulation (certification, licensing, and accreditation) of ambulatory surgical centers, and interest by group practices and large managed-care organizations in seeking voluntary accreditation from one or more national organizations as well as Medicare certification. Ambulatory care enterprises such as breast care centers, urgent care, women's centers, or radiation therapy that may physically be located in a medical office building but are covered under the hospital's license, are subject to a Joint Commission survey and accreditation. This book will help clarify the roles of these various agencies and organizations, explain which aspects of the regulations apply to the built environment, and answer many questions that often arise when trying to understand compliance. I have also tried to clarify OSHA issues that affect design, which required wading through several inches of "interpretive letters" to find those kernels that impacted safety of personnel and were within the province of design professionals as opposed to policies and procedures followed by staff to protect themselves.

On a final note, although the book attempts to familiarize readers with basic code information, codes vary geographically and it is the responsibility of the architect or designer to check local and state codes, as well as the evolution of the Americans with Disabilities Act (ADA) legislation.

Acknowledgments

I offer special thanks to my colleague, architect Joost Bende, AIA, EDAC, for his invaluable assistance in revising Chapters 2 and 14, and I thank Senior Designer Connie Max (formerly with my firm Jain Malkin Inc.) for her skill and tenacity in updating space plans and in helping me to organize over 600 pieces of art—space plans, and project and equipment photos—as well as overseeing the permissions process. This was a daunting challenge, and I could not have done this without her amazing ability to focus and keep track of many details in a project that seemed like climbing Mount Everest. I also want to thank Gary Watson for his help contacting many equipment manufacturers on my behalf to obtain product photos and for his superb skill in proofreading. Thanks also to Marleen Milligan, Steve Crosley, and Gloria Mendoza for their early work on the space plans and other drawings.

I am indebted to Lee Palmer, a biotechnology engineer with over 40 years' experience in the dental field as a space planner and equipment selection consultant, for his generosity of spirit and invaluable expertise in reviewing the dental section of the book. Thanks also to dental audio/video specialist Keith Aderman, known as "Mr. Hookup," for his very detailed explanation of the full panoply of technology that may be employed in the modern dental office down to what category of cable is optimal for each modality.

Introduction: Changing Perspectives

HEALTHCARE FINANCE

Dramatic changes have occurred in the delivery of healthcare since the first edition of this book (1982), when undiscounted fee-for-service reigned. The seminal event that kicked off a series of radical changes in the traditional fee structure began in 1984, with the federal government's prospective pricing program whereby Medicare and Medicaid reimbursements were made on a fixed, flat-fee basis, rather than as a percentage of an individual physician's fee. Based upon a list of 500 diagnosis-related groups (DRGs) of procedures, the physician/provider received a flat fee, regardless of actual cost. Each DRG has a "weight" established for it primarily based on Medicare billing and cost data. Each weight reflects the relative cost, across all hospitals, of treating cases classified in that DRG. Since Medicare and Medicaid comprise a significant percent of the national healthcare budget, hospitals and physicians have been forced to take a hard look at ways to reduce costs. Following the lead of the federal government, some states also have initiated prospective pricing programs, and insurance companies have followed suit, issuing guidelines and directives, and making physicians feel that third-party payers, rather than they, are managing their patients' care.

During the 1990s, the demands of investors increasingly influenced the delivery of healthcare services as a growing number of hospitals, home healthcare services, skilled nursing facilities, and HMOs (health maintenance organizations) became for-profit entities, publicly traded on Wall Street. Investor ownership profoundly influenced the "product" of healthcare by intensifying competition, creating a focus on cost containment, reducing the autonomy of physicians, and, ultimately, reducing healthcare services to a commodity. But by 1997, healthcare stocks were performing poorly because cost containment and competition had reduced profit margins and Medicare and Medicaid had made serious budget cuts. Then came the scandals leading to the collapse of two of the most celebrated companies—Columbia/HCA and Oxford Health Plans.

Just when healthcare finance seemed as if it couldn't get any worse, it did. The Balanced Budget Act of 1997 required that Medicare expenditures be cut by $115 billion over a period of five years, placing enormous pressure on hospitals to reduce costs. During the first decade of the 21st century, there was much jockeying between insurance companies and providers to reduce costs with continual speculation about whether health reform would ever come about and, to the amazement of many—it did. The Affordable Care Act (ACA), sometimes referred to as "Obamacare," was passed during Barack Obama's administration.[1] This changed healthcare from a privilege to a human right available to all Americans. Hotly debated—yes. Only time will tell, as with Social Security and the Medicare program, if this will achieve the overarching goal of bringing better health to more people by strategically balancing access, quality, and cost.

On the insurance front, a big change in recent years has been the growth of HMO enrollment to an eight-year high of 79.5 million Americans in 2011.[2] A more detailed discussion of HMO and PPO market penetration and statistics about numbers of visits and so forth, can be found in the *Managed Care Digest* source listed in the footnote.

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[1] Social Security Legislative Bulletin Number 111-40; March 24, 2010. "The President Signs H.R. 3590, The Patient Protection and Affordable Care Act." http://www.ssa.gov./Legislation/legis_bulletin_032310.html (accessed Oct. 14, 2013).

[2] Managed Care Digest Series® *HMO-PPO Digest*, 2012–2013; published by Sanofi, Bridgewater, NJ. www.managedcaredigest.com/digitaldigests/2012_2013 HMOOPPORxDigest/files/assets/basic-html/page8.html (accessed Oct.14, 2013).

The Patient Protection and Affordable Care Act of 2010

It would be hard to find a healthcare topic that has had more written about it in the past three years than the ACA and Accountable Care Organizations (ACOs) as well. As the final touches are put on this manuscript in October 2013, there has been an hourly flurry of articles, blogs, newsletters, and the like as a response to the inauguration of the state insurance exchanges. While there are dozens, if not hundreds, of websites that seek to define the ACA and the role of ACOs, this simple description sums it up nicely: "Accountable care is a broad concept of people-centric care, where the various providers take responsibility in a collaborative or formally integrated arrangement for a specific population's health—from prevention to acute care to chronic care management."[3] The actual legislation is lengthy and complex with reforms that include rules for insurance companies, tax impacts, funding, spending, new benefits, and rights and protections for patients.

This groundbreaking piece of legislation is very much a work in progress as various provisions of it have come into play at different times with the major event—the rollout of state healthcare insurance exchanges—on October 1, 2013. Prior to this, states had been engaged in pilot programs, tweaking existing laws, and working with large healthcare systems to reshape care delivery. In 2014, 32 million uninsured Americans will have access to care, but having access to and receiving care is not the same thing. Half of these individuals will be covered by Medicaid expansion and the other half through state insurance exchanges. With shortages of primary care physicians, how will this huge influx of patients be accommodated? This remains to be seen, but there will be funding for the expansion of Federally Qualified Health Centers (FQHC), more commonly known as community health centers or safety-net clinics—entities that are already structured to offer comprehensive healthcare services in a patient-centered medical home context. As discussed in Chapter 4, community health centers are an efficient and practical model for the delivery of health and wellness.

Clearly, it is only through a major restructuring of primary care that the influx of patients can be accommodated and this has, at its foundation, a robust clinical decisions database and continual measurement of patient outcomes. This also means fundamental changes in clinic design and space planning (discussed in Chapter 3), the use of mobile health monitoring (discussed in Chapter 1) to enable people to stay at home and not have to personally visit a provider to check vitals or manage specific chronic conditions, and proactive team-based coordination of care. When providers are paid a fixed fee per capita to manage a patient's care, being able to bill for a virtual visit or responding to an email becomes a nonissue. There are so many more efficient ways of providing care and achieving better outcomes than the current system pre-2014. Innovation is occurring everywhere. Healthcare systems across the nation have been preparing for the ACA by challenging themselves to think of ways to be more effective. An example, from Chapter 7, is the Shared Medical Appointment (SMA). Harvard Vanguard Medical Associates, the largest SMA provider in the nation, established a 90-minute enhanced appointment in which a group of patients with a similar chronic condition receive care and support each other. The success of this program can be measured in patient satisfaction scores and improved outcomes. A specialized group exam room used for this purpose can be viewed in Chapter 7, Group Practice.

REGULATORY ISSUES AFFECTING PHYSICIANS

New HIPAA Rules Take Effect

The Health Insurance Portability and Accountability Act of 1996 will continue to result in changes to regulations and costs for both physicians and dentists.[4] HIPAA

[3] Susan Davis, James Proctor, and Mark Jamikowski. White paper: "The Evolution of Accountable Care: Accelerating the Transformation of U.S. Healthcare," January 3, 2011. www.kpmginstitutes.com/healthcare-life-sciences-institute/insights/2011/the-evolution-of-accountable-care.aspx (accessed Oct. 14, 2013).

[4] Joseph Conn. "New HIPAA Rules Take Effect," posted March 25, 2013. http://modernhealthcare.com/article/20130325/NEWS/303259955.

is a mandate from the federal government to automate health-related financial and clinical data to protect patient privacy. The year 2013 brought amendments to HIPAA (with a compliance deadline of September 23, 2013) that expand privacy and security to business associates that might include vendors of remote-hosted EHRs to office-based physicians or companies providing hospitals with clinical and financial data analytics.[5] Agreements signed prior to the enactment of these amendments have a one-year grace period for compliance. Another new aspect of this is that a patient who pays out-of-pocket for medical treatment now has the right to ask the provider not to share a record of that treatment with the patient's health insurance provider. This can be difficult to manage but software vendors are developing a method of blocking a specific treatment or office visit so that it cannot be transmitted. As in past years, HIPAA compliance will result in significant cost for software, compliant hardware, employee training, personnel security policies, considerable documentation, and monitoring of compliance. The use of a single HIPAA-defined administrative standard for electronic transactions, such as claims processing and verification of eligibility, has been one of the goals for a number of years.

FORCES SHAPING HEALTHCARE

It is worthwhile to revisit a couple of concepts from the Introduction to the third edition of this book (published in 2002) to see how the forecasts by knowledgeable individuals have fared.

Telemedicine

According to Kirby Vosburgh, Associate Director of CIMIT (Center for the Integration of Medicine and Innovative Technology in Boston), healthcare will be moving into the home, changing "house calls to mouse calls."[6] Internet-enabled medicine will allow patients and providers to communicate in cyberspace, listening to a patient's heart or lungs, and monitoring blood pressure via computer. Telemedicine is especially useful for clinical consultations with physicians who are located in rural areas. This is expected to reduce the number of office visits and to help manage chronic illnesses, such as hypertension, and the number of acute complications that result from poor management of these conditions. Payment for "televisits" is expected within five years, and 50 percent of physicians will treat patients online, according to a survey by the American Medical Association.

Commentary: Excellent predictions but only now slowly starting to become a reality. One can never underestimate the glacial speed at which change occurs in the healthcare system.

Medical Informatics

The use of information systems in running a medical practice and managing patient care makes a vast store of clinical data instantly available to physicians. An aggregate database of millions of clinical encounters can be accessed with powerful software programs that will even run on a palm-top PC. Currently, patients with identical conditions may receive radically different treatments from different providers, whereas the use of a prognosis "calculator" enables physicians to quantify the advantages and disadvantages of various clinical strategies, to review research findings, and to calculate drug dosages while the patient is in the exam room. Another aspect of medical informatics is the computer-based provider order entry (CPOE), which is expected to greatly reduce errors due to illegibility.

Commentary: Physicians have been slow to adopt the clinical decisions support database, perhaps preferring to rely upon their intuition, personal experience, and

[5] Ibid.

[6] Lecture by Kirby Vosburgh, Ph.D. "The Electronic Outpatient/Home Environment—from House Calls to Mouse Calls," at "Beyond 2000: An International Conference on Architecture for Health," Vancouver, British Columbia, October, 2000.

evidence-based medicine. This will no doubt be ramped up by the passage of the ACA that makes accountability and measurement of clinical outcomes essential. Many physicians with mature practices still have not adopted EHRs due to expense and having to scan years of handwritten patient records. Younger physicians are much more comfortable accessing databases and have the expectation of using EHRs. A thoughtful discussion of the issues associated with adoption of clinical decision support (CDS) and EHRs makes the case that it is not enough just to have digitized patient information without a foundation of evidence-based intelligence to enable meaningful care.[7] *The velocity of clinical information is more than any physician can manage. Just avoiding negative drug interactions can reduce visits to the ED and this information can be accessed with a click of a button if the EHR has CDS*.

Adoption of EHR

The adoption of EHR is important if real health reform is to occur in the United States because it is hard to deliver effective care that is timely, safe, and without error, and to coordinate care for individual patients, without reliance on a clinical database and the ability to electronically share data with other providers. And it is impossible to document and measure patient outcomes without an electronic system. The goal of the federal 2009 *Health Information Technology for Economic and Clinical Health (HITECH) Act* is to encourage and advance the use of informatics by providing Medicare and Medicaid financial incentives to physicians and hospitals that adopt and demonstrate meaningful use of EHR.[8]

A government study indicates that in 2011, only 54 percent of physicians had adopted EHR and 85 percent of those reported being either somewhat or very satisfied with their systems.[9] There is higher adoption by physicians under the age of 50. The breakout of the statistics is interesting.

Standalone, self-contained systems are favored by 59 percent over Web-based systems. The larger the physician group, the higher the rate of adoption with only 29 percent of solo physicians having EHR which ramps up to 62 percent for practices of 3 to 10 physicians. The following list shows the breakdown by ownership and specialty:

Breakdown by ownership:

Physician-owned	49%
HMO	100%
Community Health Center	73%
Academic Medical Center	69%

Breakdown by specialty:

Primary care	58%
Surgical	48%
Medical	54%

The New Consumer

Author's note: This topic is from the third edition of the book and is still accurate. Attempts to update the information from these same sources was not possible because SMG is no longer in business and Yankelovich has become a huge futures consulting company under the name The Futures Company, offering many tantalizing reports online only to subscribers. Price Waterhouse Coopers has become PwC and an updated report on this topic could not be found.

[7] White paper: "Elsevier Clinical Decision Support: Impacting the Cost and Quality of Healthcare," (no date provided but 2011 is an educated guess).

[8] Healthcare IT Index. "Health Information Technology for Economic and Clinical Health Act." www.healthcarenews.com/directory/health-information-technology-economic-and-clinical-health-act (accessed October 14, 2013).

[9] Eric Jamoon, Ph.D., and others. NCHS Data Brief No. 98, July 2012 (report revised January 11, 2013). "Physician Adoption of Electronic Health Record Systems: United States, 2011." www.cdc.gov/nchs/data/databriefs/db98.htm.

Much has been written about the new consumer: a more well-educated comparison shopper, empowered by the Internet, with the analytical ability to review research and form an opinion about treatment options.

Universal Beliefs

According to a study by Yankelovich Research, the new consumer has three universal beliefs:[10]

- Doctors can be wrong.
- People know their own bodies best; self-reliance is wise.
- Quality is important, and consumers want the best for less; value is being redefined.

Patients are realizing, largely due to their personal experiences with managed care—but also influenced by the media—that cost containment pressures and the complexities of the healthcare system leave them vulnerable to being ignored, being denied treatment, or being exposed to medical error unless they aggressively take responsibility for educating themselves and "managing" their own healthcare. These *empowered consumers* are a new factor, identified in a Price Waterhouse Coopers forecast of the healthcare industry (with projections to the year 2010) as the most important force behind change.[11] It, and other similar forecasts characterize Baby Boomers as "adversarial, fickle, and impatient" and point out that providers are "not prepared to serve the highly differentiated expectations of these strong-willed and knowledgeable individuals."[12]

Baby Boomers Empowered by the Internet

The explosion of Internet sites giving patients access to self-care information, journal articles, and chat rooms associated with specific diseases 24 hours a day, 7 days a week, will continue to grow. Consumers with the motivation and education to do this type of research and the ability to understand what they are reading have been arriving at their doctors' offices prepared to discuss potential diagnoses and treatment options. Some physicians may not welcome this sort of "partnership" with patients, but if the research published in the past few years is any indication, this trend will accelerate, not diminish. From the physician's perspective, valuable examination time can be squandered by having to sort through a stack of studies that may or may not be relevant to the patient's condition. Nevertheless, the new consumer's desire to "take charge" and to play a proactive role seems to be a force that physicians will have to contend with.

Responding to the Pace of Change

The oldest Baby Boomers reached age 65 in 2011. As that population continues to age, it is expected to challenge and change society's view of aging as it has changed other societal structures. The increase in the numbers of persons who have attended college will impact the healthcare system as income inequality declines slightly. (Research has shown that health status increases proportionately with educational level.) The report "Boomers and Technology: An Extended Conversation" sponsored by Microsoft and AARP, discussed in Chapter 1, will be of interest.

Even with the ACA, it is likely that tiered access to healthcare will exist. The top tier, composed of empowered patients with discretionary income, education, and the ability to use technology like the Internet will have numerous options for health insurance; the next tier, those who have access to basic health insurance through the state insurance exchanges' choice of health plans (this includes those who are temporarily employed and early retirees who have less or no discretionary income); and the third tier, comprised of the uninsured and those on Medicaid, who have little access to technology and relatively little ability to participate in decisions about their health or treatment options but now have access to healthcare through Medicaid expansion and state insurance exchanges.

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[10] A report delivered at Healthcare Forum Summit, 1998.
[11] "SMG Market Letter," (Chicago, IL: SMG Marketing Group Inc., 2000), 14(1): 1.
[12] Ibid: 1.

Disconnect between Values and Economic Reality

The sense of mission and the core values that attract many to a career in healthcare has been jeopardized by the notion that economic performance is more important than properly caring for patients. The "business of medicine" has created a corrosive environment for doctors, nurses, and patients.

According to noted ethicist Emily Friedman, every healthcare decision is both a business decision and a values decision. This has been a tug-of-war between these two polar forces. Physicians are being faced with seismic changes in a system that has served them well for a hundred years: the shift to electronic medical records, telemedicine, and medical informatics in all its forms; digital imaging; and the erosion of authority by virtue of vast medical data banks now available to consumers, not in a medical library, but in their own homes. These are tremendous cultural changes for midcareer physicians that, in the past few years, have caused many to leave private practice to join healthcare systems as salaried physicians or to join a large group practice that is able to wield more power in negotiating contracts. Recent medical school graduates, on the other hand, will be far more comfortable in this new environment.

ABOUT THIS BOOK

A Reader's Guide

For an understanding of medical practices, it is essential to read Chapter 3 first, as it is the foundation for all the specialty practices that follow in Chapter 5. Chapters on physical therapy, diagnostic imaging and clinical lab, and ambulatory surgical centers are relatively self-contained. Chapter 10, Practice of Dentistry, can be read independently of the medical chapters, although there are cross-references to other chapters on lighting, construction methods, furniture, and interior finishes.

Programming tables are provided for each medical and dental specialty to enable a design professional, physician, or dentist to calculate the approximate size of an office depending upon the number of providers and the specific specialty. For medical offices, in this edition of the book, a standard exam room has been increased from 8 × 12 feet to 10 × 12 feet, reflecting the new norm explained in Chapter 3.

Demystifying Medical Procedures

Presenting oneself as a medical space planner implies an understanding of what each medical specialist does. Yet it is hard to ask many of these questions (or even know what to ask) without appearing to lack the proper experience. Threaded throughout this book are explanations of dozens of procedures and discussions of how specific pieces of equipment are used. This knowledge leads to much more functional design and planning innovation.

A Word of Advice to Providers

Physicians and dentists should not lease office space prior to having a space planner prepare a program (list of rooms, sizes, and critical adjacencies) and a summary of total square footage required. This would be analogous to shopping for a suit of clothes without knowing what size one wears. In fact, if considering two or three alternative spaces, the fee invested in a program and schematic space plan will pay huge rewards in demonstrating which space most appropriately lends itself to your practice's needs. In fact, a smaller space with specific dimensions or a specific configuration may accommodate you better than a larger one. Signing a 10-year lease on an inefficient, awkward space can hamper your practice and be costly in more ways than one.

The Heterogeneous Nature of the Clinical Office

This book addresses a wide variety of clinical offices, from solo practitioners of primary care with one or two

employees in the front office to large group practices with dozens of physicians, medical assistants, and support staff. The latter category includes multispecialty group practices, specialists who may be accessed by referral only, and hospital-based clinics. But despite the heterogeneous nature of the clinical office as a place of work, almost all its settings have, until recently, shared in common one property: consistency of design in the face of enormous changes in the agenda of healthcare. In this edition of *Medical and Dental Space Planning*, however, at last, change can be seen as a result of the ACA. Strategies for seeing more patients and spending more, not less, time with each of them is driven by having to manage their care in a way that provides value to keep them out of emergency rooms and get them on a path to wellness or to at least be able to effectively manage their chronic conditions. This means clinical team collaboration, connection to community services, and consistent and continual follow-up with patients as part of a patient-centered medical home. This is a new agenda for physicians, many of whom are wondering how to do this with further impending cuts in reimbursement. This is a time for architects and planners to explore new models of care such as *The Ambulatory Practice of the Future*, discussed in Chapter 3. It is also an opportunity to implement evidence-based design research from The Center for Health Design (healthdesign.org).

Hopefully the information and resources introduced in this book will stimulate innovation and encourage providers to consider new possibilities, in addition to explaining the basic principles of medical space planning.

Meeting the Challenges Ahead

As physicians regroup to meet the challenges ahead, competent medical space planners will be needed, and they will be expected to be familiar with new technology, the types of medical procedures being performed, and the latest techniques and equipment. To that end, this book will be an invaluable guide.

The Office of the Actuary of the Centers for Medicare and Medicaid Services (CMS) projects that many of the 11 million newly insured individuals are likely to be younger and healthier and expected to devote a larger share of their healthcare spending to prescription drugs and physician and clinical services rather than hospitals.[13] This means an increased need for physician offices and clinics and more business for those who know how to plan these facilities.

[13] "US Health Spending Projected to Grow an Average of 5.8 Percent Annually through 2022," October 10, 2013. www.Science Codex.com/us_health_spending_projected_to_grow_an_average_of 5.8_percent_annually_through_2022-120837.

CHAPTER 1

New Directions

Primary care is undergoing a radical transformation from physician-centered practices to team-based patient-centered care. Amid the upheaval, this is spawning real innovation as healthcare organizations across the nation challenge themselves to reduce waste and provide more effective care and—most important—to document and measure health outcomes with robust IT systems. States have some leeway in determining how they wish to handle newly insured Medicaid beneficiaries and even if they wish to participate at all in the state health insurance exchange program. If they do not, Medicaid enrollees will be eligible to join through an exchange created by the federal government. One thing is certain: This is a massive undertaking and the regulations are voluminous, the "shared savings" with Medicare and Medicaid—the incentive payments for meeting the targets—are complex beyond measure, and this bold experiment is going to provide a lot of work for analysts and financial consultants. But isn't it great that people with preexisting conditions will now be able to buy insurance and the many Americans who are uninsured will now be able to buy a basic level of coverage?

When the dust settles from all the chaos, there should be huge benefits in the areas of patient safety, proactive coordination of care for those with chronic conditions, and reduced hospitalization and visits to the ED due to the focus on prevention. In theory, if patients have access to primary care, most of their conditions can be dealt with in a low-cost setting and in a timely manner, before they ramp up to requiring more expensive procedures. This will save money and reduce the escalation of healthcare expenditures. A thoughtful exploration of healthcare reform delving into specific (and often amusing) examples of the ineffectiveness of our current system will be of interest to anyone wondering about how we got to this point and how we can get better healthcare for half the cost.[1] The writing style makes it a page-turner as its author, Joe Flower, untangles the many forces that have resulted in our current system, but he ends with optimism.

ACO QUALITY METRICS

Accountable care organizations (ACOs) will be assessed by 65 quality metrics spanning five equally weighted domains: patient and caregiver experience, care coordination, patient safety, preventive health, and care for frail elderly and at-risk populations.[2]

A SAMPLING OF INNOVATION

Innovation occurs in small and large settings as can be seen in the examples below, starting with Oregon's five-year Medicaid experiment to test whether coordinated care can deliver better health at lower cost. Next, a project at the Mayo Innovation Center looks at outpatient obstetrical care and better ways to provide continuity between scheduled visits. Last, a two-physician family practice takes bold steps to redesign care with a new office that

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[1] Joe Flower. *Healthcare Beyond Reform: Doing It Right for Half the Cost* (New York: CRC Press, 2012).

[2] Rob Lazerow. "First Impressions: The Medicare ACO Program," The Advisory Board Company, April 1, 2011. www.advisory.com/research/Health-Care-Advisory-Board/Blogs/Toward-Accountable-Payment/2011/04/First-Impressions:The-Medicare-ACO-Program.

is iconoclastic in its concept and aesthetically stunning as well.

Oregon's Medicaid Transformation

The cover story in *Modern Healthcare* shouts "Kitzhaber's Gamble: Oregon makes risky bet on fixed-budget ACOs to curb Medicaid costs."[3] A year into Oregon's five-year plan, 16 Coordinated Care Organizations (CCOs) are caring for 90 percent of Medicaid beneficiaries using a patient-centered medical home model. CCOs receive per capita monthly payments for care delivered in this pilot program that is underwritten by $1.9 billion in federal funding from the Centers for Medicare & Medicaid Services (CMS). The provider organizations must include dental and mental healthcare and focus on chronic conditions, including addiction problems and mental illness. A principal goal is to transition from costly fee-for-service to a program that emphasizes primary and preventive care. This requires social workers, nurses, medical assistants, and physicians to work together to systematically keep track of complex patients to anticipate their needs and reach out to them for adjustments to medications and to get them to the clinic for preventive care. These are the patients who end up in the ER repeatedly if not closely managed.

Governor Kitzhaber negotiated a waiver with the CMS to get funding to kick off this initiative and, in return, the deal requires progress on 33 quality and access measures. The program is not without controversy from those who wonder if a capitated payment will cause providers to stint on care, and hospitals express concern that success will result in a reduction in admissions. This is a bold plan in the national spotlight. Several other states are proposing to follow Oregon's lead, and only time will tell whether it is possible to get a handle on soaring healthcare costs and, at the same time, improve the health and well-being of Americans.

[3] Joe Rojas-Burke. "Inside Oregon's Medicaid Lab," *Modern Healthcare*, September 9, 2013.

Mayo OB Nest: Redesigning Continuity of Care

A project undertaken at the Mayo Innovation Center was the study of outpatient OB care.[4] They realized that the current schedule of appointments was based on a provider-centric sense of continuity that did not address what happens between visits, and this may even be more important to patients. Looking at ways to give mothers the opportunity to tap into their own knowledge base—to be able to validate their wisdom—led to experimentation with different options. Patients were given the ability to text a nurse, and to be able to Skype in for a patient visit. They were given portable Doppler devices to be able to listen to the baby's heartbeat to help build the mother's sense of confidence. This continual feedback loop is designed to reduce the bottleneck around the scheduled appointments and allow mothers to enjoy a sense of well-being, rather than stress.

Village Family Medicine

Breaking the mold for primary care practices led the two physicians who formed this practice to examine the patient encounter to see how they could improve the patient experience. To begin with, they have a same-day appointment policy and most visits are 30 minutes from arrival to checkout. As they worked with their architects to program the space, they realized that 85 percent of patients did not need to sit on an exam table during the visit. Instead, they developed assessment rooms (Figure 1-1) that serve for everything except minor procedures or disrobing. The following functions occur in this room:

- Registration
- Check vitals (BP, height, weight, pulse, O_2)
- Immunizations, injections
- Collect patient history, discuss reason for visit

[4] Marnie Meylor. "Mayo OB Nest" (Lecture, Center for Health Design, Pebble in Practice, Chicago, IL), May 8, 2013.

Figure 1-1. Assessment examination room at Village Family Medicine, Spartanburg, South Carolina. *(Courtesy of McMillan Pazdan Smith Architecture; Photographer: Kris Decker/Firewater Photography)*

- Diagnosis: perform tests such as EKG, spirometry, tympanometry in office, and order other tests; access point-of-care databases
- Patient education: provider advice, coaching, handouts printed from EHR
- Referrals, checkout, and payment; book future appointment

The background for this project is interesting in that this medical practice is part of a large system, Spartanburg Regional Health System in Spartanburg, South Carolina, and they are also a member of Spartanburg Regional Physicians Group, a large multispecialty group. The lead physician was given considerable latitude in the design of this facility with the goal that it would become a prototype for the system. It opened in January 2011. The design was influenced by the Disney concept of on-stage/off-stage and the emphasis on creating a great experience. In the space plan (Figure 1-2), there are dual entries to the assessment rooms with staff entering from a rear corridor adjacent to the nurse station and lab (see Figure 3-65) and

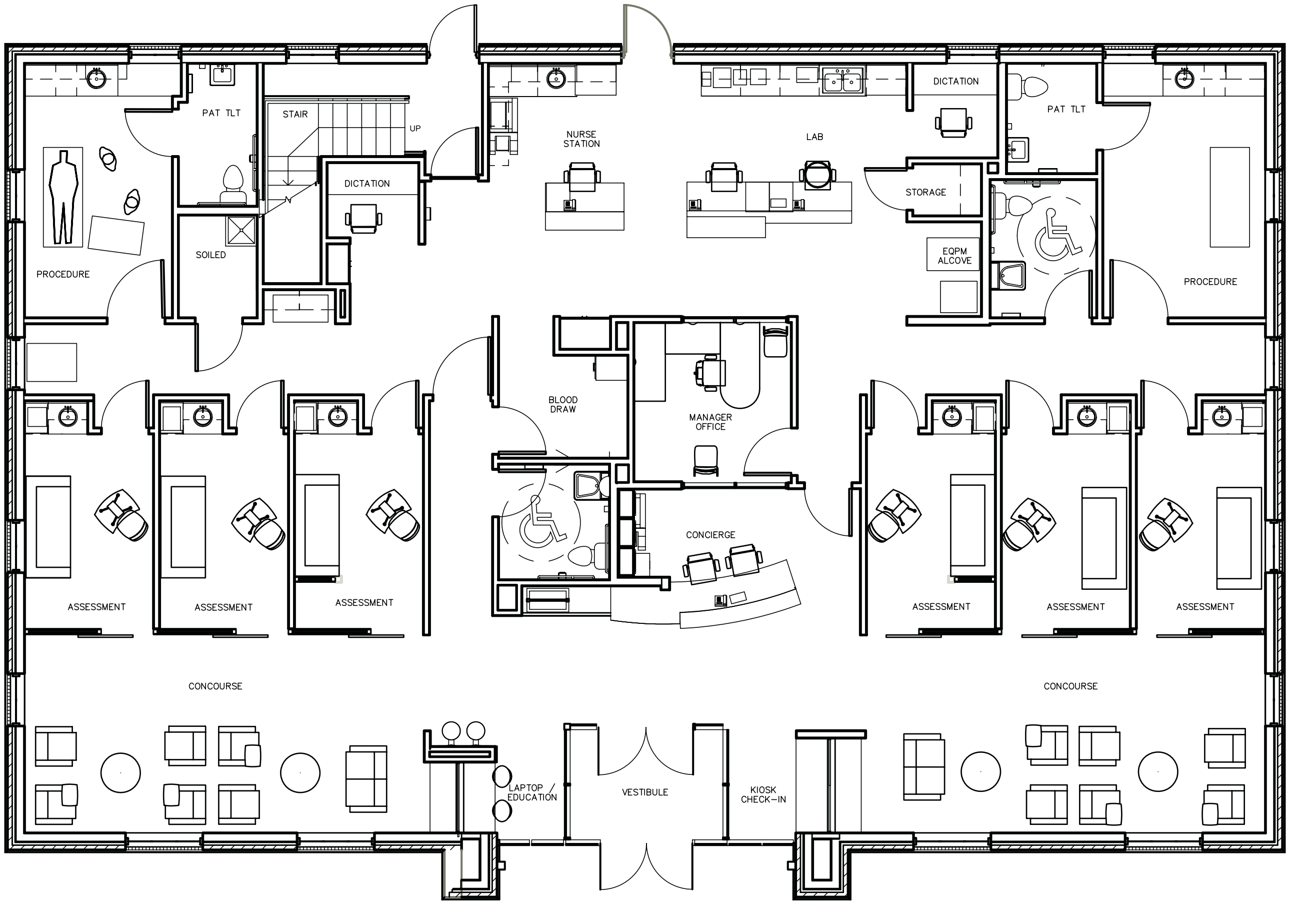


Figure 1-2. Space plan, Village Family Medicine, 5,680 square feet. *(Courtesy of McMillan Pazdan Smith Architecture)*

patients entering through acoustically sealed sliding barn doors off of what is called the "concourse." Patients are able to check themselves in upon arrival at a kiosk. Other influences in the design were based on the architects' analysis of retail models with a strong customer-centric philosophy such as Apple and Nordstrom. In addition, students from Clemson University Architecture + Health posed as mystery shoppers, visiting three or four family practice locations in the health system to enable them to experience the care and to make suggestions for improvement. Last, NXT Health, a nonprofit organization with leadership from Clemson University's Architecture + Health master's degree program graduates, participated in the project. Innovation through collaboration is the goal of NXT Health.

The interior design of the office is contemporary with finishes in various neutral colors that have enough contrast to avoid being bland (Figure 1-3). The pattern in the flooring is no-wax, vinyl plank. The distressed appearance was selected to reflect the history of the area, which was farming and horse land.

BUILDING BLOCKS OF HIGH-PERFORMING PRIMARY CARE

Across the nation, primary care is being transformed from physician-centered practices to patient-centered teams. To better understand the dynamics of this change, Rachel Willard, MPH, and Tom Bodenheimer, MD, studied seven high-performing large primary care practices in California, Oregon, Washington, and Colorado, doing research that involved extensive site visits and interviews with the leadership and all levels of staff at these organizations.[5] "High-performing" was defined as having high levels of patient and staff satisfaction, a stable financial base, and clinical quality metrics that have improved over time.

Six building blocks were considered essential for success in the new model of healthcare delivery by the seven organizations studied. Readers are encouraged to read the entire white paper as it has many specific examples of innovation and an extensive reference list.

1. **Data-driven improvement.** Collect, clean, and summarize performance data for use by clinicians to drive effective action. "Data provide the bedrock of high-performing health practices...."
2. **Empanelment and panel size management.** Assign patients to a clinician and team in the process of empanelment, actively manage panel size, balancing capacity and demand to maintain continuity of care.
3. **Team-based care.** Includes front-desk personnel, clinicians, MAs, RNs, psychologists, social workers, and the like. Rely on clear vision and principles, working in shared space, using well-honed communication skills and defined workplans.
4. **Population management.** Patients with complicated medical and psychosocial needs receive a different level of care and management. Employ health coaching for patients with chronic diseases. Use panel

[5] Rachel Willard and Tom Bodenheimer. White paper: "The Building Blocks of High-Performing Primary Care: Lessons from the Field," California HealthCare Foundation, April 2012. www.chcf.org/publications/2012/04/building-blocks-primary-care.

Figure 1-3. Waiting room, Village Family Medicine. *(Courtesy of McMillan Pazdan Smith Architecture; Photographer: Kris Decker/Firewater Photography)*

management to support the preventive care needs of all patients.

5. **Continuity of care.** Improves quality of care, the patient's experience, and lowers costs. Actively control panel size to ensure demand does not exceed supply.
6. **Prompt access to care.** Timely access cannot be achieved without managing panel size to balance capacity and demand. Strategy: Open the schedule only a few weeks at a time, space visits by taking care of more needs at each visit, and offer phone visits, Web-based patient portals, group visits, and visits with nonclinician team members.

THE SMARTPHONE WILL SEE YOU NOW: THE mHEALTH REVOLUTION

If there is a prophet in the transformation of medicine as we know it today to what it will be in five or ten years, it is surely Eric Topol, MD, director of the Scripps Translational Science Institute in La Jolla, California. He is both a practicing cardiologist and a professor of genomics at the Scripps Research Institute. He is widely acknowledged as a visionary, a pioneer, and a charismatic change agent whose book *The Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care* (Basic Books, 2012) forecasts that smart consumers—patients—will push healthcare providers to accelerate the adoption of technology. His book is intended to educate consumers about the possibilities because he finds the medical community frustratingly slow to change and unwilling to let the digital world "pierce the medical cocoon" in his words.

Dr. Topol's vision is of a world in which healthcare diagnosis and treatment will be personalized according to an individual's genome. In certain types of cancer treatment, this has already been put into action. Chemotherapy agents can be tested in the lab prior to administering them to know which will be more effective for a specific tumor in a specific person. Miniature ultrasound imaging devices are replacing the stethoscope. The goal is to capture as much data as possible about an individual to enable precisely targeted therapies and to prevent major side effects of medications. This is very timely in view of the nation's increasing escalation of healthcare costs, growing number of preventable chronic illnesses, and the shortage of primary care physicians. Through the use of wearable sensors and smartphone apps, email communications, and e-visits through Skype and other video conferencing modalities, considerable time and cost can be saved by not having to schedule face-to-face visits when it is unnecessary. The problem is, in fee-for-service models, billing for this type of care is currently not possible. As patients move into patient-centered medical homes and capitated fee arrangements, providers will be only too delighted to handle routine matters for generally healthy patients in the most expeditious manner possible.

In Dr. Topol's vision, patients become informed consumers who are in the driver seat, armed by access to genomic information and real-time bio-data derived from nanosensors and enabled by wireless technology. According to J. Craig Ventor (the scientist who sequenced the human genome), whose research institute is a stone's throw away from Dr. Topol's institute in La Jolla, "Our sequencing of the human genome eleven years ago was the beginning of the individualized medicine revolution, a revolution that cannot happen without digitized personal phenotype information."[6]

Medical Body Area Network Systems

Mobile sensors will record and transmit personal data wirelessly to physicians by way of Medical Body Area Network (MBAN) systems. The Federal Communications Commission (FCC) has proposed to allocate radiofrequency spectrum for secure transmission of personal data derived from multiple body sensors used for monitoring physiological data. It is expected to be a few years before

[6] Eric Topol, *The Creative Destruction of Medicine: How the Digital Revolution Will Create Better Health Care* (New York: CRC Press 2012), Foreword.

the first MBAN products come to market. According to a Deloitte study published in 2012, the market for all wireless health-monitoring devices in the United States is estimated to hit $22 billion by 2015.[7] Qualcomm, a San Diego–based maker of microprocessor chips, has developed Qualcomm Life, a 2net platform and hub to provide data management over a secure network. The hub functions like a router and is plugged into a wall. As it receives signals from wireless device sensors, it directs the information into the 2net platform for distribution. This hub can support the *Visi® Mobile System* (soterawireless.com) being introduced to hospitals for monitoring inpatients. This device, like a large wristwatch, performs comprehensive vital signs monitoring (ECG, heart/pulse rate, SpO_2, blood pressure, respiration rate, and skin temperature) and can send data to desktop or tablet PCs for viewing. Imagine not having to wake a patient every four hours to monitor their vitals because continuous monitoring is possible and a nurse need only look at the color touch-screen display on the patient's wrist. (This device has been cleared by the FDA.)

The Explosion of mHealth

Anyone doubting the growth of mobile health (mHealth) would do well to attend the annual mHealth Summit held each December in Washington, D.C., which draws 4,000 attendees. *Mobile health*, by definition, is the use of mobile communication and devices for providing healthcare services. These services can be broadly classified into two categories: solutions with direct touch points to patients (wellness and prevention, diagnostic and treatment monitoring) and those that strengthen healthcare systems (emergency response, provider support, healthcare administration). According to a 2012 report by Price Waterhouse Coopers[8]:

- Over 90 percent of revenue from monitoring is expected to come from chronic disease management solutions. Other common uses will be for post–acute care monitoring and independent aging apps.
- Monitoring services and applications are expected to drive the market significantly and account for 65 percent of the market.
- From a patient pathway perspective, most mobile health devices can be classified into five categories: wellness, prevention, diagnosis, treatment, and monitoring.
- The United States has been at the forefront of mHealth deployment in the world. Forty percent of solutions work toward strengthening the healthcare system, 25 percent are devoted to monitoring and treatment, and 13 percent to wellness and fitness.
- Worldwide, mobile devices are very helpful in supporting healthcare workers in remote or undeveloped areas.
- The increase in 3G and 4G networks creates data highways. 3G networks support video calling and high-speed data transfer, useful in delivering telemedicine services; 4G networks offer superior image quality and reduced distortion for video calls.

The enthusiasm engendered by mHealth must be tempered, according to Francis Collins, MD, PhD, director of the National Institutes of Health (a great supporter of mHealth), by doing the research to demonstrate the benefit. There are currently fewer than 20 randomly controlled studies to demonstrate if it improves outcomes. Dr. Collins noted the difficulty in doing studies since clinical trials typically take four years for the entire process and technology changes so rapidly.[9]

[7] Jaimy Lee, "A New Sensory System," *Modern Healthcare*, May 13, 2013, pp. 30–31.

[8] "Touching Lives Through Mobile Health: Assessment of the Global Market Opportunity," February 2012. www.pwc.in/assets/pdfs/telecom/gsma-pwc_mhealth_report.pdf.

[9] Francis Collins, Keynote address, MHealth Summit, Washington, DC, December 5, 2012. www.mhealthsummit.org/about-summit/opening-remarks-and-keynote-speakers (accessed Oct. 20, 2013).

Mobile Devices

A number of mobile devices, often working through a smartphone app, enable consumers to monitor biometric data. The *Glooko* mobile app and meter sync cable (Figure 1-4) work with most FDA-approved glucose meter devices to sync and log blood glucose levels. The pulse oximeter checks the level of oxygen saturation in the blood (Figure 1-5). A remarkable new device, currently in clinical trials, is the *I-SugarX*, (freedom-meditech.com), which noninvasively measures glucose levels by detecting polarization of light reflected from the eye. The *Alive Cor*® ECG recorder is licensed to medical professionals and prescribed patients and works through a smartphone; it has a monitor that attaches to the phone, and data is stored on a protected site.

One of the most interesting devices is the Scanadu Scout™, a round scanner disk packed with sensors, not much larger than an Oreo cookie, that connects to a smartphone and performs numerous biometric readings: heart rate, skin/core body temperature, pulse oximetry, respiratory rate, blood pressure, ECG, HRV (heart rate variability), and PWTT (pulse wave transit time—the time it takes for a heart beat to reach another location in the body which is related to blood pressure). The product website promises users they will be able to "check your health as easily as your email," to reduce unnecessary doctor visits, and to "bring the tools of the emergency room into the comfort your living room." The device is currently in FDA trials and is expected to be available in 2015.

The distinction must be made, however, that a smartphone is not a medical device and has inherent limitations with respect to interpretation. The *HeartCheck*™ pen (cardiocommsolutions.com) has been cleared by the FDA as

Figure 1-4. Mobile glucose monitor, Glooko, copyright © 2013. *(Property of Glooko, Inc., 2013)*

Figure 1-5. The Phone Oximeter™ checks the level of oxygen saturation in the blood. *(Courtesy of LGT Medical)*

a Class II medical device and can be used to detect heart arrhythmias and record them at the moment they occur with the wave forms analyzed and interpreted by a cardiologist or ECG coordinating center virtually anywhere in the world that there is an Internet connection (Figure 1-6). The immediate access to interpretation makes this product unique. This device can be purchased without a prescription and comes with the *GEMS*™ Global ECG Management Solution FDA-cleared software that integrates with the pen. CardioComm Solutions was awarded the 2012 Enabling Technology Award by Frost & Sullivan Global Research.

Other mobile devices are used by clinicians or perhaps home health nurses such as the Mobisante portable ultrasound that works on a smartphone and can be uploaded to a cloud server making it easy for caregivers to access from remote sites (Figure 1-7). The *NanoMaxx*® by SonoSite, Inc., is a powerful machine in a small package (Figure 1-8). It does high-quality diagnostic imaging, color power Doppler, and color-flow velocity to help physicians make clinical decisions at the point of care and to guide interventional procedures such as the insertion of a catheter to avoid infections. Another ultrasound device, the GE *VScan*, enables clinicians to inspect organ function, check fetal viability, and monitor fetal position during labor (Figure 1-9). It can be used for abdominal, urological, cardiac, and pediatric scanning, and be carried in the pocket. The *PanOptic*™ ophthalmoscope enables physicians to observe conditions such as hypertension, diabetic retinopathy, and papilledema (Figure 1-10a and b). With an accessory and software, when used with the iPhone 4/4S, images can be captured, sent, stored, retrieved, and printed. Other mobile diagnostic devices are depicted in Chapters 3 and 5.

Figure 1-6. HeartCheck™ pen, a Class II mobile medical device used to detect heart arrhythmias and record them at the moment they occur. *(Images provided by CardioComm Solutions, Inc.)*

Figure 1-7. Portable ultrasound device works on a smartphone. *(Courtesy of Mobisante)*

Figure 1-8. NanoMaxx® Mobile ultrasound device used in point-of-care decisionmaking. *(Courtesy of FUJIFILM SonoSite, Inc.)*

BRINGING HEALTHCARE INTO THE HOME

Anyone who has had to take an elderly family member to a doctor's appointment knows how unsettling it can be for the patient who might have ambulation problems and difficulties getting in and out of a car. If it is winter with snow on the ground, there are worries about falling. In addition, there are opportunities to be exposed to flu viruses and other infections. In addition, the escort—perhaps an adult daughter or son—has to take time off from work to assist. True, sometimes a face-to-face visit is essential but much of the time, these visits are for routine matters such as

Figure 1-9. VScan™ Mobile ultrasound device can be carried in the pocket and used in a variety of patient care settings including acute care. *(Courtesy of GE Healthcare)*

checking blood pressure, listening to lungs, looking at spots on the skin, or checking blood sugar. One of the biggest changes we will soon see is the use of home monitoring devices such as the *Intel Health Guide* to enable communication between patients and healthcare professionals, giving clinicians access to the most current, actionable data (Figure 1-11). These devices offer patient reminders, relevant educational content, and feedback tools such as video conferencing and alerts (Figure 1-12). Numerous vendors have entered this market with products that are easy to use. The patient applies the sensors or blood pressure cuff and sees a colored visual display indicating whether the results are good (may be indicated by a green light), less than ideal (may be indicated by a yellow light), or in the danger zone (a red light). Rather than waiting for a doctor's appointment every few weeks, the patient can monitor vitals daily to more closely manage chronic conditions.

This will boost business for home health agencies to set up secure portals by which medically trained staff can monitor the "danger warnings" sent by a patient's monitoring system and either alert the patient's physician or family member who manages their care. Or they can send a nurse to visit the patient. If this type of service has not been contracted, the results of the monitoring can be sent

Figure 1-10. (a) iEXAMINER™ PanOptic. Mobile ophthalmoscope can be used with a smartphone to capture, send, and store images. (b) iEXAMINER™ PanOptic with smartphone attached. *(Source: Welch Allyn, Inc.)*

directly to the physician's office. Provider organizations will likely be setting up home monitoring systems for patients with chronic conditions as part of a patient-centered medical home approach to care management. Companies like White Glove Health in Austin, Texas, use board-certified family nurse practitioners to offer members mobile primary care and chronic care, providing technology-enabled services that include biometrics, wellness coaching, and telemedicine through Web-based portals. They will also go to the home or office to draw blood, and later, deliver and explain lab results. Insurance companies like Humana and Aetna in Texas pay the membership fee. White Glove describes itself as "the nation's revolutionary provider of healthcare," referring to the convenience and access and the quality of the experience.

TELEMEDICINE

Telemedicine is quite a benefit to those whose chronic conditions become unstable from time to time, requiring clinical assessment in the home, but it is also useful, as shown in Figure 1-13, to enable a parent to use an otoscope to help diagnose a child's ear problem without having to physically visit the doctor. In this image, *VSee*, a software product, has multiple video feeds enabling a

Figure 1-11. Cloud-based Telehealth Solution remote care management in the home. *(Intel-GE Care Innovations™)*

Figure 1-12. Cloud-based Telehealth Solution remote care management in the home. *(Intel-GE Care Innovations™)*

Figure 1-13. VSee enables remote telemedicine consultation. *(Courtesy of VSee copyright © 2013)*

photo of the nurse, the patient, and the image of the inner ear to be visualized.

Within the clinical setting, telemedicine allows patients in rural or remote areas to be diagnosed in consultations with specialists, and it enables specialists to observe and teach in real time the proper way to do a procedure. A Web-based telemedicine workspace such as *Agnes Interactive*™ (amdtelemedicine.com) integrates live patient diagnostic data and real-time video conferencing. The *IMED II* (amdtelemedicine.com) is a customizable telemedicine mobile system that can be found in hospitals and large clinics (Figure 1-14). Cisco *HealthPresence* is another telemedicine system intended for remote consultations. It enables video conferencing integrated with a high-resolution magnifying video camera, a telephonic stethoscope, an ear-nose-throat scope, and tracking of oxygen concentration, blood pressure, respiratory rate, and heart rhythm.

The *TeleSteth*™ electronic stethoscope (Figure 1-15) transmits heart and lung sounds remotely in real time

Figure 1-14. IMED II is a mobile Clinical Telemedicine System. *(Photo courtesy of AMD Global Telemedicine, Inc., copyright © 2013)*

Figure 1-15. AMD-3150 3M™ Littmann® electronic stethoscope. *(Photo courtesy of AMD Global Telemedicine, Inc., copyright © 2013)*

during an exam or stores them to be heard later. It is designed to be accessed from a user's PC through the Internet.

BOOMERS AND TECHNOLOGY

Much has been written about Boomers and how this huge influx of people will impact the healthcare system. What is rarely discussed is the considerable age range within this group born between the years 1946 and 1964 and the profound differences in experience between the early boomers and the late boomers. In 2014, the youngest of the boomers will turn 50, whereas the post-war cohorts are now in their 60s, and this is the group

many refer to when discussing preferences and impact on our healthcare system. A recent article in the *New York Times* provided a thought-provoking discussion of the life events that shaped the mindset of the two distinct groups.[10] Older boomers were influenced by the Vietnam war, shared an idealistic view of America, had faith in the government, experienced loss of innocence when John Kennedy was shot, understood the danger in casual sex (the birth control pill did not come along until 1961 and Roe v. Wade in 1973), had little personal exposure to illegal drugs, and many in this cohort finished school and found jobs, enjoying an historic period of economic prosperity or at least stability. Younger boomers took for granted the sexual freedom that was so revolutionary for the older cohort. Illegal drugs were plentiful and their use was not considered stigmatizing. Societal issues included AIDS and a huge spike in divorce and in the number of babies born to single mothers. Philosophically, the younger group has a more jaded, less idealistic view of America. They lived through the Watergate debacle and the Nixon resignation and, economically, lived through three recessions and the disillusionment of high unemployment. Last, there were huge differences in the roles of women within that 18-year period, with older boomers less likely to get a college education or experience parity with male colleagues in jobs. The boomers in the middle of this time span one could say straddle the extremes of the early and late boomers. They are described in the Microsoft/AARP study below as having a foot in both the future and the past.

Microsoft and AARP teamed up to study the boomer demographic, and it turns out that, indeed, owing to the cultural and technological time span, this group has one foot in the future and one in the past.[11] They still remember when families had one phone, a landline, but now they live with cell phones. They keep abreast of social networking to be able to communicate with their children and grandchildren, but they also manage their parents' care and are part of that world. Boomers are enthusiastic about using new technology and quick to share it with peers. They are, surprisingly, the fastest-growing age segment on social networking sites like Facebook. One thing that characterizes the group is thoughtfulness about adopting technology only if it adds value to their lives. For example, they are keen to wire parents' homes with smart sensors to be able to check in on their safety. When it fits their needs, they will embrace cutting-edge technology, but they want it to fit their lives. They buy into EHR, gene scans, digital fitness monitors, and they want mobile phones with built-in projectors to deal with the problem of tiny screens. From all accounts, Boomers will embrace mHealth and conveniences like virtual visits to consult with providers for routine care. And they are all about the quality of the experience.

[10] "I May Be 50 but Don't Call Me a Boomer," Richard Pérez-Peña, *New York Times*, January 12, 2014, page 11.

[11] "Boomers and Technology: An Extended Conversation," a report sponsored and prepared by AARP and Microsoft, October 2009. www.assets.aarp.org/www.aarp.org_/articles/computers/2009_boomers_and_technology_final_report.pdf.

CHAPTER 2

General Parameters of Medical Space Planning

BUILDING SHELL DESIGN

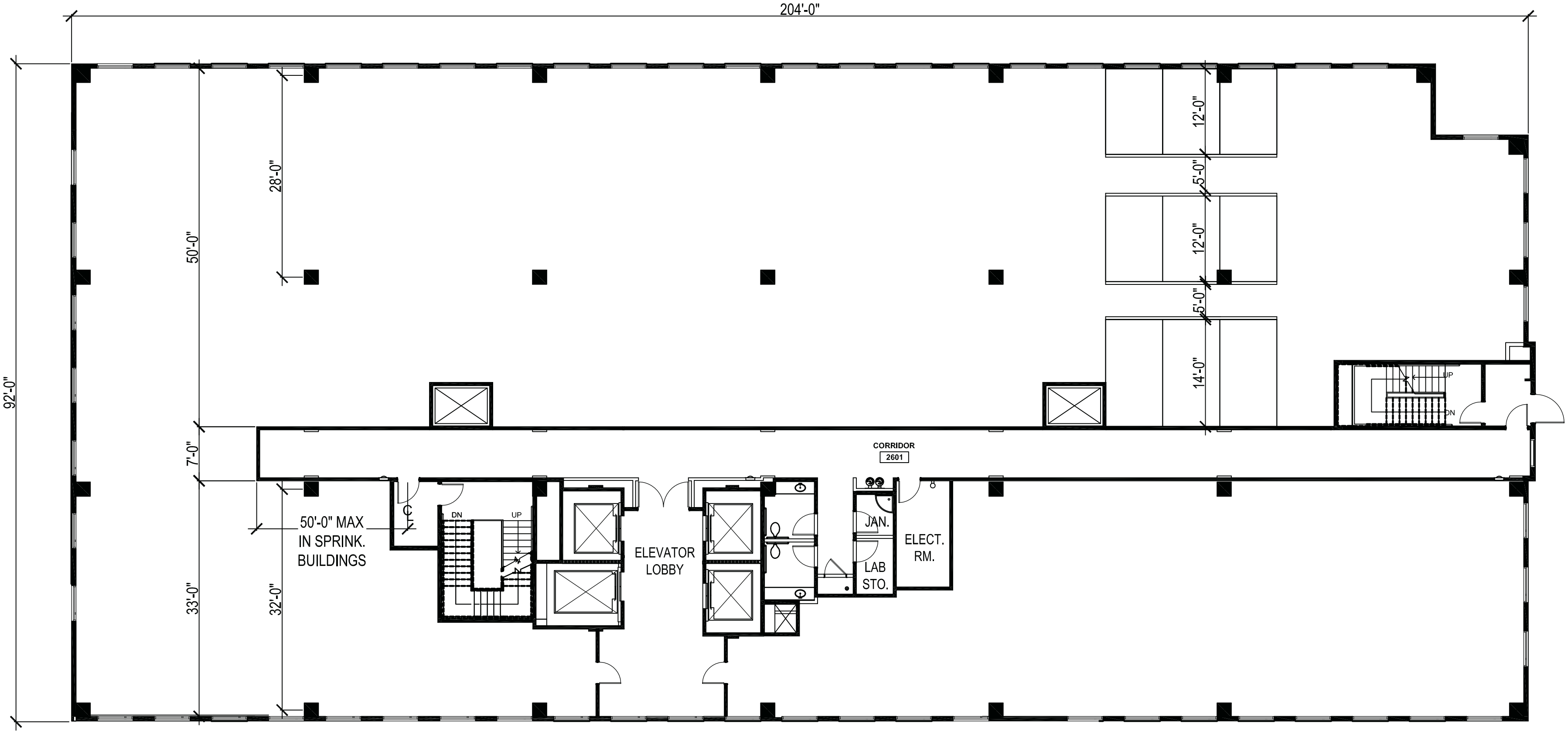
Efficient medical offices begin with an intelligently designed building shell. All too often, medical office buildings (MOBs) are planned by designers or architects who are unfamiliar with the special requirements of medical tenants; thus, the structure of the building does not lend itself to an efficient layout of suites. Structural column locations, stair placement, elevators, electrical rooms, mechanical shafts, public restrooms, and window modules either impede or facilitate layout of individual suites. The importance of an efficient shell and core design upon the interior space planning cannot be stressed enough.

Other factors that influence the design of an MOB are the shape and size of the site, the specific requirements of a particular tenant or client, a beautiful view, accessibility, site utilities, solar orientation, parking requirements, and the architect's desire to impose a unique design on the project. All of these factors have to be weighed and balanced along with applicable codes, height and zoning restrictions, and the budget. A building that is completely functional and efficient, but totally insensitive to aesthetics may not lease as quickly as the owners may wish. But an MOB designed primarily for aesthetic merit, with only secondary concern for internal planning efficiency, will also be difficult to lease.

Another important factor in the design of an MOB is the exterior skin of the building. Whether the windows are part of a curtain wall or in a bearing wall affects the openness of the exterior wall and how much daylight is coming in. The spacing of the mullions is critical not only in the vertical direction but also in the horizontal. For example, the sill height should be no lower than the height of a typical countertop plus backsplash, and the header should not be higher than the typical ceiling height. The spacing of the mullions is also critical to interior layouts and efficiencies.

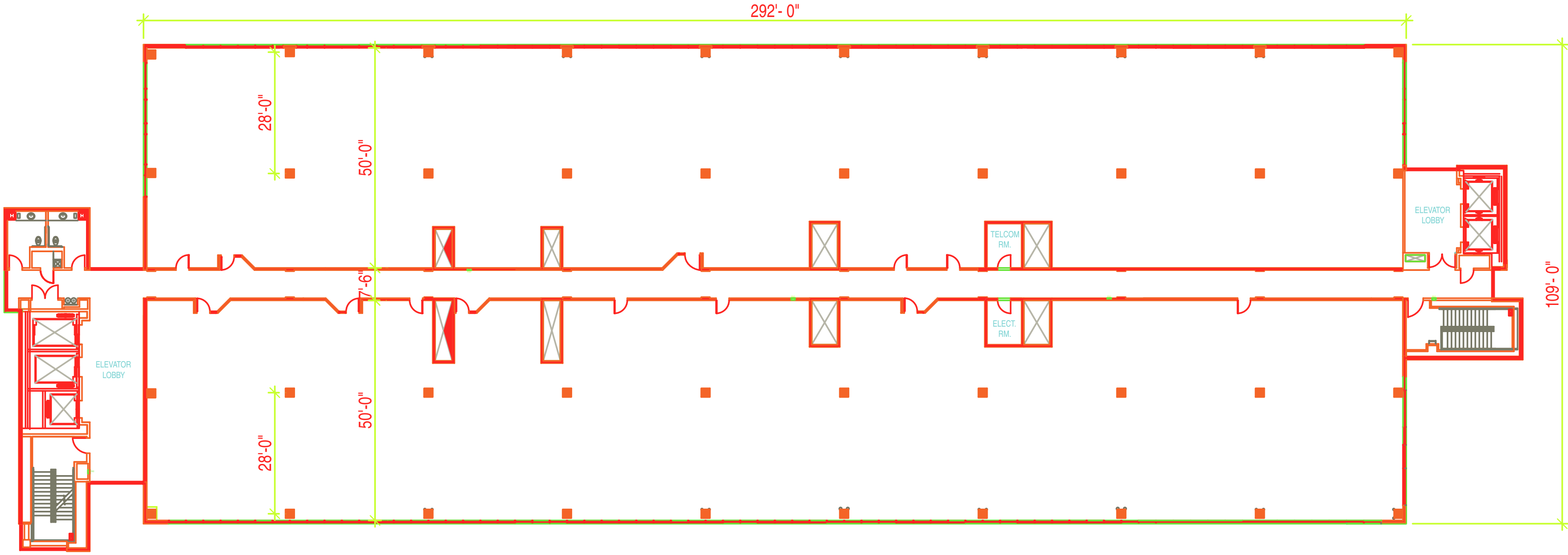
Floor Area Efficiency

To begin with, an MOB should contain at least 12,000 square feet of rentable space per floor in order to accommodate suites of varying sizes and configurations as well as to increase the efficiency of stairs and elevators. Larger buildings often have 20,000 square feet or more per floor. The elevators, elevator lobby, mechanical equipment room, electrical room, telephone room, lab pickup box storage room, and public restrooms can be placed in the core with rental space wrapped around the perimeter (Figure 2-1) or the services may be located at the ends of a double-loaded public corridor (Figure 2-2). Figure 2-3 gives 89 percent rentable space, but it lacks public restrooms. Medical buildings are usually designed to 85 percent efficiency, but architectural features such as



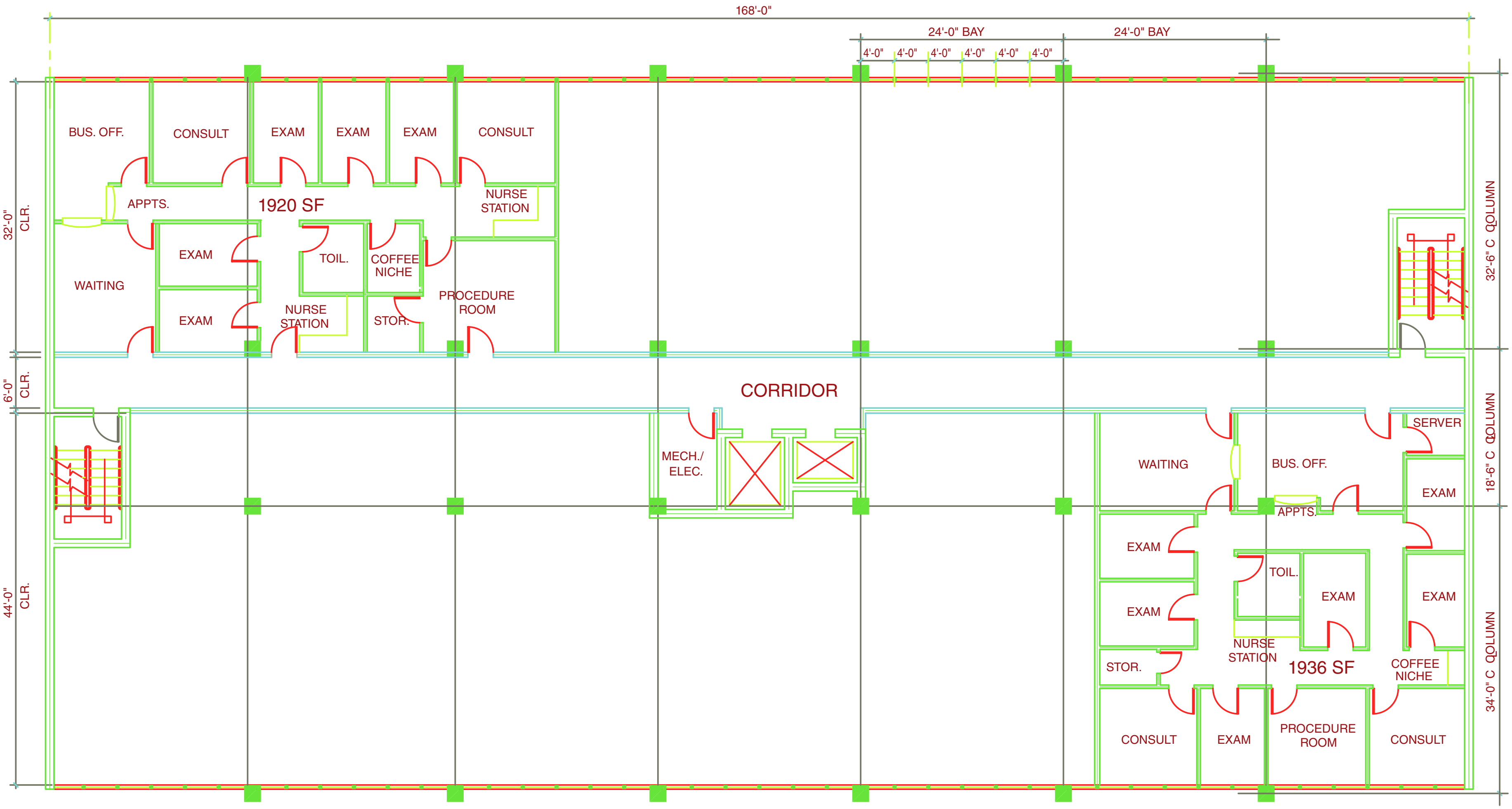
18,768 SF RENTABLE PER FLOOR

Figure 2-1. Floor plan, building shell, depicts a 33-foot deep bay for smaller suites and a 50-foot deep bay for larger suites, providing maximum flexibility. Locations of stairs and core services allow for a very large suite to wrap across the end of the building.



32,120 SF RENTABLE PER FLOOR

Figure 2-2. Floor plan, building shell, depicts a large building footprint with both sides of the building offering a 50-foot bay depth that puts smaller suites at a disadvantage as they will be narrow and with little natural light reaching the core of the space.



13,766 SF RENTABLE PER FLOOR

Figure 2-3. Floor plan, building shell, offers an example of how the same suite, built in two different bay depths, can yield significant differences in access to natural light, flow, and even the number of exam rooms.

an atrium or a large lobby can reduce the efficiency to 80 percent.

The core factor is 12 percent in Figure 2-2, reflecting the gain in efficiency due to the large floor plate that is designed to accommodate large users on the 50-foot-bay-depth side. If the building is leased to smaller tenants, public corridors penetrating the 50-foot depth may have to be added, thereby reducing somewhat the potential usable area.

Special attention must be paid to location of stairwells when one tenant intends to lease an entire floor or half a floor. In such a case, the public exit stairwell may fall within an individual suite—a nonpublic space. One way to handle this is to provide a third stair in the center of the building so that, even if one tenant takes half a floor, two stairs remain accessible for tenants on the other half of the floor (Figure 2-4).

Figure 2-1 shows a layout with one stair set in to allow a large suite to run across the end of the building at 92 feet, using a 50-foot "allowable" dead-end corridor, extending from the stairwell. One must remember, however, when locating a suite across the end of a building: If the occupancy load is high enough, two exits may be required, with a separation equal to one-third the distance of the longest diagonal of the suite in a building equipped throughout with an automatic sprinkler system. In a large suite, this would be achieved by extending another corridor perpendicular to the public corridor for the secondary exit.

In spite of these issues, especially with a floor plate as large as that shown in Figure 2-1, setting in the stair on one end provides great flexibility with respect to the size of suites that may be accommodated. It should be noted that the stairwells themselves must be located with a minimum separation equal to one-third the distance of the longest diagonal of the building floor plate measured along the shortest path of travel within the corridor if the building is equipped throughout with an automatic sprinkler system.

Structural Support

The structural support system for the building should allow as much flexibility as possible for the layout of tenant spaces. For a multistory building, a moment-resistant steel frame offers considerably more flexibility in space planning and window placement than does a building supported with diagonal or "K" braces, for example. Of course, moment-resistant steel frame connections are a considerably more expensive option. An additional consideration in the selection of the structural system is the tenant's perspective. In using the national BOMA (ANSI Z65.1) standards for measuring buildings, tenants pay for the "wasted" space above and below diagonal bracing. Tenants will use this as a bargaining chip and present the lessor with a challenge in maintaining cordial tenant relationships. Regardless of the type of structural system used, it is imperative that the structural engineer work very closely with the medical space planner, so that structural elements can be accommodated within the planning grid.

Perimeter columns, ideally, would be flush with the inside face of the exterior wall (Figure 2-3) so that they do not protrude into the building or room and, at the very least, are flush with the exterior face of the building so that protrusion into the building or room is minimized. On the interior, columns for a 32-foot bay depth would fall as shown in Figure 2-3 on the inside face of the public corridor wall, spanning 32 feet 6 inches center to center, creating a column-free space in between.

For a 50-foot bay depth, the intermediate column should occur at 30 feet on center, measured from the column on the exterior wall, and depending upon whether it is flush with the exterior face or extends totally from the inside of the exterior wall (Figures 2-1 and 2-2). Here, there will be a 12-foot-deep row of rooms across the exterior wall and then a 5-foot-wide hallway, followed by another row of 12-foot-deep rooms, then another 5-foot-wide hallway and a row of 14-foot-deep rooms adjacent to the common area corridor. The column should fall inside a room creating a flush wall in the hallway, as shown in the lower diagram of Figure 2-5.

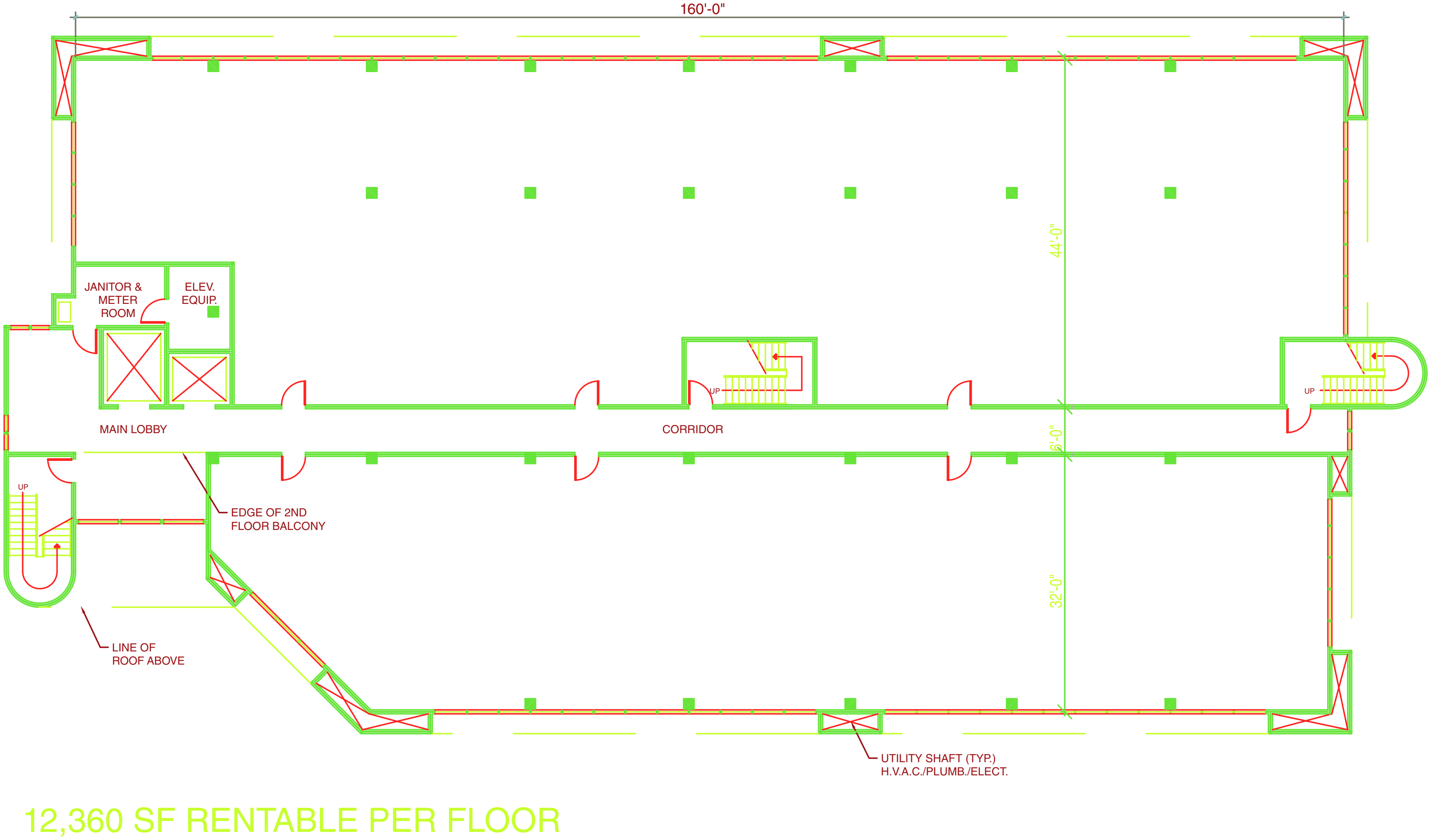
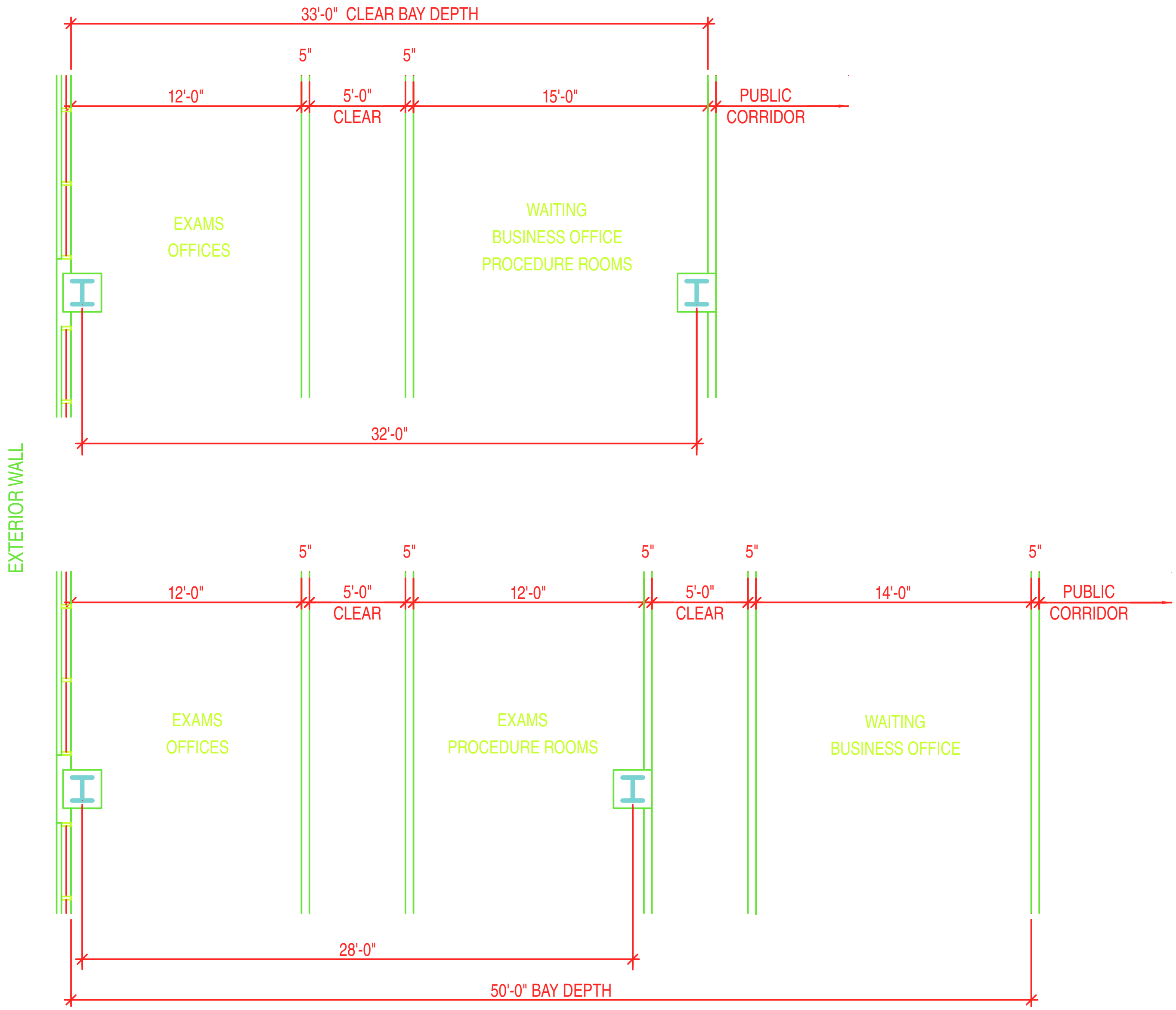


Figure 2-4. Floor plan, building shell, shows a small building footprint that accommodates both small and large suites. The placement of stairs provides access to two exits even if one tenant leases half of the building, running across the 82-foot width.



PLACEMENT OF COLUMNS

Figure 2-5. Placement of columns. *(Design: Jain Malkin Inc.)*

Another option for locating the intermediate column in a 44-foot-bay depth is illustrated in Figure 2-3. It occurs in the wall of the business office or waiting room, making it 34 feet on center, measured from the column on the exterior wall.

It is difficult to give absolute dimensions for locating columns, because there are so many variables: the "box-in" size of the columns; utilities running along columns, including roof drains and sewer lines; and the fact that high-rise buildings have larger columns, all affect the spacing between them.

Locations of structural columns should not adversely affect the flexibility of the space if the building is engineered properly. Most rooms are small thus the density of partitions is high. Long spans are not necessary but a tradeoff inevitably arises here. Reducing the span between columns makes it possible to use lighter-weight and shorter beams, thereby reducing the cost of the building and reducing the height. However, more columns, closer together, reduce space-planning flexibility. The occurrence of perimeter columns at intervals, creating 24-foot-wide or 32-foot-wide bays, and interior columns spaced as shown in Figure 2-4, often works well. Where the bay depths on both sides of the corridor are 32 feet, all columns may be contained in the perimeter walls, with none occurring within tenant spaces.

PLANNING MODULE

A considerable amount of standardization exists in the sizes of rooms in a medical suite. For the most part, suites can be laid out on a 4-foot planning grid. However, one must acknowledge the odd-sized treatment rooms, toilets, and specialty rooms such as radiology. The 4-foot planning module accommodates the traditional 8 × 12–foot exam room and the larger 10 × 12–foot exam room that is becoming the new standard for reasons explained in Chapter 3.

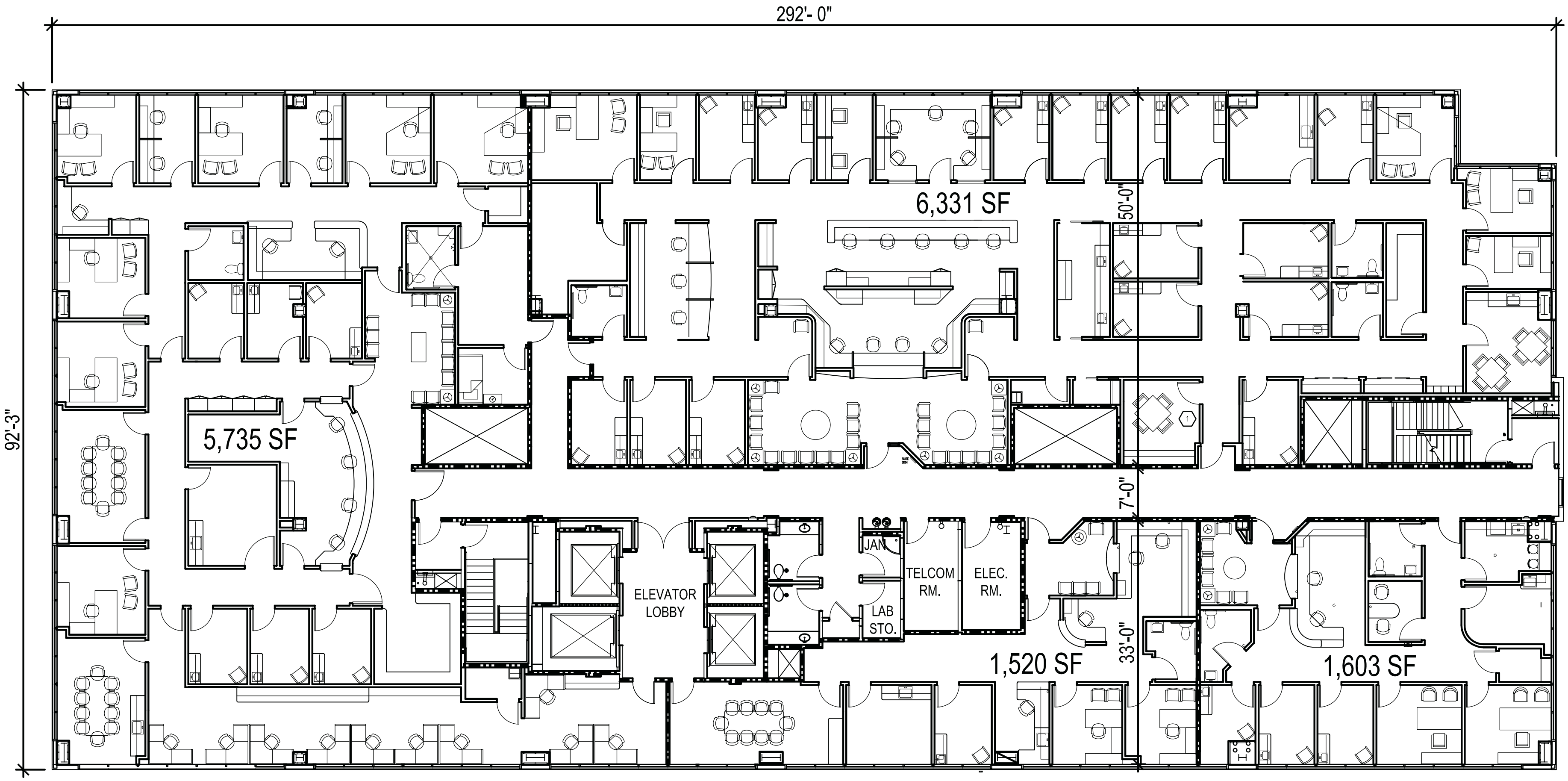
For this discussion the "depth of bay" refers to the dimension between the exterior wall and the common corridor wall. Based on this, there are three common bay depths that accommodate efficiently suites of various sizes. To begin with, a 32 or 33-foot bay depth works well for small suites anywhere from 1,100 to 2,500 square feet. It can accommodate a 1,600-square-foot suite as shown in Figure 2-6. These suites are extremely easy to plan because they involve one 12-foot-deep row of exam rooms and doctors' offices at the exterior wall separated by a 5-foot-wide hallway, and then the 14-foot-deep row of the waiting room, business office, procedure room, and staff lounge along the common area corridor.

A 3,000-square-foot suite, at a 32-foot bay depth, would be 92 feet long and would involve long walking distances, but also gives a tenant more linear feet of windows and access to daylighting and views of nature. A 3,000-square-foot suite would be accommodated better in a 44-foot bay depth where a center core, or island, may be used, as it is more efficient in saving steps (Figure 2-3).

A *44-foot bay depth* works well for suites between 2,000 and 4,500 square feet. Figure 2-3 illustrates how a central core might be used. With suites less than 1,800 square feet, a 44-foot bay depth does not allow enough windows. It creates a narrow, deep suite.

Suite Bay Depths	
32-foot suites	1,100 to 2,500 square feet
44-foot suites	2,000 to 4,500 square feet
50-foot suites	4,000 to 10,000 plus square feet

For purposes of illustration, an identical suite is created in a 32-foot bay depth and a 44-foot bay depth in Figure 2-3. Consultation rooms (private offices) are 12 × 12 feet, and exam rooms have traditionally been 8 × 12 feet in size, although now a more optimal size is 10 × 12 feet as they must accommodate the ability for a provider and patient to sit side-by-side while looking at a monitor. Minor surgery rooms are generally 12 × 12 feet. Thus, a fairly predictable layout of rooms can be expected.



TYPICAL BUILD-OUT OF FIGURE 2-1 BUILDING SHELL

Figure 2.6. Floor plan, building shell. *(Design: Jain Malkin Inc.)*

If suites are laid out with a storage room at the end of a corridor, a tenant can expand into an adjoining suite by eliminating the storage room and continuing the corridor, with no other remodeling necessary in the existing suite, assuming an adjacent space is available.

Suites over 4,000 square feet work well in a 50-foot bay depth (Figure 2-6). Starting at the common area corridor wall and moving toward the exterior wall, this allows for a 15-foot-deep row of rooms, a 5-foot-wide hallway, one 12-foot-deep row of rooms, another 5-foot hallway, and a 12-foot-deep row of rooms parallel to the exterior wall as depicted in Figure 2-1. One may have a number of transverse corridors running perpendicular to the two aforementioned ones. This bay depth works for suites anywhere from 4,000 to 10,000 square feet and larger. It is not impossible to design a suite less than 4,000 square feet in a 50-foot bay depth; however, unless it is a corner suite with windows on two sides, it becomes a narrow, deep suite.

Suites over 10,000 square feet, depending on the size of the building, may become spaces for full-floor tenants. In this case, a tenant in the building shown in Figure 2-3 would have a bay depth of 82 feet. In the building shown in Figure 2-4, the tenant could take one-half of the floor (to the right of the center stair) and achieve a large square space. The third stair, centrally located, would provide the two required exits for the tenants in the other half of the floor.

One cannot state unequivocally, for example, that a 4,000-square-foot suite would be more efficient in a 44-foot bay depth than in a 50-foot bay depth. The type of medical specialty, penetrations of stairs, mechanical shafts and elevators, and the spacing between columns may, in an individual building, make one bay depth preferable to another. If both are available in the building, it would be wise to provide alternate layouts to see which works best.

If one designs a medical building so that suites on one side of the common area corridor have a depth of 32 feet, and the other, a depth of 44 feet (Figures 2-3 and 2-4), one would have considerable flexibility to place tenants where the suites can be laid out most efficiently. If feasibility studies prepared prior to the design of the building shell show that there is a considerable need for large suites, then one side of the building might be designed with a central stair to allow for half-floor and full-floor tenants across the width of the entire building as in Figure 2-4. Alternatively, stairs may be pulled to the ends of the building as in Figure 2-2 to provide maximum flexibility for large suites. Sometimes a suite can be laid out equally well in two different bay depths, and the only difference may be that one requires more circulation area than another.

The average medical suite for a solo practitioner would be 1,200 square feet. Few suites are smaller than that. The bulk of suites the designer will encounter fall in the range of 1,200 to 2,500 square feet. There may be large orthopedic or internal medicine suites ranging from 3,500 to 8,000 square feet. Since the terms of financing often specify that the building must be 50 percent preleased before construction begins, it is often possible to know who the large tenants with special needs will be, and the building can be shaped with those requirements in mind.

The developer has to take into consideration market forces with regard to coordinating the different bay depths into a leasable building. More than likely it will be a combination of a 32-foot bay depth separated by a 7-foot-wide common area corridor and a 50-foot bay depth giving the developer maximum flexibility for private practices and large group practices. If, however, it is known that many hospital-based departments are going to occupy the building then a double 50-foot-bay-depth building may be more suitable (Figure 2-2). Although rare, in small markets, and perhaps due to site conditions, a double 32-foot-bay-depth building may be functional. Anything less than 32 feet is a mistake. A 28-foot bay depth that one sometimes sees in smaller buildings is very limiting even for small suites.

An MOB constructed purely on speculation with little preleasing would be difficult to plan without a profile or

feasibility study of physicians in the area, their space needs were they to lease space, and their respective specialties.

Window Placement

Window placement is a significant issue in a medical office building. With so many small rooms, it is important that windows fall in the right place and that structural columns occur on the coordinates of the planning module so that they can be buried in the walls. Windows with mullions at 4 feet on center function well when a 4-foot planning grid is used. This permits exam rooms to be 8 feet wide (7 feet 6 inches clear) and consultation rooms to be 12 feet wide (11 feet 6 inches clear) along the window wall. This is a problem with the new larger size of exam rooms that typically have the 10-foot-wide dimension running along the exterior window wall. The 4-foot window module can be reduced to a 2-foot module to permit even greater flexibility, but this amounts to an increased construction cost. When windows are irregularly sized, or something other than the 4-foot module, partitions have to jog in order to meet a mullion. The importance of interior walls meeting mullions cannot be stressed enough in trying to achieve patient privacy. The mullion presents the best opportunity to get a sound attenuated room. When walls meet at the glass with a false mullion, sound transmission between the rooms is a certainty.

It is important that windows start at 42 inches off the floor so that cabinets can be put under them and patient privacy in an exam room is not violated. It is also important that the height of the window header be located at the preplanned height of the ceilings, allowing the "L" metal of the ceiling system to tie into the mullion system. Even in a waiting room or lobby, windows should not start at the floor because it limits the area of seating. The glazing color should be gray, not bronze, because the latter tends to make skin look jaundiced; nor is green appropriate as its reflection makes it difficult to diagnose certain dermatological disorders.

Ceiling Heights

An 8-foot or 8-foot 6-inch ceiling height is suitable for individual suites with the exception of a few individual rooms such as radiology, outpatient surgery, or physical therapy, which require a 9- or 10-foot-high ceiling. Although file rooms are becoming obsolete, one must always remember to have 18 inches clear between the top of the storage cabinet and the ceiling for the required clearance of the sprinklers. A standard suspended acoustic ceiling works well, but ideally, for privacy and acoustical reasons, it should be laid out individually in each room with interior partitions extending above the finished ceiling 6 to 9 inches. Care should be taken in the selection of acoustical ceiling tile: Not only is the *noise reduction coefficient (NRC)* rating important for reduction of sound reverberation within a room, but the *sound transmission class (STC)* and *ceiling attenuation class (CAC)* are of even greater importance for reducing sound travel between rooms. A higher ceiling is preferred due to its inherent better performance in reducing sound transmission and reverberation.

AMENITIES

When a dentist or physician evaluates one building against another, various factors are considered in addition to lease terms and a possible equity position. Amenities such as a health club, a conference center, dedicated parking for physicians, and a coffee shop or deli may make one building more attractive than another. A building's image is important, but less so than for corporate

users, who will generally seek out the most upscale building their budgets will allow.

Access to the Internet through a free Wi-Fi guest network for patients is an amenity valued by patients, staff, and physicians. However, care must be taken to properly secure all other wireless networks that communicate patient and business data.

Physicians try to tailor the image to their patient profile. Plastic surgeons and other specialists who perform largely elective procedures may be more interested in a high-profile building. However, a primary care physician with a broad spectrum of patients may choose a more modest building that will not make low-income patients feel uncomfortable. This physician would be more interested in other attributes of the building such as freeway access, convenient parking for patients, proximity to the hospital, and public transportation.

BUILDING SHELL CONFIGURATIONS

The building shell configurations illustrated in this chapter are straightforward and highly functional. Other considerations sometimes prevail. The site may be best suited to a square building, a cruciform building, or perhaps one in an "L" or "T" shape. If located on a prominent corner, the part of the building facing the corner might be sculpted or articulated in such a way as to make it more dramatic.

Sometimes, in an attempt to make an architectural statement, the exterior of the building will have a stair-step configuration. This can greatly reduce the efficiency of the suites unless careful consideration is given to the length of each staggered section to make sure that a row of rooms will fit within it. Notches in the exterior wall can be even more of a problem, resulting in very irregular room shapes (see Figure 7-7). Buildings that are oval or have a circular configuration are very challenging to use for medical office buildings. Figures 3-101, 5-9, 5-41, and 5-88 demonstrate this situation.

BUILDING STANDARDS

It is important to define building standards for tenant improvements in order to establish an acceptable level of quality for construction items. These building standards would usually be prepared by the medical space planner for review by the owner and tenant improvement contractor. The items included are construction details for each type of partition, sound attenuation, suite entry hardware, door closers, interior doors, casework style and details, plumbing fixtures, ceiling system, light fixtures, electrical hardware, interior finishes, design of reception window, and so forth.

Developers may wish to hire an interior designer to provide the tenant a choice of perhaps three or four color palettes. Such an investment will be valuable to the tenant and save time in the design and construction document phase of the tenant improvement project. It potentially provides a higher level of finishes and aesthetics within the economies of scale, and thus cost savings, if these same building standards and color palettes are employed over several buildings being developed around the same time frame.

These items are generally accepted by all tenants in the building. Some may wish to upgrade light fixtures, add wallcovering, or upgrade the carpet, but the basic construction items will be consistent throughout the building. This assures the owner, who has to maintain the building, that replacements will be on hand, and, if a tenant moves out, the owner won't be left with a suite having French Provincial residential hardware, for example.

TENANT IMPROVEMENT ALLOWANCES

Owners or developers offer tenants a *tenant improvement allowance*, expressed as a per-square-foot amount, to build their suites. The amount of square feet used for this allowance calculation is the usable square feet

(USF). Tenant improvement allowance amounts vary from building to building and also reflect geographical differences in construction costs. At the lower end of the spectrum, tenants cannot build even a simple suite without adding $25 to $30 per foot, from their own pockets, to the allowance of $65 to $85 per USF. Stepping up from there, tenants may be able to build a "plain vanilla" suite (one with minimum casework, building standard lighting, and painted walls) at the tenant improvement allowance of $95 to $125 per USF, without adding money to it but allowances that high are not common. At the upper end of the spectrum, tenants may spend $135 to $150 and more per USF to create a unique design with a lot of detailing and features. The tenant may be able to negotiate that the landlord pay for it and amortize it in the rent over the period of the lease.

Generally speaking, tenants expect to be able to build a medical or dental suite within the tenant improvement allowance. However, this is not a realistic expectation and at times the space planner is the bearer of this bad news. Suites such as family practice, pediatrics, and dermatology, however, would be less expensive to build than an ophthalmology suite, for example, which has complex electrical requirements in the refraction rooms.

At the upper end in terms of construction cost are radiology suites, oral surgery, ambulatory surgical centers, and dental suites. All of these contain a great deal of plumbing, electrical, and special construction details that make them extremely expensive to construct. For this reason, physicians and dentists are highly desirable tenants. They invest so much in tenant improvements that they move infrequently. Commercial office tenants often move every few years, whereas it is not unusual for a physician to occupy a space for 10 to 15 years.

An alternate method of dealing with tenant improvements is to present tenants with a *work letter* stipulating exactly how many of each item (i.e., lineal feet of casework, number of electrical outlets, number of doors, lineal feet of partitions) they will receive per 1,000 square feet of rentable space. These quantities are tied to the per-square-foot allowance. In theory, if the tenant did not exceed those quantities of each item, per 1,000 square feet, the suite would be built with no out-of-pocket expenses.

POLITICS

When designing tenant suites, one becomes aware of a fundamental issue: conflicting goals of various parties regarding tenant privileges and limitations. Of particular concern are ownership of the building (whether the tenants may participate in ownership), tenant improvement allowances offered by the owners, whether tenants may have their own radiology equipment, and whether tenants will be permitted to engage their own designer, architect, or contractors.

In essence, owners generally want to give as little as possible but lease the building quickly and at high rents, and tenants want to move into custom suites, designed according to their every whim, without having to pay for any out-of-pocket expenses. The tug-of-war usually continues until the tenant actually takes occupancy of the suite, and then, little by little, the issues seem to resolve themselves. However, the space planner is often caught in the middle.

If retained by the owner of the building to do space planning for the tenants, the designer's obligation is to protect the rights of the owner; when employed by an individual tenant, the designer is charged with negotiating with the building owner to secure the greatest number of goods for the tenant. When one is the space planner for the building and also engaged to provide custom interior design services for a tenant, one must wear two hats and represent both parties well.

LEASING STRATEGY

Leasing a medical building requires a great deal of strategy. It is helpful if the leasing agent is experienced in dealing with physicians. Targeting one or two key physician

groups is the best way to kick off the leasing effort. Physicians are often reluctant to be the first to lease space in a new building. It takes a couple of leaders who are not afraid to risk being first in order to interest other physicians. The strategy involves determining who those key physicians are and going after them. Their interest in the project signals the seal of approval to others in the medical community.

Strategy also comes into play when determining optimum locations for various suites within the building. Some of this is a factor of the building shell itself, as suites of a certain size might be better accommodated in one location than another. Apart from that consideration, however, high-volume suites are best located, if not on the ground floor, then at least near the elevator, to limit foot traffic down the corridor.

Radiology, due to the weight of the equipment, would usually be found on the ground floor and, for ease of access, so would the clinical lab. Specialties such as general practice or internal medicine, which use radiology and lab services a great deal, would wisely be located adjacent to those suites. Low-volume specialties such as plastic surgery, neurology, or cardiac surgery might be located on upper floors, perhaps in a corner suite.

For corner suites, one would not locate a 1,500-square-foot tenant in a choice corner. These suites should be saved to use as an inducement to attract a prime tenant. Remember, however, when a suite is located across the end of a building, if the suite is of sufficient size to require two exits, there will have to be a *rated* separation between them. This is sometimes difficult to achieve at the end of a building.

Another issue to consider when laying out suites on a floor and taking into account the tenant's preference for location is that it is important to not leave any "holes" or unleasable size spaces between suites. In order to avoid this, tenants cannot always be located exactly where they would wish to be. This is where the space planner's skill as a mediator comes into play.

The first tenants to express interest in a new medical building are often radiology, clinical lab, and pharmacy, but they are often the last actually to confirm a lease since they depend on the other tenants for their livelihood. If the building is only 50 percent leased upon completion and these tenants have to move in, they will suffer. Furthermore, they will want to know, in advance of signing a lease, who the major tenants are, so that they can project whether the composition of the building will generate enough revenue for them. A fully equipped radiology suite represents an investment of several million dollars in equipment and construction costs. Such equipment is not easily relocated. Understandably, such tenants want very specific information on the other tenants in the building before committing to a lease.

HOSPITAL-BASED MOBS

Medical office buildings that are adjacent to and affiliated with hospitals have very special needs that will be touched on only briefly in this discussion. The major consideration lies in the interface with the hospital. Will the hospital actually be occupying space in the MOB? If so, and if inpatients have access to these facilities, the MOB will be subject to more stringent standards and codes, thereby greatly increasing construction costs. Even outpatient services provided in the MOB in clinics operating under the hospital license, thus a state licensed clinic, will also be subject to more stringent building code and operational requirements.

If the MOB is to be physically connected to the hospital, great thought must be given to the configuration of each floor with regard to floor-to-floor heights, stairwells, elevators, and point of entry to the hospital, so that future expansion is not hampered, and circulation between the hospital and the MOB is efficient. Another means by which the MOB may be connected to the hospital is through a bridge. One disadvantage to physicians

in a hospital-affiliated MOB is that sometimes the hospital imposes limitations upon individual tenants whose services or practices are likely to compete with hospital departments. This is particularly true of diagnostic imaging, clinical lab, physical therapy, surgery, and pharmacy services. In addition, if an MOB has a ground lease on the hospital campus, terms of the ground lease may exclude certain medical practices such as reproductive enhancement and even abortion services.

Hospitals benefit by having on-campus MOBs to provide a core group of admitting physicians who are loyal to the hospital. This also increases utilization of the hospital's ancillary services. Investing in a well-designed building with good architecture and quality materials creates a long-term asset for a healthcare organization.

Note: The author wishes to thank former colleague, Joost Bende, AIA, of Pacific 33 Architects for his help revising this chapter.

CHAPTER 3
Practice of Medicine: Primary Care

The field of medicine is continually expanding as new knowledge and concepts are put into practice. But at the base level of the healthcare delivery system, we begin with primary care: general practice, pediatrics, family practice, and internal medicine. Physicians in these areas are responsible for the total healthcare needs of their patients. They are termed “primary” medical specialists because they are usually the first providers one would consult about a medical problem. This chapter will include two other providers of primary care not discussed in the previous edition of this book: integrative medicine and direct care, sometimes referred to as “concierge care.” In addition, Chapter 4 presents Community Health Centers, also known as “safety-net clinics,” providers of primary care to the underserved and often uninsured. The Affordable Care Act funnels considerable money to federally qualified (community) health centers to care for the large numbers of persons who will now have healthcare coverage and, one hopes, access to care.

If a medical condition requires a specialist, the family practitioner or internist will then refer the patient to a specialist—perhaps a urologist, neurologist, orthopedist, or allergist. There are certain obvious exceptions to this primary-care referral system. People frequently consult allergists, plastic surgeons, dermatologists, obstetricians and gynecologists, or orthopedists on their own if they feel certain they have a problem that falls within that specialist’s domain.

While a primary physician may refer patients to a specialist to consult on a specific problem, he or she will be in contact with the specialist and will retain overall responsibility for the patient’s care. This provides for continuity of care—one physician who records a continuing health history for a patient and who oversees and coordinates total healthcare over a period of years. This is particularly important for patients with long-term disabilities or chronic conditions such as diabetes, heart disease, or hypertension. In managed-care systems, the primary-care referral physician is often called the “gatekeeper,” since access to specialty care is controlled by this individual.

The terms “general practice” and “family practice” are sometimes used interchangeably but they are different although both provide primary care. A general practitioner (G.P.) is a doctor who, having completed medical school and an internship, began his or her medical practice. A G.P. gains a broad general knowledge through experience that enables him or her to treat most medical disorders encountered by his or her patients. Doctors in family practice do a three-year residency that provides training in all major areas of medicine such as surgery, obstetrics and gynecology, pediatrics, internal medicine, geriatrics, and psychiatry. The practice of family medicine is based on four principles of care: continuity, comprehensiveness, family orientation, and commitment to the person.[1] Family practice is recognized as a medical specialty by the American Board of Medical Specialties and these physicians are board certified. G.P.s practice primary care but lack board certification in family medicine or internal medicine. For the purpose of space planning, the needs of general practice and family practice physicians are identical.

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[1] I.R. McWhinney, *An Introduction to Family Medicine* (New York: Oxford University Press, 1981).

FAMILY PRACTICE

The individual rooms that comprise this suite, with modifications, form the specialized suites to be discussed in future chapters. Together, these rooms constitute the *basic medical suite*. Therefore the philosophy behind the design of these individual rooms (waiting room, business office, exam room, consultation room, nurse station, and lab) will be discussed in depth in this chapter.

Functions of a Medical Suite

1. Administrative

    Waiting and reception

    Business (appointments, bookkeeping, insurance, clerical)

    Medical records (now electronic EHR)

2. Patient care

    Examination

    Treatment/minor surgery

    Consultation

    Collaboration space

3. Support services

    Nurse station/laboratory

    X-ray

    Storage

    Staff lounge/break room

Figure 3-1 shows the relationship of rooms. The patient enters the waiting room, checks in with the receptionist (usually at a transaction counter between the business office and waiting room), and takes a seat in the waiting room. Since most medical offices require advance appointments (as opposed to walk-ins), the staff are able to access the patient's medical records on the EHR in advance and the patient, upon arrival, may be asked to verify any changes in address or insurance coverage.

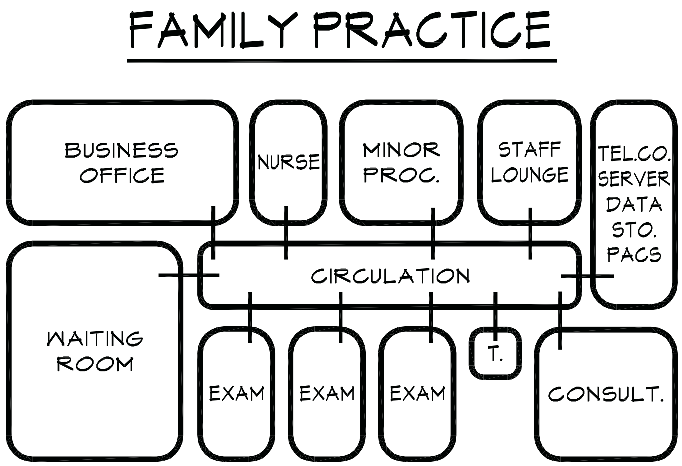


Figure 3-1. Schematic diagram of family practice suite.

Later, a nurse or medical assistant calls the patient to the examination area. Usually, the nurse or assistant will then weigh the patient, may request a urine sample (if required), record blood pressure, temperature, and take a short history. The scale is often located at the nurse station but vital signs are taken in the exam room and this is where a brief discussion occurs about the nature of the visit. The patient may be asked about any changes in a chronic condition or about any new medications.

In the exam room, the nurse or medical assistant (M.A.) prepares the patient for the examination and arranges the instruments the physician will need. The doctor enters the room, washes his or her hands, chats with the patient about symptoms, writes or types notes in the patient's chart (soon all will be EHR), and proceeds to examine the patient, often with a nurse or assistant in attendance. There are individual preferences as to how the physician discusses the diagnosis and treatment plan with the patient and this is also a matter of how the exam room is laid out—whether it has an area for consultation, as in Figures 3-2, 3-3, and 3-4a and b, or whether it is the

Figure 3-2. Primary care exam room. *(Design: Jain Malkin Inc.; Photographer: Steve McClelland Photography)*

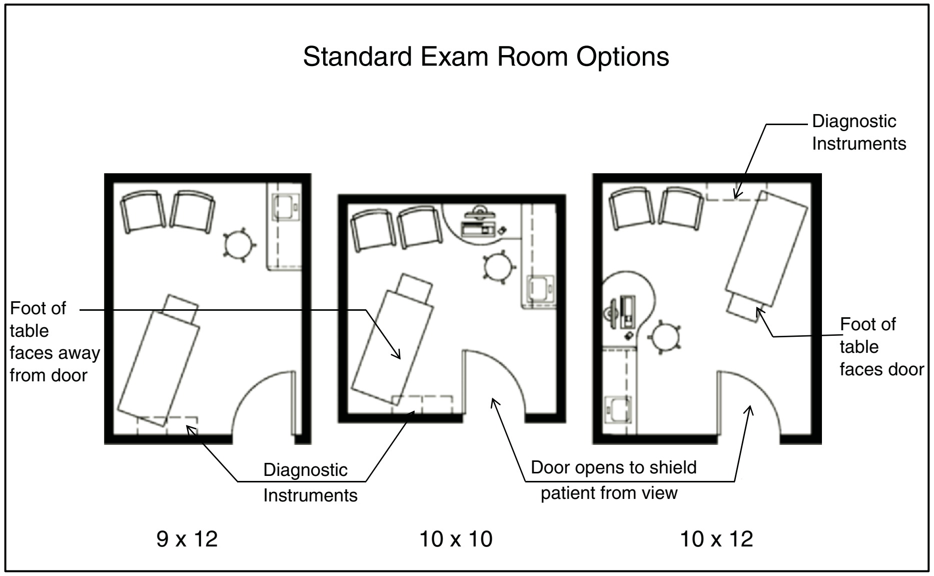


Figure 3-3. Standard exam room layout options. *(Design: Jain Malkin Inc.)*

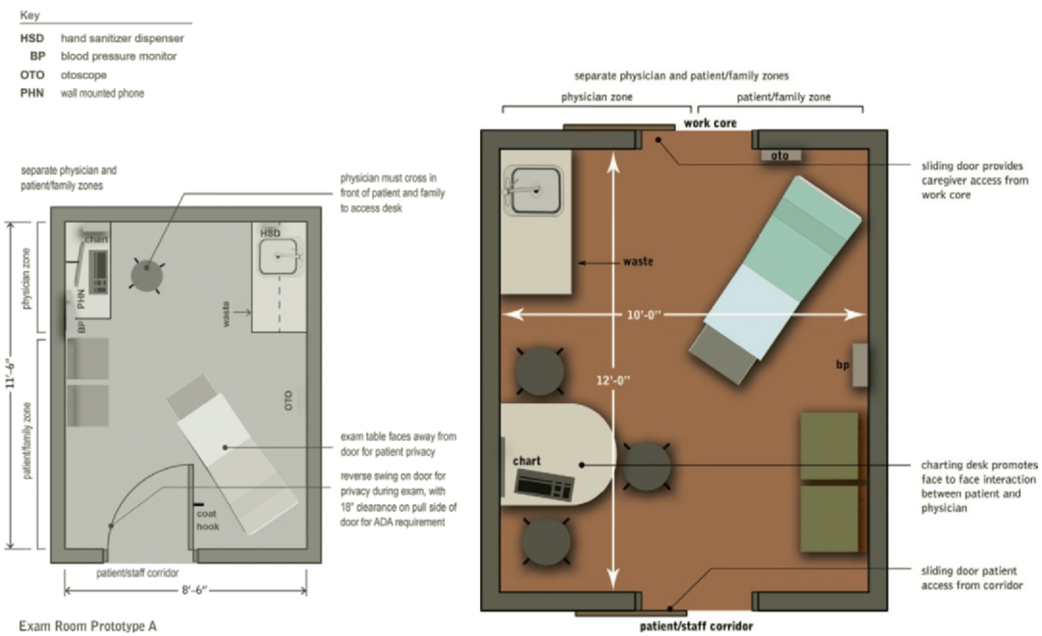


Figure 3-4. Examination room space plan options. (a) Potential features of a 9 × 12 room. (b) A 10 × 12 room allows for a consultation table. *(Courtesy of HGA Architects)*

"traditional" 8 × 12–foot exam room as in Figure 5-3. It is also influenced by the age of the patient and cultural background as to whether it would be psychologically uncomfortable for the patient to sit next to the doctor while gowned. Some physicians ask the patient to dress and they leave the room, returning 10 minutes later to discuss the diagnosis. Alternatively, while the patient is gowned the doctor diagnoses and prescribes right in the exam room. Sometimes the patient is asked to dress behind a cubicle drape while the physician remains in the room and charts the plan of action (see Figure 5-4). Then they sit at a lowered countertop or desk, making eye-to-eye contact, in discussion, sometimes looking at a monitor together. The presence of the computer and monitor in exam rooms has enabled physicians to sit beside patients to review lab tests, X-rays, and educational material. The patient leaves the office, passing an appointment desk or window where future appointments may be booked and where, occasionally, payments may be made. Usually co-pays are collected upon check-in.

Obvious deviations to the above may occur when, for example, a patient breaks a limb. In this case, the patient may be sent to an X-ray room first, and then proceed to a minor surgery room to have a cast applied without ever entering an exam room. Alternatively, once a break has been established, the patient may be referred to an orthopedist for care.

Some medical practices have fully embraced electronic patient management. Using a secure portal, patients may log in, update their medical histories, find an available slot in the appointment schedule, book it, and also communicate by email with a provider to ask questions. Lab test reports can be viewed through this portal as well as pre-procedure tutorials. This is very efficient and convenient for patients and empowers them. Some physicians have not implemented it because it takes time to respond and they cannot bill for this time. It is hoped that the ACA will bring some changes in this regard. If the only way a patient can get a question answered is to be physically present in an exam room this will continue to clog physicians' schedules, but one can't fault them for wanting to be paid for their expertise. When communicating informally with a patient in an email, there are likely other issues of concern to physicians such as documentation of the correspondence for legal purposes and recordkeeping, but it could all be archived within the patient's portal. The system is broken and needs to be fixed. Everyone knows that; five years from now all this will likely have been sorted out.

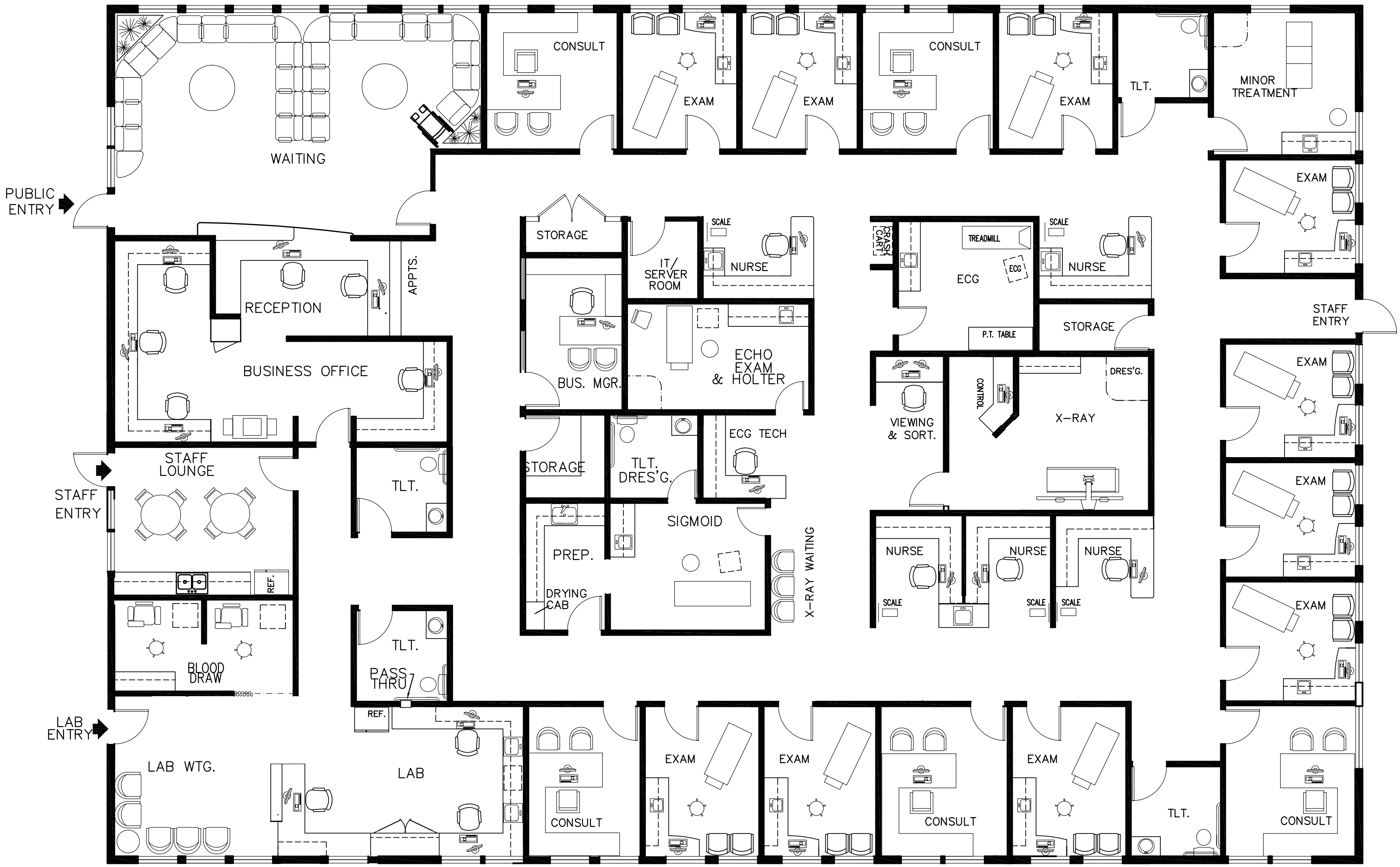
Flow

The efficiency of the medical practice will be largely influenced by the flow of patients, staff, and—to a lesser degree—supplies, through the suite. The layout of rooms must be based on a thorough understanding of how staff interface with patients and, most important, separation of incoming and outgoing traffic (see Figures 7-1 and 7-2). This is rarely possible in a small office for one or two practitioners but is increasingly important as the size of the office grows.

In Figure 3-5, exam rooms and consultation rooms are arranged in clusters, enabling five physicians to practice simultaneously with two exam rooms each in addition to a procedure room, ECG, and sigmoid. There is the option of a fifth physician at any time having a day off, which would then provide 2.5 exams rooms per each of four physicians. Patients, after checking in with the receptionist, proceed to one of five nurse stations to be weighed. If a urine specimen is required, the patient would be directed to the specimen toilet in the lab. For those arriving for lab work only, or for those who know they need lab work after having visited the physician and who are now on their way out of the suite, the lab is conveniently located with a direct entry/exit. The exit/checkout path of travel is more or less separate from the ingress. Circulation for staff is direct, enabling them to quickly access all parts of the suite without having to navigate a maze.

Electronic Communication Systems

Flow can be enhanced and managed by custom light-signaling communication systems that consist of a panel of colored signal lights mounted on the wall of exam and procedure rooms, nurse stations, and the reception



INTERNAL MEDICINE

7245 SF

Figure 3-5. Space plan, internal medicine suite, 7,245 square feet. *(Design: Jain Malkin Inc.)*

area. By glancing at a panel or pressing a button, physicians and staff can silently be notified of messages and emergencies, let others in the office know where they are located, and tell nurses and technicians where they are needed. The sequence memory program advances automatically, telling the doctor which patient is next. Monitor panels at nurse stations indicate at a glance the status of exam rooms, while another panel at the reception desk notifies clinical staff when patients have arrived and which provider they're scheduled to see. Expeditor Systems of Alpharetta, Georgia, is a leading vendor of these systems.

An add-on to the *Expeditor* communication system, called *Practice Profiler*®, provides room utilization analysis and documentation of the entire patient encounter. It measures the time a patient spends waiting in the exam room before the doctor arrives, the amount of time the doctor spends with the patient, and a monthly report on physician and staff productivity is emailed to subscribers. This type of data can help physicians become more efficient in the eternal quest to see more patients each day without sacrificing quality.

Another vendor, *Kelkom*, offers a similar type of signal communication and workflow management system that delivers information via a hardwired panel, a wireless tablet, or a virtual panel on a PC screen that disappears when in work mode with the patient (see Figure 10-57). *Comlite*, a third vendor, offers another customized system that is software-based which tells physicians what patient is in which room, who is next, and summons staff.

Physician Extenders

In recent years physicians (especially those in group practices) have increasingly added physician extenders (PEs) to their patient care management teams. Also referred to as "midlevel providers," these generic terms usually refer to physician assistants (PAs), medical assistants (MAs), and advanced practice registered nurses (APRNs). According to the American Association of Colleges of

Figure 3-6. Medical assistant workstation. *(Design: Pacific 33 Architects, Inc.; Photography: Ethan Kamisky)*

Nursing, APRNs are advanced registered nurses, typically with master's degrees, who fall into four categories:

1. *Nurse practitioners*, who provide primary-care diagnosis and treatment, immunizations, physical exams, and management of common chronic problems
2. *Certified nurse midwives*, who provide prenatal, postpartum, and gynecological care to healthy women, and deliver babies in a variety of settings
3. *Clinical nurse specialists*, who are trained in a range of specialized areas such as oncology, cardiac care, and pediatrics
4. *Certified registered nurse anesthetists*, who, according to the American Association of Colleges of Nursing, administer more than 65 percent of all anesthetics given to patients

Statistics for nurse practitioners, the largest group of APRNs, indicate that 22 states allow nurse practitioners (NPs) to practice independently without physician supervision, 24 states require a formal relationship (documented in writing) between an NP and a physician, and 4 states require the relationship but without the formal documentation. Only 13 states allow NPs to prescribe medications without the supervision of a physician.

Clearly, the use of physician extenders dovetails with the economics of our current healthcare system and the exigencies of the Affordable Care Act (ACA). Studies by the Medical Group Management Association (MGMA) and the American Medical Association (AMA) Center for Health Policy Research indicate that PEs can increase a physician's productivity and income and that patients are generally pleased with the quality of care delivered. Under Medicare regulations, services provided by a physician assistant in most physicians' offices are reimbursed the same as if provided by a physician.

If the medical practice includes physician extenders, they will require shared or private offices, based on the tasks they perform and their roles in the practice (Figure 3-6). Thus, a four-physician office with two PAs and one NP is a seven-provider office for the purpose of determining the number of exam and treatment rooms.

OFFICE OF THE FUTURE

Author's Comment: This section appeared in the last edition of the book, written in 2001, 12 years ago. It is strange how applicable it is today. We are still "rethinking" the process with the difference being that it is being driven by the mandates of the Affordable Care Act. As a reaction to the restrictive environment and progressively lower reimbursement, physicians have been leaving private practice in droves to become salaried physicians of hospitals in foundation model large group practices or another type of hospital-physician integrated delivery model. Others are joining Kaiser, while still others are working for insurance companies. Some have joined large single-specialty groups where the individual risk is less and the bargaining power of the group is more effective in contracting. In short, this is not the healthcare experience most midcareer and older physicians envisioned when they finished medical school. Yet, the new crop of physicians is stepping on stage totally comfortable with electronic health records and patient management and with very different expectations about the practice of medicine. The transition from "volume-based" care to "value-based" care is not one they will have to make.

Two forces—managed care and digital technology—are exerting pressure on physicians to rethink the *process*

of how they practice medicine. These pressures are particularly difficult for midcareer physicians and those with mature practices who may not be as comfortable with digital technology as young physicians and for whom the severe decline in reimbursement and the loss of control in determining the course of treatment for specific patients are barriers to the way they are accustomed to practicing medicine.

Change is indeed difficult and access to healthcare is a vital as well as emotional issue. What health plans and third-party payers will cover and what the physician believes is best for the patient are often at odds, creating great tension. It's not that younger physicians find this situation less frustrating, but their expectations may be lower since they were familiar with the new environment in which healthcare is practiced prior to entering medical school. They knew what they were getting into and one might even say that anyone going into medicine now must have the heart of a missionary, as one can no longer expect it will lead to a life of wealth and privilege.

As healthcare becomes more of a commodity, "processing" more patients in less time is a strategy for dealing with low reimbursement and the ever-growing demand for care. However, most physicians don't want to run in and out of exam rooms, spending mere minutes with each patient, never really getting to know them or developing a trusting relationship. This sets the stage for looking at a new way of practicing medicine that uses physician extenders for more routine examinations as well as digital technology to free up more time for the physician to spend with patients who require complex diagnostic assessments.

MANUAL VERSUS DIGITAL INSTRUMENTATION FOR DIAGNOSIS

The contrast between the use of manual diagnostic instruments and those with digital output is dramatic. The ubiquitous Welch Allyn diagnostic instrument panel mounted on the wall in almost every exam room relies on the practitioner's senses—hand to eye and eye to brain—versus the same instrument panel with wireless automated vital signs capture that uploads to an EHR. The Welch Allyn *Connex*® integrated wall system is fully electronic with pulse oximetry, pulse rate, blood pressure, and thermometer (Figure 3-7a). The otoscope and ophthalmoscope, if desired, can upload video images to a PC for transmission to another physician or upload them to the patient's EHR, which can also be useful if documentation is later needed for insurance verification of a claim. The AMD ophthalmoscope in Figure 3-7b is used widely by primary care and pediatric physicians for video examination of the retina. The avoidance of duplicate data entry and the efficiency afforded by electronic diagnostic devices will likely, over time, make it easy to recover the initial cost in a primary care setting where the emphasis is on seeing more patients in less time and providing a satisfying experience for them.

INTERCONNECTIVITY AND BIG DATA

Interconnectivity is the name of the game in the new healthcare system. This is IT on steroids—what's called "Big Data." It's one thing to have all your systems sharing data and "talking" to each other but entirely another to be able to analyze all the data meaningfully to be able to demonstrate value-based care. Currently, it is still a problem for private practice physicians to gain access to a patient's medical records for emergency department visits, for example, and vice versa. It is totally understandable, however, since although a private practice physician may have privileges at that hospital, he or she is not a salaried provider and many potential legal issues arise with providing access to a patient's confidential medical records. Nevertheless, it is frustrating for patients who visit private practice physicians in medical office buildings at different hospital campus sites (within the same system) to not have access to medical records. Patients who enroll in a hospital's health plan and receive treatment from providers within that system,

Figure 3-7a. Welch Allyn Connex® integrated wall system. *(Source: Welch Allyn, Inc.)*

Figure 3-7b. Mobile ophthalmoscope attached to smartphone. *(Courtesy of AMD Global Telemedicine, Inc., copyright © 2013)*

at whatever sites they choose to access, can reasonably expect total interconnectivity and sharing of data, whether they are inpatients or outpatients. If a patient selects, for example, Mayo Clinic, Cleveland Clinic, or Scripps Clinic, the entire network of clinic sites and hospitals will have access to the patient's medical chart, which offers the patient a great advantage in collaborative and coordinated care.

EXAMINATION ROOM DESIGN CHANGES

It is clear the "future" has arrived. One can see how the practice of medicine is being transformed by digital technology. But, psychologically, are physicians ready and willing to discharge their responsibilities and sensory contact with patients to an electronic device? Physicians who have been in practice for many years pride themselves on being able to tell a great deal by looking at a patient's skin tone, or examining their tongues, or picking up some elusive quality during the process of monitoring vital signs. After all, medicine is a science *and* an art. And with interest in integrative medicine (integration of allopathic or Western medicine and complementary therapies) steadily growing, it won't be easy to forge a marriage between digital technology and New Age "energy" medicine. James Bond meets Andrew Weil.

[From a 2014 perspective, this doesn't have to be a zero sum game. With a properly designed exam room, it can be both high-tech and high-touch with physicians relying on EHR to more quickly access notes in order to spend more quality time face to face with patients. New exam

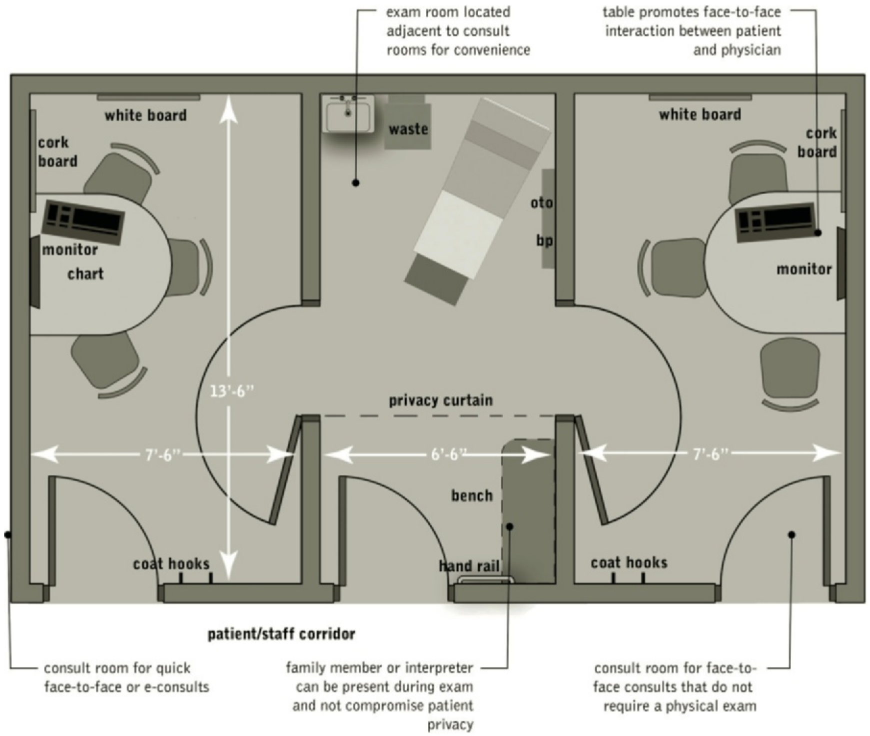


Figure 3-8. Talking room suite concept. *(Courtesy: HGA Architects)*

Figure 3-9. Examination room consultation station. *(Photo courtesy of Nurture by Steelcase, Inc.)*

room designs integrate computers and monitors in numerous layouts offering individual practitioners many options according to personal preference (see Figures 1-1, 3-2, 3-4b, 3-8, 3-9, and Color Plate 6, Figure 3-123). Likewise, exam room size is growing. The "new" exam room is covered in detail later in this chapter. The room in Figure 3-4b can be used as an exam room or a talking room.]

PLACEBO EFFECT

In integrative medicine, rapport between the physician and patient is key to a successful outcome. According to Herbert Benson, M.D., author of *Timeless Healing: The Power and Biology of Belief*, the placebo effect (belief that causes self-healing) is greatly enhanced when the patient *believes* that the physician is capable of healing him, when the physician *believes* in the efficacy of the treatment, and when, together, there is a belief in the relationship. In the end, digital technology need not preclude developing a warm and caring relationship with patients. By automating the more routine aspects of a patient visit, the physician may have more time to spend as diagnostician and teacher.

INSTITUTE FOR HEALTHCARE IMPROVEMENT[2]

This nonprofit, Boston-based research and education organization, established in 1991, focuses on accelerating the pace of improvement in healthcare systems. It is based on broad collaboration, rather than competition, between people and organizations that are committed to major reform. Initiatives that might be of interest to readers of this book are those relating to subsystems of office practice such as workflow and patient flow, patient satisfaction, physical office design, and the elimination of delays and waiting in all aspects of patient care delivery. The organization's mission statement for the *Idealized Design of Clinical Office Practices*™ project (initiated in January 1999) states that it will "design, test, and deploy new models of office-based practices...capable of fundamentally improved performance levels, better clinical outcomes, higher satisfaction, lower costs, and improved efficiency in a more rewarding work setting." Forty-two prototype sites from 23 organizations participated in this study. Readers are encouraged to consult the IHI website (www.ihi.org) for more information about the innovative work undertaken by this organization. A brief outline of the philosophical principles underpinning the IHI vision for idealized office-based care follows.

Author's Comment: Although there are no recent updates to this research endeavor, this information from the third edition of the book will be repeated here because Don Berwick (no longer the CEO) is a giant in the healthcare world and the organization he founded (ihi.org) has done more to prod and challenge the status quo of how healthcare is delivered in both outpatient and acute care settings than any other organization. Dr. Berwick's consistent focus on reducing or eliminating preventable deaths and improving patient safety in its many aspects has brought him worldwide attention and admiration. Sometimes it takes a very long time—15 years in this case—for the healthcare industry to catch up with the forecast of one of its most visionary practitioners.

PRINCIPLES FOR OFFICE-BASED PRACTICES (IHI)

We believe that the following Principles serve as a foundation upon which clinical offices will be designed; they represent the fundamental underpinnings of office-based care. The ideal clinical office will create systems to assure that these Principles are achieved.

1. Paramount focus on the clinician-patient relationship
2. Individualized access to care and information at all times
3. Knowledge-based care is the standard
4. Individuals control their own care to the extent that each individual desires
5. Minimal waiting for all involved in the processes of care
6. Seamless transfer and communication of information and coordination of care
7. Financial performance sufficient to ensure unhindered viability
8. Patient and practice management will be based on real-time data, including measures of process, satisfaction, finance, outcomes, and epidemiology
9. Continual improvement and waste reduction in all processes and services
10. Individual health linked to broader community health
11. A model work environment

[2] All IHI information was provided by permission of Donald Berwick, M.D., M.P.P., President and CEO, Institute for Healthcare Improvement.

One cannot fail to observe that, despite seismic pressures on physicians and the healthcare system in general, the clinical office practice has changed little in decades—that is, until now. The description below, by Charles Kilo, M.D., of IHI, is dated 1998 and it still holds true today, in 2013, except for a handful of pilot projects such as the innovative Ambulatory Practice of the Future discussed below. The Affordable Care Act (ACA) will spawn more such experiments as providers try to truly redesign the way they deliver care to be more efficient and effective.

Few can disagree with IHI's premise:

> The clinical office lies at the heart of health care. For most patients most of the time, it is the portal of entry, the communications hub, the primary locus of care, and, in these days of integrated care, the coordinating center. For most doctors, too, it is home base; they speak of *the* hospital, but *my* office.
>
> The average clinical office practice of today bears remarkable similarity in form, process, design, and activity to the offices of a decade, two decades, even a half-century ago. In the typical office setting, patients still phone in for appointments, register upon arrival, wait in waiting rooms, disrobe in examination rooms, listen in consulting rooms, and wave goodbye to the receptionist in a sequence of actions that would look nearly identical if we could compare, say, 1950 to 1998. A few differences would be noticeable, of course—the desktop computer instead of the typewriter, the otoscope now fiberoptic, the furniture modular, the increased ability to provide certain treatments such as antibiotics and chemotherapeutics, and the credit card taken and checked automatically. But, the core sequence, the systems that support the work and, more importantly, the assumptions about what work is to be done, would all be almost identical—1950 equals 1998.[3]

[3] Lecture handout by Charles Kilo, M.D., M.P.H., *Idealized Design of Clinical Office Practices*, Symposium on Healthcare Design, San Francisco, November 1998.

THE TRIPLE AIM

The *Triple Aim* is a framework developed by the Institute for Healthcare Improvement that describes an optimizing health system performance. It underscores three critical objectives of the ACA:

1. Improve the health of the population
2. Enhance the patient experience of care (quality, access, reliability)
3. Reduce the per capita cost of care

Patient-Centered Medical Home

There is a fundamental restructuring of primary care occurring in the United States and it is largely focused on the Patient-Centered Medical Home (PCMH), which is a foundational piece of the Accountable Care Organization (ACO). The many patients who will gain healthcare coverage as a result of the ACA may not actually have access unless a fundamental shift in care management occurs. Valuable lessons can be learned from the approach to holistic care at two ends of the spectrum—safety-net community health centers (refer to Chapter 4), and from physicians who practice membership-based direct care, sometimes referred to as "concierge care." Both achieve a high level of continuity of care, create a medical home for patients, and offer prompt access and coordination of care for patients who have chronic or complex medical conditions. The ACA will ramp up the need for primary care and the deployment of many more community health center and ambulatory care facilities, but the physical design and clinical workflow will be distinctly different from existing models. Clearly, the focus is on wellness, management of chronic conditions, team-based care delivery, an optimized and personalized patient experience, and measurement of performance in health outcomes. In fact, a value-based payment model is on the horizon. Here comes the need for "Big Data" analytics. Experiments are going on around the nation as physicians try to respond to the new normal of reduced

reimbursement, prevention, and the tsunami of newly insured patients heading their way. It's an exciting time to be working in healthcare as it is reshaped and reformed in ways that will hopefully achieve the IHI's Triple Aim.

An important building block of primary care reform is the creation of Patient-Centered Medical Homes. The concept actually parallels in a more formal way the characteristics of safety-net health centers in terms of delivery of care. To be designated a PCMH, "primary care practices are expected to provide *comprehensive* primary care including care management, care coordination, enhanced access, patient engagement, and proactive patient planning and are expected to be NCQA (National Committee for Quality Assurance) Level 3 or an equivalent (i.e., complete medical homes) and meaningful use certified." (www.transformed.com/ceoreports/comprehensive_primary_care_initiative.cfm; retrieved 15 March, 2013).

Transforming Care

Think about the radical change here. Typically one consults a primary care physician for episodic care and the diagnosis and advice are generally limited to that one specific visit. Whereas, becoming a PCMH requires a physician to proactively follow up with each patient, creating a care plan whether it is prevention and wellness for a healthy person or a plan that extends community-wide for a patient with chronic conditions and comorbidities to reach out to a variety of providers from nutritionists to physical therapists and home health agencies. Coordinating all of this and eventually measuring if one is providing value according to state and national metrics is a daunting task, especially with continually lower reimbursement. The proposition is: If patients receive *health* care, not *sickness* care, they will ultimately need less of it, some may avoid chronic debilitating illnesses, and emergency room visits will go down as will hospital admissions. But that is based on patients being compliant and some inroads being made in controlling the nation's obesity problem. A lot of "ifs." This is why "improving the health of the population" is one of the Triple Aims. Healthcare is moving from the individual to the community and one expression of this is the Patient-Centered Medical Neighborhood.[4]

The American Academy of Family Physicians established *TransforMED* in 2005 to assist physicians in transforming their practices to a new model of care. Their website (transformed.com) offers many interesting resources and articles on PCMH and Patient-Centered Medical Neighborhoods (PCMN). In 2007, leading primary care associations endorsed the *Joint Principles of the Patient-Centered Medical Home* as a goal for the organization and for delivery of care throughout the healthcare system. It requires a high level of information technology, provider payment reform that rewards outcomes, and team-based education and training of the health professions workforce (www.pcpcc.net/what-we-do). In 2008 the Commonwealth Fund launched the five-year *Safety-Net Medical Home Initiative* to help 65 community health centers transform into Patient-Centered Medical Homes. In 2010 the ACA included substantial support for medical home initiatives, including the CMS *Advanced Primary Care Practice Demonstration* bringing together, for the first time, public and private health plans to examine the effectiveness of medical homes. As of January 2012, 41 states had adopted medical home programs; however, they structure their definitions and priorities differently. In some states, payments to providers may vary depending on the number of chronic conditions a patient has and if there is a language barrier or mental illness. In other states, payments are based on a maximum per member per month that varies with the payer type (Medicare Advantage Plans, Medicaid, commercial payers) and may vary based on medical home effectiveness. A state may pay primary care providers for remote consultations with hospital-based specialists to improve care for complex patients or they may receive funding for establishing a registry for tracking important patient data to develop a system for sharing clinical information perhaps with a key hospital.

PCMH Accreditation Agencies

There are various accreditation agencies for PCMH each with a set of standards and specific criteria. The Joint

[4] Bruce Bagley, "PCMH Primary Care Practices: Crucial Component to Successful Medical Neighborhood Development and Implementation," *Medical Home News*: Vol.5, No. 7, Health Policy Publishing: July 2013 (www.medicalhomenews.com).

Commission, in 2011, launched the *Primary Care Medical Home Certification* option for its accredited ambulatory care organizations. In addition, the Accreditation Association for Ambulatory Health Care (AAAHC) offers accreditation for medical homes. There is the *National Center for Medical Home Implementation Accreditation* and the *National Committee for Quality Assurance (NCQA) PCMH Recognition* designation that has three levels of achievement.

Financial Benefits of Medical Homes

Leading insurance payers, such as WellPoint and United Healthcare, expect that PCMHs have the potential to save twice as much as they cost with estimates of 70 percent reduction in ED visits and 40 percent fewer hospital readmissions. (See Tables 1 and 2 (www.pcpcc.net/guide/benefits-implementing-pcmh) for outcome measures for 7 of the 41 states engaged in PCMH demonstration projects.) In addition, the Agency for Healthcare Research and Quality (ahrq.gov/research/primarix.htm), awarded, in 2010, 14 two-year "transforming primary care" grants to selected organizations to study the transformation of primary care practices to PCMHs. A description of each project's diverse objectives can be found on the AHRQ website (ahrq.gov/research/transpcaw.htm).

Geisinger Clinic has been celebrated by the Obama Administration and the American Hospital Association as one of the nation's most effective providers, achieving quality outcomes at moderate cost. Through its ProvenCare program (a version of the medical home model), the health plan integrates care managers into the clinical team to proactively keep in touch with patients to coach them. "Every time the system 'touches' the patient, it is reported to the case manager, who calls the patient and coordinates appropriate care—for example, reminding the individual to pick up a prescription.[5] Accordingly to Dr. Alfred Casale, this has resulted in a 30 to 50 percent reduction in hospital readmissions and other benefits.

[5] Howard Skoke, "Strategic Planning and Institutional Health," *Healthcare Design*, June 2011, 62.

RESOURCES: MEDICAL HOMES

California HealthCare Foundation (chcf.org)

Patient-Centered Primary Care Collaborative (pcpcc.net/what-we-do). See downloadable guide under "Publications": *Benefits of Implementing the Medical Home*.

Agency for Healthcare Research and Quality (ahrq.gov/research/primarix.htm)

National Academy for State Health Policy (nashp.org/med-home-map)

TransforMED.com

Benefits of Implementing the Primary Care Patient-Centered Medical Home: A Review of Cost and Quality Results 2012 (www.pcpcc.net/guide/benefits-implementing-pcmh)

The American Academy of Private Physicians (AAPP.org)

Primary care, everywhere: *Connecting the dots across the emerging health landscape*, November 2011, by Jane Sarasohn-Kahn (chcf.org)

Direct Care—The Future of Private Medicine?

Physicians have long been frustrated by the interaction with insurance companies and third-party payers that will pay only for episodic care and all-too-brief wellness visits. They know that to practice the kind of medicine that would be effective and make them feel good about what they do, they would have to spend much more time with patients, really get to know them, and take a long-term view of each patient's health and goals. A growing number of physicians have redesigned their practices to be what is called "direct care" and sometimes referred to as "concierge care." There is a misunderstanding, however, that

this is healthcare for rich people. Although the monthly or annual fees and the specific practice model vary widely, the amount of care a patient typically receives for that sum of money is quite a bargain in most cases. And who wouldn't want to be able to email his or her physician directly or send a text to get an immediate reply to a problem? This movement is changing American healthcare by restoring the doctor-patient relationship of times past unencumbered by insurance company policies, provider-network constraints, and the misaligned incentives that are characteristic of our current healthcare system. The American Academy of Private Physicians (AAPP) is the national association representing direct care physicians.

Patients at both ends of the health spectrum find this type of relationship with a physician particularly appealing. Someone in fragile health, for example, with multiple cardiovascular problems, may appreciate being able to get their doctor on the phone—someone who is intimately familiar with their health problems—instead of having to make numerous trips to the ED to be evaluated by an on-call doctor who doesn't really know them. Healthy patients who are keen on preventive care appreciate the lengthy appointments with their personal physician who has the time to listen to them and to educate them about maintaining optimal health as well as employ advanced risk assessment tests for asymptomatic cardiovascular disease. Patients who pay a membership fee, according to some of these physicians, are more motivated to be compliant, which increases the physician's professional satisfaction. According to one of the leaders of this movement, the direct primary care model decreases hospital utilization by an average of 75 percent and also significantly reduces ED use, which has brought it to the attention of large self-insured employers and also health plans.[6]

The practice of medicine has become increasingly difficult for physicians and the ACA has not made it any easier. Reimbursement has been cut and pressure to see even more patients at a lower cost has ramped up, causing many physicians to sell their practices to hospitals, to join an organization like Kaiser Permanente, or to associate with a very large group that has more clout in negotiating contracts and can ease the burden of malpractice premiums. A growing number will savor the opportunity of direct primary medicine in which they can have an old-fashioned, close relationship with their patients while embracing a high level of technology. In these practices, creating a great patient experience is fundamental and that includes wanting to have a memorable office ambience. In these practices, waiting rooms are small because the goal is not to have patients wait (see Color Plate 1, Figures 3-10 and 3-11). In this practice, the physician's love of art and architecture is expressed in the selection of books. The reception room is designed more like a library reading room.

Direct primary care (DPC) is an emerging practice model that is expected to grow rapidly in the next ten years and, for that reason, needs to be discussed. Even prior to the ACA, physicians practicing in this model have been achieving the Triple Aim, managing costs well with improved patient outcomes and high patient satisfaction. For this reason it's been getting a lot of attention. Not surprisingly, Seattle and its environs are home to *Qliance*, the first DPC that has offices throughout the region. It was founded by physician Garrison Bliss, one of the pioneers of this movement, and an early evangelist for a more patient-centric model of care. Today, he has the financial backing of Amazon's Jeff Bezos and others who recognize the value in Qliance's promise on its website "for one monthly fee, you get unlimited access to the finest doctors, whether you have insurance or not." Washington State has always been progressive with respect to embracing alternative models of care such as naturopathy and homeopathy. Dave Chase, a health IT pundit and author of a book on patient engagement, has studied this model of care and written some of the most well-researched articles on it.[7],[8]

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[6] Edward Goldman, M.D., American Academy of Private Physicians Conference, Boston, 9/24/2011.

[7] Dave Chase, "On Retainer: Direct Primary Care Practices Bypass Insurance," California HealthCare Foundation: April 2013 (chcf.org)

[8] Dave Chase, "Health Plan Rorschach Test: Direct Primary Care," www.forbes.com/sites/davechase/2013/07/06/health-plan-rorschach-test-direct-primary-care; accessed August 7, 2013.

Figure 3-10. Reception desk in concierge care suite. *(Interior architecture and design: Jain Malkin Inc.)*

Figure 3-11. Waiting room, concierge care suite. *(Interior architecture and design: Jain Malkin Inc.)*

Some of the larger DPC organizations include *MedLion*® in Las Vegas; *Iora* Health in Cambridge, Massachusetts; *Paladina Health*™ of Denver; and *White Glove Health* headquartered in Austin, Texas. A visit to their websites can be an educational experience with thoughtful discussions about how to improve healthcare. Iora Health has developed *Dartmouth Health Connect* for the employees and dependents of Dartmouth College and *Culinary Extra Clinic* serving hotel and restaurant workers in Las Vegas. The latter is sponsored by the Culinary Health Fund specifically for workers with severe and chronic illness. Paladina Health™ offers patient-centered medical homes and many interesting statistics and hot links to articles on healthcare topics. White Glove Health offers *empowered health* and house calls and has contracts with 130 employers, according to their website. While these are large organizations more geared to employer contracting, hundreds of one- and two-physician direct primary care and concierge care practices exist throughout the nation.

The Economics of Direct Care

If this model of care sounds like it's too good to be true, here's a simplified version of how it generally works. A primary care physician in an insurance-based model typically has a panel of 2,500 patients, whereas a physician in a direct care practice typically has 800 patients in a

panel. If the retainer or member fee is $75 per month per patient, that provides an income of $720,000, which after paying office expenses, offers a reasonable salary for the physician. Two physicians sharing an office would reduce the overhead for each. These physicians do not have to have a fleet of staff to deal with billing and collections from insurance companies, which means they can keep more of the money from member fees. In a concierge care practice, members may pay $2,000 to $5,000 annually for 24/7 access (often including the physician's personal email address and cell phone) and very personalized service. The physician gets to know the patient and their families well and, for people who travel, will connect the patient to a network of providers wherever they happen to be. It's direct care ramped up to another level.

Whether DPC or concierge care, the way it works is similar. Because there are fewer patients, visits are longer, same-day appointments are common, and there are usually no waits in the waiting room. These practices develop EHRs that are unique because they are not focused on billing codes and charges, but on metrics for managing patients' health and on making these records available through secure portals anywhere. Some of these physicians give their patients their entire health record on a magnetic card like a credit card to carry in their wallets. There is a tremendous focus on mobile devices to be able to communicate easily with patients and for patients to be able to send a photo, for example, of a skin rash or other condition, to their physician for advice. One of the real differentiators between this and an insurance-based practice is the patient doesn't have to visit the office in order for the physician to bill. It's a different system so virtual consults are not a problem and are often a patient-pleaser for busy individuals. Patients also use biometric devices to monitor chronic conditions such as high blood pressure, heart rhythm irregularities, or blood sugar. These results can be interpreted and monitored by the physician remotely in a proactive manner before things get out of hand leading to unnecessary emergency room visits. This practice model unites high technology and high touch in a very personalized approach to care.

Author's Comment: I was introduced to this model of care several years ago and have followed it with fascination ever since. I attended several AAPP member conferences, having been invited to speak on office design to support this model of care. I found the physician presentations enlightening. I had opportunities to meet many physicians and to experience their passion for the successes they have had in improving their patients' health status. As you can tell from what I have written, I am a believer in this model of care.

The Ambulatory Practice of the Future

This is one of the more interesting experiments in primary care that melds a great patient experience with clinical excellence, operational efficiency, cost control, and dedication to a culture of continuous improvement. On top of that, it has great design. Owned by Partners® Healthcare (founded by Massachusetts General Hospital and Brigham and Women's Hospital) the *Ambulatory Practice of the Future* (7,200 square feet) is located on the tenth floor of an office building with views of downtown Boston and the harbor. The waiting area is more like a residential living room, open and airy, and offering options of enjoying a beverage, working online, or reading (see Figure 3-12 and Color Plate 2, Figure 3-13). Intended to be a total redesign of the outpatient care experience, it is based on the patient being an active participant with exam rooms designed to break down the traditional barriers between patient and physician (Figure 3-14). In this model, the patient is regarded as the expert in their own health needs and this is supported by proactive continuous healthcare and access to educational resources. Family members are integrated into the care. A core principle—collaborative team interaction—is reinforced by the space plan (Figure 3-15) giving staff visual and geographic access to exam rooms (Figure 3-16) as well as flexible, adjustable height workstations (Figure 3-17). Scheduling and check-in is onsite or remote (Figure 3-12); virtual visits are offered including remote monitoring and automatic recording of vital signs to electronic health records. Remote conferencing and consulting is also available. This project is intended as a prototype for future clinics.

Figure 3-12. The Ambulatory Practice of the Future entry kiosk. *(Stantec; Photographer: Gina Kish)*

Figure 3-13. The Ambulatory Practice of the Future waiting area. *(Stantec; Photographer: Gina Kish)*

Figure 3-14. The Ambulatory Practice of the Future examination room. *(Stantec; Photographer: Gina Kish)*

Figure 3-15. Space plan for the Ambulatory Practice of the Future, an innovative approach to the delivery of primary care. *(Courtesy of Stantec)*

Figure 3-16. Team collaboration area, the Ambulatory Practice of the Future. *(Stantec; Photographer: Gina Kish)*

Figure 3-17. Team collaboration area, the Ambulatory Practice of the Future. *(Stantec; Photographer: Gina Kish)*

Clinic Operational Principles

1. All clinical staff operate to the upper limits of their licenses.
2. All exam rooms have a consultation desk to foster patient/provider information sharing.
3. A practice driven by data; a robust IT interface with multiple locations of monitors.
4. Design intended to impact the behavior of staff and patients (patients to be more compliant and focus on prevention and wellness).
5. Virtual visits are possible from any exam room or private location.
6. Teaching and learning spaces flex in size to accommodate patient and staff learning.
7. Lean design operational principles.
8. Shared off-stage offices and staff interaction spaces offer places of respite and promote a collaborative culture.

A Paradigm Shift

Current Paradigm	APF Paradigm
Focus on sickness	Focus on health and life balance
Event-based healthcare	Continuous healthcare
Static experiences	Interactive experiences
Directive communication	Collaboration
Individual experiences	Team-based experiences
Patient goes to treatment	Treatment goes to patient
One size fits all	Mass customization
Obscurity	Transparency

The author wishes to thank the Stantec Principal-in-Charge, Gina Kish, for sharing information on this project.

The parallels to the patient-centered medical home and especially to direct primary care are apparent. This project opened in May 2010. The owner is self-insured, which enables them to test the model without being fettered by issues of insurance reimbursement.

Cisco LifeConnections®

Cisco, the global leader in networking systems, embarked on a project to determine if they could improve the health and wellness of their employees by developing a clinic on their San Jose campus. According to the size of this venture (24,000 square feet) it more accurately belongs in the Group Practice chapter of this book, but it is included in Primary Care because it is relevant to the discussion of new directions and innovation. Cisco was searching for a new care model that offered a relaxing spa-like setting embedded with a high level of technology that would meet the expectations of employees who are accustomed to a high-tech environment. The Cisco leadership team crafted a document in which they choreographed every aspect of the customer/patient experience, examining each stage of the journey, creating "magical moments," experience goals, and technology requirements to make it happen. They tried to anticipate what an optimal experience would look like and how it might be perceived by the patient. They gave the design team (Jain Malkin Inc.) books and literature given to new Cisco employees to help them understand the culture and provided opportunities to visit their innovation center.

A central theme in their marketing is "the human connection" and this became the clinic theme, "nurturing health through the human connection," which evolved into heart, mind, body, and spirit—the four nodes/rotundas that anchor each area of the clinic (Figure 3-18). The heart node is closest to the reception area and the core or center of the clinic. The "mind" node is closest to the large server (the metaphorical "brain") room that supports the clinic and can be viewed when the electric glazing is switched from frosted to vision. Apart from the desire to manage their employees' health and develop metrics by which to measure performance, Cisco saw this as an opportunity to develop a business model for other Fortune 500 companies to help them see the value of building an employee health center on their campuses. To this end, a large showcase suite was developed to demonstrate the technology to a group of visitors without disturbing clinic functions.

The clinic offers primary care along with acupuncture, travel medicine, dental care, mental health, nutrition counseling, chiropractic, physical therapy, pharmacy, laboratory (see Figure 6-61), and radiology. On the lower level, a large fitness center has equipment that allows an individual's exercise program to be uploaded to each piece of equipment, which, in turn, sends a report documenting whether the user actually "fulfilled" the prescription. At the reception desk, by swiping a card, the employee's visits are logged, showing frequency and duration. These reports are sent to the care team to provide feedback. (Whether this is still being used in this manner is not known.)

Patients can schedule, check-in, and communicate with providers online through a secure portal or they can check themselves in on a tablet upon arrival (Figure 3-19). The goal was to allow patients to function as independently as possible even to the point of knowing which care suite is open and available and being able to find it on their own.

The most unique aspect of this clinic is the care suite concept that was a response to creating a memorable experience for patients. A care suite consists of three rooms: a "living room," an exam room, and private bathroom (Figure 3-20). The entry to a care suite can be seen in the rear of the photo in Figure 3-21. It consists of horizontal panels of frosted glass framed by bands of maple wood. To ensure privacy, all walls of the clinic extend to the deck above and exam room doors have sound-sealing gaskets and an automatic drop-down seal at the bottom. The "living room" has lounge chairs facing a large flat screen monitor (Figure 3-22); this is where vitals are taken and discussion with the provider occurs in an informal setting that minimizes the power differential between physician and patient. There is total transparency with charting notes visible to the patient on the monitor. If an

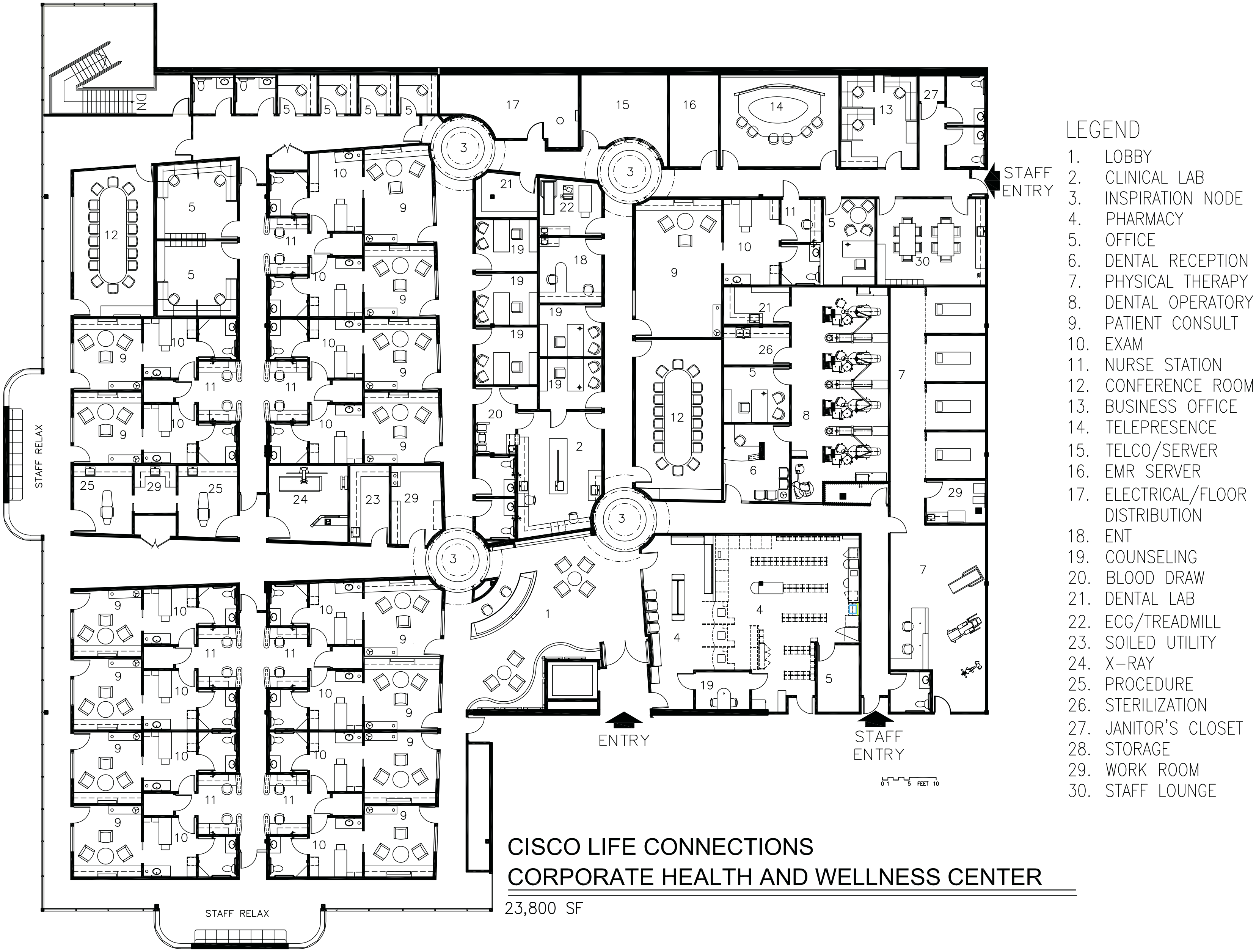
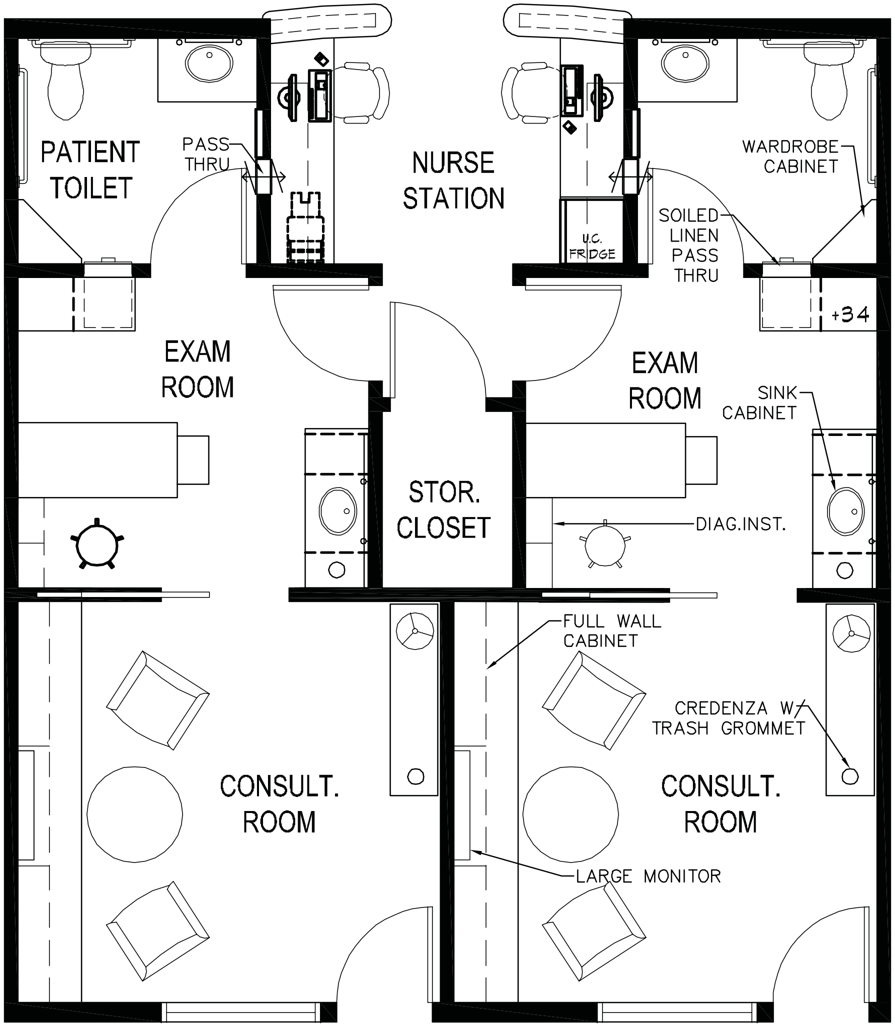


Figure 3-18. Cisco LifeConnections Health Center, corporate health and wellness, 23,800 square feet. *(Space planning and design: Jain Malkin Inc.)*

Figure 3-19. Registration kiosk, Cisco LifeConnnections. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*



CISCO LIFECONNECTIONS ENLARGED VIEW CARE SUITE

435 SF

Figure 3-20. Layout of a care suite, Cisco LifeConnections. *(Space planning and design: Jain Malkin Inc.)*

Figure 3-21. Reception/waiting area, Cisco LifeConnections Health Center. *(Interior architecture and design: Jain Malkin Inc.; Steve McClelland Photography)*

Figure 3-22. Care suite consultation room, Cisco LifeConnections Health Center. *(Interior architecture and design: Jain Malkin Inc.; Steve McClelland Photography)*

examination is required, a family member who may be present, or a child, can remain in the living room and watch entertainment or educational programming while the patient moves to the examination area. That room also has a large flat screen monitor because the emphasis is always on education (Figure 3-23). The cabinet alongside the exam table conceals all clinical gear until needed (Figure 3-24). The private bathroom has a locked cabinet for backpack, clothing, or handbag.

The staff accesses care suites through "off-stage" corridors that have a nurse station for each care suite (Figure 3-25). Because the clinic is on the second floor with full glazing on exterior walls, it has the feeling of a tree house. The space plan, although dense, has plentiful natural light due to light flowing in from exposed exterior walls (see Figure 7-18) and 6-foot diameter skylights in the rotundas. Lighting of corridors is recessed into the wall to not disrupt the wood grille ceiling and also to provide subtle lighting (Figure 3-26). This project is LEED® Gold certified.

Waiting Room

The waiting room is the patient's introduction to a physician or dentist. One forms a first impression of the practitioner by the image projected in the waiting room. This is where psychology plays a significant role. Outdated furniture with faded or torn upholstery may simply be the result of a doctor's busy schedule or his or her reluctance to focus on it as an important aspect of patient care. The neglect of the waiting room generalizes to other areas, and patients may feel that this is a physician or dentist who might be neglectful in their care—one who manages to slide along with minimum standards. Designing the waiting room as a comfortable, cheerful space with appealing colors, soft lighting, and appropriate furniture is important.

Occasionally a physician will desire to have an office design that is an expression of his or her approach to care. Such was the case at LifeScape in Scottsdale,

Figure 3-23. Examination room, Cisco LifeConnections Health Center. *(Interior architecture and design: Jain Malkin Inc.; Steve McClelland Photography)*

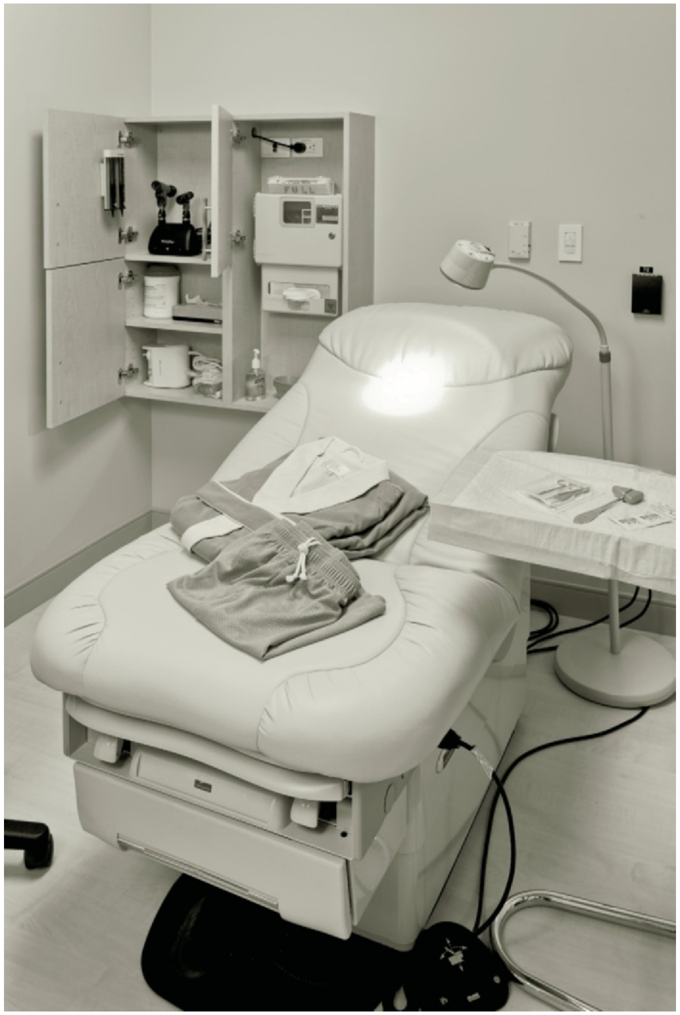


Figure 3-24. Examination room with diagnostic medical instruments concealed in cabinet. Cisco LifeConnections Health Center. *(Interior architecture and design: Jain Malkin Inc.; Steve McClelland Photography)*

Arizona, a family practice office that is a hybrid model offering patients the option of insurance-based or membership concierge care. The practice is based on holistic care—"*whole health for a whole life*"—and, as such, the goal was to create an office that felt different from the moment one entered—a feeling of calm and tranquility. The first thing one sees is a granite boulder with water cascading down it and bamboo extending up through the wood grid ceiling (see Color Plate 3, Figure 3-27). Much attention was afforded lighting design, including large custom-built disks of white fabric that softly diffuse light. Although this is not a LEED project, natural materials were used wherever possible such as slate on the reception wall and floor. The waiting area is designed like a living room in that it has several styles of seating arranged in privacy clusters. Sails suspended over the children's play area reduce the scale (see Color Plate 3, Figure 3-28); electronic educational games are mounted to the wall (Figure 3-29).

Figure 3-25. Nurses' workstation in off-stage zone, Cisco LifeConnections Health Center. *(Interior architecture and design: Jain Malkin Inc.; Steve McClelland Photography)*

Figure 3-26. Internal clinic corridor, Cisco LifeConnections Health Center. *(Interior architecture and design: Jain Malkin Inc.; Steve McClelland Photography)*

Table 3-1.
Analysis of Program
Family Practice

No. of Physicians:		**1**		**2**		**3**
Consultation Room/ Private Office		12 × 12 = 144	2 @	12 × 12 = 288	3 @	12 × 12 = 432
Exam Rooms	3 @	10 × 12 = 360	6 @	10 × 12 = 720	9 @	10 × 12 = 1080
Waiting Room		14 × 18 = 252		16 × 20 = 320		18 × 20 = 360
Business Office[a]		12 × 18 = 216		16 × 18 = 288		18 × 30 = 540
Office Manager				10 × 12 = 120		10 × 12 = 120
Nurse Stations		10 × 12 = 120	2 @	10 × 10 = 200	3 @	10 × 10 = 300
M.A. Workstation		6 × 10 = 60		6 × 10 = 60		6 × 12 = 72
Toilets	2 @	8 × 8 = 128	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Storage		6 × 8 = 48		8 × 8 = 64		10 × 10=100
Cast Room		Use Minor Surgery		Use Minor Surgery		Use Minor Surgery
Staff Lounge		8 × 10 = 80		10 × 12 = 120		12 × 12 = 144
Minor Surgery		12 × 12 = 144		12 × 12 = 144		12 × 14 = 168
Radiology[b]		—		16 × 20 = 320		16 × 20 = 320
Laboratory		8 × 8 = 64		8 × 10 = 80		16 × 16 = 256[c]
Tel. Equip/Server Closet		4 × 5 = 20		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16		4 × 4 = 16
Subtotal		1652 $ft.^2$		2888 $ft.^2$		4120 $ft.^2$
20% Circulation		330		577		824
Total		1982 $ft.^2$		3465 $ft.^2$		4944 $ft.^2$

[a]Includes reception, appointments, bookkeeping, and insurance/collections.
[b]Includes control and dressing area.
[c]Includes lab, sub-wait, and blood draw.
Note: Consultation rooms (private offices) may be smaller (10 × 12) or shared (two physicians in a 12 × 12 room).

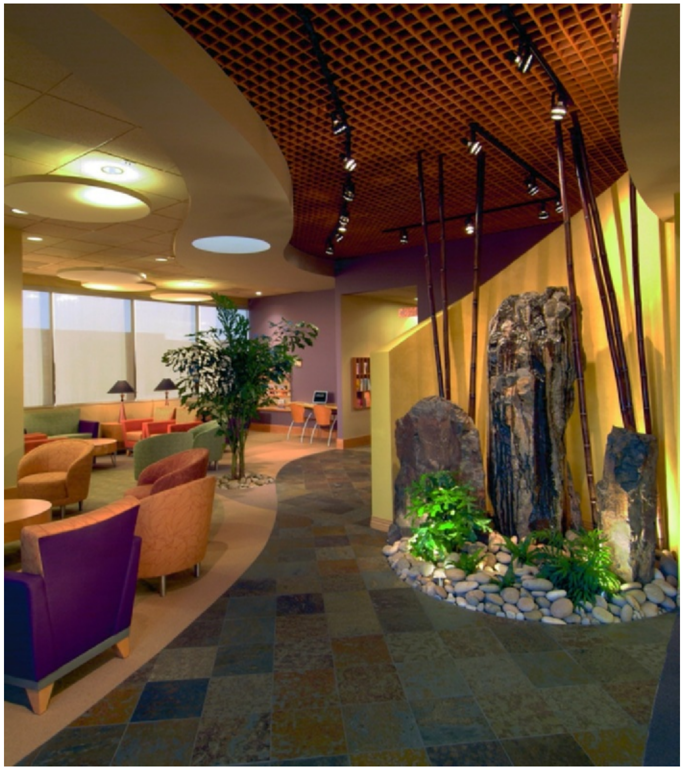


Figure 3-27. Reception and entry, LifeScape Medical Associates. *(Interior architecture and design: Jain Malkin Inc.; Gary Knight Photography)*

Note, in the space plan (Figure 3-30), that walls of exam rooms are staggered in a stair-step design to add interest to the corridor and also provide opportunities to have appropriate start and stop points for an array of accent colors. Throughout, design detail was directed to ceilings; fortunately, this was a freestanding new building in which high ceilings were possible. The large central nurses' station is close to all exam rooms and features cone-shaped writing surfaces for physicians and also a stand-up height PACS viewing station (Figure 3-31). A multipurpose conference room is also used for group sessions with patients who have chronic disorders. A nearby kitchen makes it easy to serve food. The suite contains a radiography room, lab, Dexa scan, an aesthetic procedure room, Optomat vision screening, and a fitness stress test treadmill room. Exam rooms have a built-in bench that accommodates several people (see Figure 3-55). According to the physician, this has worked very well and it is easier to clean the room without having to move several guest chairs.

Figure 3-28. Children's entertainment area features suspended "sails" to reduce, for children, the scale of the high ceiling. LifeScape Medical Associates. *(Interior architecture and design: Jain Malkin Inc.; Gary Knight Photography)*

Evidence-Based Design

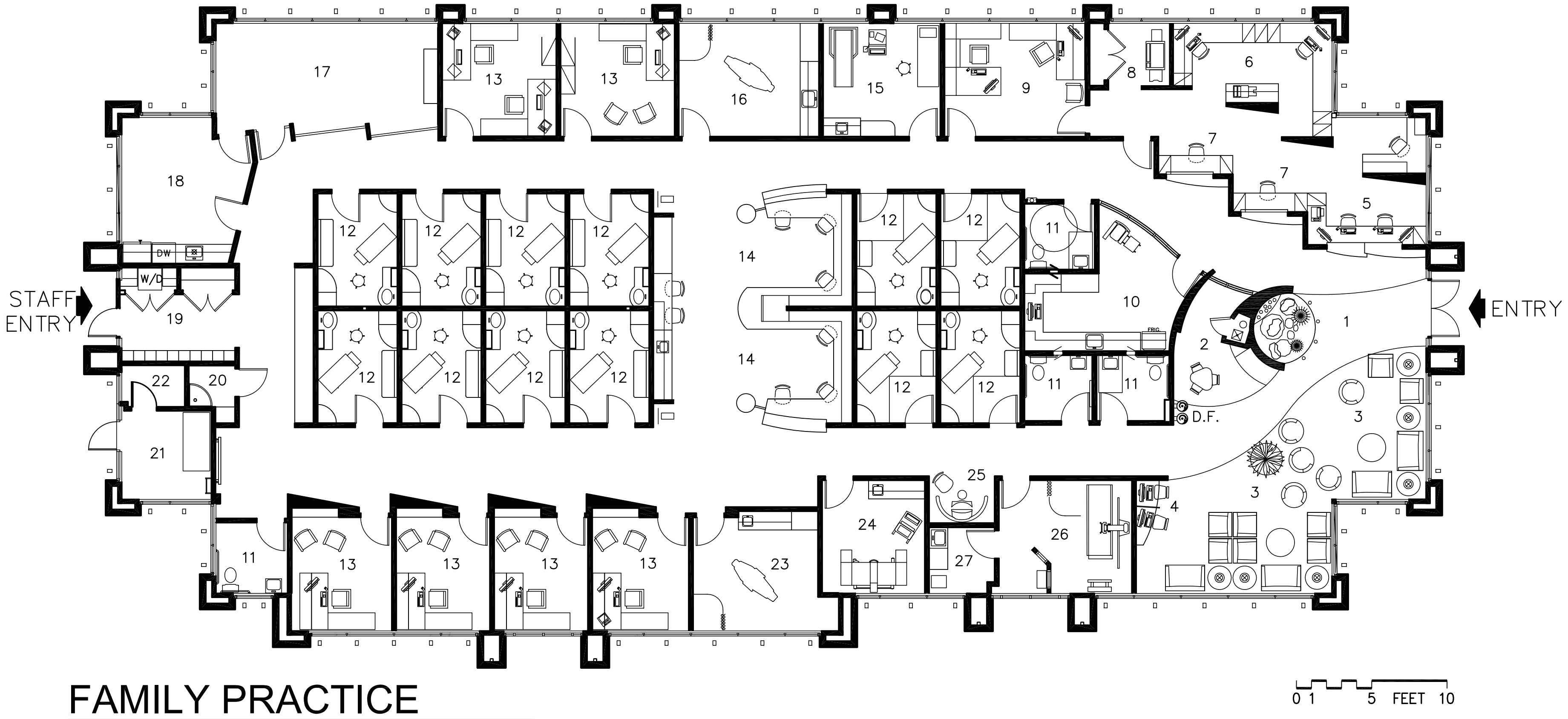
A number of studies have demonstrated that attractiveness—the aesthetics—of the waiting room influence patients' assessment of clinical care. At Weill Cornell Medical Center, in 2006, six different gastrointestinal waiting rooms reflecting differing levels of comfort and ambience were studied with these results:

Figure 3-29. Children's entertainment area, LifeScape Medical Associates. *(Interior architecture and design: Jain Malkin Inc.; Gary Knight Photography)*

- The more visually attractive the environment, the higher the perceived quality of clinical care and the lower the anxiety
- In an attractive environment, wait time is underestimated

The Weill Cornell Greenberg Center (a new ambulatory care facility), consistent with findings of other studies on the impact of attractiveness on patient perceptions, demonstrated:

- Slightly less anxiety
- Patients' perceived quality of care high
- Patients' perceived quality of staff interactions high



LEGEND

1 ENTRY
2 KIDS WAITING
3 WAITING
4 ON–LINE DATA STATIONS
5 RECEPTION/CHECK–IN
6 BUSINESS OFFICE
7 CHECK–OUT
8 WORKROOM
9 OFFICE MGR.
10 LAB
11 TOILET
12 EXAM
13 OFFICE
14 NURSE STATION
15 FITNESS TESTING
16 AESTHETIC PROCEDURE
17 CONFERENCE/EDUCATION
18 STAFF LOUNGE
19 STAFF LOCKERS
20 JAN. CLOSET
21 ELECT. ROOM
22 TELEPH. ROOM
23 PROCEDURE
24 BONE SCAN
25 OPTOMAT VISION SCREENING
26 X–RAY
27 X–RAY PROCESSING

Figure 3-30. Space plan for LifeScape Medical Associates, 9,500 square feet. *(Space planning and design: Jain Malkin Inc.)*

Figure 3-31. Nurses' station, LifeScape Medical Associates. *(Interior architecture and design: Jain Malkin Inc.; Gary Knight Photography)*

- Willingness to recommend
- High patient satisfaction

Security

Depending on the demographics and location of the medical practice, the door between the waiting room and the medical office may have a lock that can be released by the receptionist. Irate patients or those who may be mentally unstable can pose a threat to staff.

Notices

Private practice physicians and dentists generally do not have to post patients' rights in the waiting room, but facilities that are under a hospital's license such as a breast center, medical oncology, radiation therapy, diagnostic imaging, and clinics and community health centers are required to post a number of notices, sometimes in English plus another one or two languages depending upon the composition of the community served. This can amount to over a dozen 8-1/2 × 11- to 8-1/2 × 14-inch documents that have to be at a certain font size. Finding a prominent location in the lobby or waiting room is not easy and is best thought about and planned for in advance. They can be framed in one or two panels with attractive matting and a frame that coordinates with the décor. Unfortunately, due to size, they are never an aesthetic addition to the room. In Figure 4-32 they are sandwiched between Plexiglas panels, which calls less attention to them and are contemporary in style.

Function and Comfort

In addition to the psychological aspects of waiting room design it must, above all, be functional. Unless the office is located in a warm climate, the waiting room should include a secure space for hanging coats and stashing boots and umbrellas (Figure 3-32). A patient must be able to enter the room and proceed directly to the receptionist's window without tripping over people or furniture. After checking in, the patient should be able to select a magazine from a conveniently located rack and find a seat. When called, the seated patient should be able to move quickly into the examination area without disturbing other patients.

Should the patient be disabled, traffic aisles must be wide enough to accommodate a wheelchair, and there should be an open space in the room where a person in a wheelchair can comfortably sit without being on display. The needs of the disabled and rights to access are best addressed from the viewpoint of universal design principles. Books by Cynthia Leibrock are an excellent resource for this.[9] Architects and space planners are familiar with

[9] Readers are referred to two excellent books on this subject: *Beautiful Universal Design* by Cynthia Leibrock and James Evan Terry (John Wiley, 1999) and *Design Details for Health* by Cynthia Leibrock (John Wiley, 2000).

Figure 3-32. Built-in brochure rack and closet in clinic waiting area. *(Photo: Jain Malkin Inc.)*

the Americans with Disabilities Act (ADA), which must be adhered to in any medical or dental office, or public building for that matter.

Seating: One Size Does Not Fit All

Perhaps this is pointing out the obvious, but one chair style or type will not accommodate everybody. Temporary, moderate discomfort is acceptable to most individuals but for some—the obese and the elderly—there can be both psychological and physical distress. A number of journal articles have documented that obese persons sometimes defer needed medical care due to embarrassment about the lack of seating that accommodates their size and weight both in waiting rooms and examination rooms. Bariatric seating options are widely available (see Chapter 11). A small loveseat with a reinforced frame is not stigmatizing—does not stand out as being for an obese person—and armless chairs that are similarly reinforced work well. Even the most high-style seating designed for healthcare settings offers bariatric models that appear identical to the other seating, just a bit larger. They fit right in. The elderly, on the other hand, may have arthritis or mobility problems that make it difficult to rise from a chair. Chairs with arms are a necessity and those with a wooden arm that has a curved grip at the end (see Figures 11-10 and 11-19) make it even easier for an arthritic hand to grasp.

There has been a disturbing trend in recent years toward furnishing clinic waiting areas with stylish hospitality seating, notably without arms and sometimes having no way of separating patients. One also sees stylish benches without backs. While this looks great in architectural photography, one can't lose sight of the functional needs of patients: Most need arms on chairs, a seat height of 18 to 19 inches, a firm seat back, and they do not want to touch a stranger seated next to them on a sofa or loveseat unless that person is a relative or good friend.

Beyond this, a person of any age may have a broken limb or a hip or knee replacement (and these people are not just found in orthopedic offices) who may use the chair for assistance in leaning, rising, or gaining stability. Chairs selected for medical waiting areas should be tested for

stability—when a person places their weight on only one arm of the chair, it should not tip.

Size of Waiting Room

The size of the waiting room can be determined after interviewing the physician and staff (see the Appendix for a client interview form). The composition of the doctor's patient population and his or her work habits will indicate parameters the designer must follow. Common sense dictates that a physician who sees people without advance appointments will need a larger waiting room than one who follows an appointment schedule. The formulas below are approximate because there are many variables associated with individual practices. In addition, the desire to create a more residential "living room" ambience will require more than 20 square feet per person. These chairs are often 30 × 30 inches in size and can be even larger. If a child's play area is appropriate, that also needs to be taken into consideration in sizing the room.

Low-volume practices such as surgical specialties or psychiatry require smaller waiting rooms than do high-volume specialties such as general practice, orthopedics, pediatrics, internal medicine, and obstetrics and gynecology (OB-GYN). In addition, practices that accommodate a large number of emergencies need a larger waiting room. Accident cases will often be brought through the staff entrance to avoid exposing them to those in the waiting room. The larger the patient volume, the larger the waiting room needs to be.

A convenient formula for determining the number of seats is as follows:

$$S = 2\,P \times D - E$$

where

P = Average number of patients per hour (per physician)

D = Number of doctors

E = Number of exam rooms

S = Seating

L = Late factor (see below)

The waiting room must accommodate at least one hour's worth of patients. If a physician sees an average of four patients per hour, and has three examining rooms, and it is assumed that each patient is accompanied by one friend or relative, a solo practitioner would require five seats in the waiting room:

$$2(4) \times 1 - 3 = 5$$

Because this is a one-physician practice, it would be wise to assume that the doctor will run half an hour late, so the waiting room must accommodate 1.5 hours' worth of patients. This expansion factor can be expressed as:

$$\frac{L}{2} = \underline{2P} \times \underline{D}$$

Thus, the waiting room should accommodate $S + L$, or *nine persons*, plus an area for children, if space permits. The late factor can generally be reduced as the number of physicians is increased. Using the above formulas for a two-physician family practice with six exam rooms including a late factor, 18 seats would be required:

$$\begin{array}{ll} 2(4) \times 2 - 6 = 10 & \\ \dfrac{2(4) \times 2}{2} \quad = \underline{8} & \\ \qquad\qquad\; 18 \text{ Total seats} & \end{array}$$

A quick rule of thumb is 2.5 seats per exam room, which, in this case, yields 15 seats (6 exam rooms × 2.5 persons). There are many variables here since every patient does not arrive with escorts and every practice is unique in terms of walk-ins and patient scheduling practices.

It is important to understand that these formulas are only a guide. The specifics of each practice and space limitations of the suite will often dictate waiting room capacity.

The formula, and good common sense, may tell you that ideally 45 seats should be provided, but the physical limitations of the space and the physicians' intent to squeeze in as many exam rooms as possible may limit seating capacity to 25.

In medical space planning, as in life, rarely does the ideal prevail. The designer has to skillfully juggle the client's requests, the client's budget, building codes, structural limitations of the given space, and principles of medical space planning. Tradeoffs and compromises are the reality from which suites are built.

Once the number of waiting room seats has been estimated, the size of the room can be determined, allowing 18 to 20 square feet per person. The author has found 20 square feet per person a workable guide for the average medical office. Nevertheless, the amount of space required for a comfortable waiting room will vary according to the room's configuration and the location of the entry foyer and the reception window. Attempts to make the room appear more like a living room setting require more space per chair (see Color Plate 3, Figure 3-27).

Figure 3-34. Fire engine. *(Photo courtesy of People Friendly Places, Inc., La Jolla, CA)*

Figure 3-35. Sea Monster. *(Photo courtesy of People Friendly Places, Inc., La Jolla, CA)*

Accommodating Children

An area may be provided for children. A table and chairs or a toy box is welcomed by parents. The goal is to keep children occupied, quiet, and out of danger of being stepped on. Interactive toys (Figures 3-33, 3-34, and 3-35), available from People Friendly Places, Inc. (peoplefriendlyplaces.com), keep young children engaged. Keep in mind that a children's corner must be located away from door swings or other hazards on which children might injure themselves (see Color Plate 3, Figures 3-28 and 3-29). The children's area must be in sight of the receptionist, who is charged with keeping order.

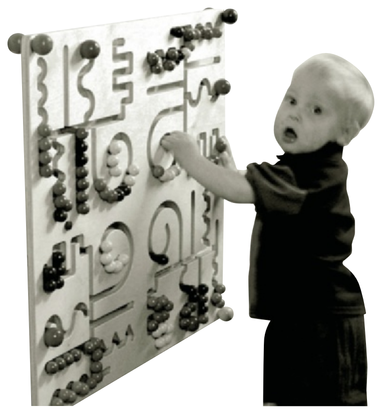


Figure 3-33. Interactive play toy engages toddlers. *(Photo courtesy of People Friendly Places, Inc., La Jolla, CA)*

Amenities

A large aquarium (Figures 3-36 and 3-37) is a nice addition to a waiting room. It is restful and enjoyed by adults and children alike. Other amenities include a desk or countertop with a computer and Internet access.

As medical offices make the transition to EHR, there may be a need to provide a space in the waiting room where patients can update their electronic medical records. Sometimes patients are handed a tablet computer on which to do this or a countertop may be provided with a couple of tablets security-fastened to the top (see Figure 5-117). Although not yet widespread, it is currently

Figure 3-36. Aquarium adds interest to waiting room. *(Design: Jain Malkin Inc.; Photographer: John Christian)*

Figure 3-37. Aquarium adds unique touch to children's play area. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

possible for a patient medical record to be encoded on a "smart card" that can be downloaded at a provider's office. As providers address HIPAA they will be making substantial investments in information technology that may require accommodation in the way patients are registered, processed, and followed during their care. Futurists for a number of years have forecast that the home will increasingly become the site for healthcare and it is finally about to happen: Patients will self-monitor their vital signs, which will simultaneously be transmitted to a provider's office, and telemedicine-type consults will enable the provider and patient to see each other and speak in real time (see Figures 1-11 and 1-13). A prescription can be sent via the Internet directly to a pharmacy; however, appropriate security measures mandated by HIPAA have to be in place.

A considerable amount of educational literature is dispensed in some offices. Wall-mounted brochure racks prevent a cluttered appearance (see Figures 3-32 and 11-3).

Patient Privacy

Some physicians prefer maximum communication between front office staff and patients and favor a waiting room separated from the business office by only a low partition or they prefer a hospitality-type concierge desk (see Color Plate 1, Figure 3-10). Although this may comfort the patient psychologically by removing what may be perceived as a barrier, it often results in a loss of privacy for staff when they have to discuss delicate matters with a patient. The patient might suffer embarrassment, knowing that the adjacent waiting patients may overhear the conversation.

For this reason, many offices use a 4- to 6-foot-wide opening with a plastic laminate transaction shelf, starting at 42 inches off the floor (see Figure 3-66). The ADA requires accommodation for wheelchair users at 34-inch countertop height; however, a section of 30-inch-high counter is even friendlier. This means either the entire reception transaction counter must be no higher than 34 inches or a portion of it must be at that height (Figure 3-38). A sliding glass window may be added for additional staff privacy, but it conveys a negative image of closing out patients. If glass is used, it should always be clear, not obscure, so that patients have visual contact with staff.

Figure 3-38. Reception/waiting area. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

There is a tradeoff here in that lowering the countertop to 30 or 34 inches exposes all the clutter (and there is usually a lot) on the desktop as well as the unsightly backs of computers. If a section of the reception counter has a 42-inch-high transaction shelf, it makes it easy for patients to sign in or to write a check without bending. On the staff side it conceals staplers, tape dispenser, telephone, and other items as well as keeps confidential paperwork away from prying eyes.

To deal effectively with issues of patient privacy when designing the waiting room, do not place chairs too close to the reception window. Position the receptionist's telephone to the side of the window opening to help mask conversations, and provide an area, in the front office, where staff and patients may discuss a sensitive topic without it being overheard.

There is disagreement as to the practicality of providing a toilet room in the waiting area. It saves staff the trouble of frequently directing patients to the bathroom in the examination area, but it has the disadvantage of patients emptying their bladders before the nurse can request a urine specimen. Additionally, it is unattractive to look at the door to a bathroom and watch people go in and out while waiting. In pediatric offices, however, a toilet in the reception area is desirable to enable mothers to change a baby's diaper (see Figures 3-103 and 3-104). Ceramic tile floors and wainscot are the most practical long-term finishes for bathrooms. For little additional cost, an interesting tile pattern can be created, as shown in Figure 3-39. Note that grout on the floor should not be light because it becomes stained and is hard to clean. Dark tile provides excellent contrast with a white sink and toilet for low-vision individuals. The wall-hung sink in this photo meets the ADA requirements and conceals the unsightly P-trap drain.

Figure 3-39. Clinical bathroom is both functional and attractive. Montefiore Medical Center in the Bronx. *(Architecture and interior design: Guenther Petrarca, New York, NY; Photographer: Copyright © Christopher Lovi)*

The number of staff toilet rooms and locations are a matter of preference but also referenced in the building code depending on the number of employees and whether they have to be designated as men's and women's rooms.

Reception

Since the receptionist often books appointments and maintains the day's schedule, she/he must see the patient on arrival and just before leaving. This requires a good view of the waiting room from the chair to be able to see who is waiting (see Figure 3-5). Despite working at a computer, adequate "clear" countertop workspace is required, in addition to a place for the phone and to write messages; a place for a printer, scanner, and countertop copier (for copying insurance eligibility cards) nearby; and, if possible, an L-shaped return facing the corridor appointment "goodbye" window so that, while remaining seated, she/he can swivel around, acknowledge an exiting patient, book an appointment, or accept payment for services (see Figure 3-65).

In an office with two or three front office staff, the appointments/cashier workstation and reception window may be separated (see Figure 3-30) to provide greater privacy for the exiting patient (Figure 3-40). It is desirable to design the business office in such a way that staff can easily cover one another's stations. An efficient layout can sometimes mean that one fewer person is required, considerably reducing the overhead.

Patient Education

Patient education now usually takes place in a person's home because most people have access to a computer and are knowledgeable about accessing the Internet. The physician may suggest certain websites that have reliable information or the patient may be directed to information about a specific disease or surgery.

Business Office

Frequently referred to as the *front office* in medical jargon (versus the *back office* or examination area), this is the heart of the medical office. This is where patients are greeted, appointments scheduled, patients are billed, medical records stored (if not electronic), and routine insurance and bookkeeping duties are performed.

In a small practice, two people may perform all these tasks. In a large practice, several persons may occupy the business office. A convenient rule of thumb is one

Figure 3-40. Check-out desk offers privacy. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

secretary for every two doctors in a low-volume practice and one secretary per physician in a high-volume practice. If a physician is seeing four to six patients per hour, the secretary may be spending more time with patients than the doctor does, since the secretary's work would involve arranging and rescheduling patient appointments on the telephone (now often via texting) whenever the doctor is delayed or has to rearrange his or her daily schedule, filing medical charts, sending reports to referring physicians, billing patients, collecting money, filing insurance claims, answering the phone, and ordering supplies. In larger practices there is more division of labor: One individual does billing and collections, another accounts payable, another insurance, another a transcriptionist, and so forth, as well as an office manager or administrator.

Workroom and Storage Needs

Unless one has worked in a medical business office, or at least spent several days observing the flow of paper and communication, it is difficult to plan adequately sized workspaces, storage areas, and accommodation of equipment. Furthermore, upper cabinets are often too high for the average 5-foot-4-inch woman to reach; the cabinets (if 12-inch overall depth) may be too shallow to house reams of paper, boxes of envelopes, and computer forms, and they are often poorly utilized. It is not uncommon for front office staff to say they have no storage space only to find the upper cabinets only 25 percent full. A series of full-height cabinets at least 15 inches deep with adjustable shelves is far more practical. Alternatively, one could provide a workroom as depicted in Figures 3-41 and 5-13 off of the business office and out of public view, with simple open shelves, a countertop for postage meter, printers, fax machine, shredder, recycling bins, and space for a floor-model copier, if needed. It is always desirable to place copiers in a room that is well ventilated and has no occupants. Copiers, especially large floor models, are a health hazard in terms of air quality. Sometimes the rear wall of the appointments/checkout counter accommodates the workroom (see Figures 7-1 and 7-2). Bins for recycled paper and other trash may be located in the workroom or elsewhere.

A workroom (see Figures 3-41 and 5-13) at the entry to the business office provides easy access to others in the clinic for faxing, copying, and printing without having to disturb those working in the front office. Do not underestimate the number of machines and equipment that may have to be accommodated, including a large shredder and/or storage container for confidential material

Figure 3-41. Business office workroom accommodates several printers with paper feed slots in cabinets below, fax machine, and floor-model copier (out of view) on opposite wall. Business office staff access it from one end and clinic staff from the other. Scripps Breast Care Center, La Jolla, California. *(Interior architecture and design: Jain Malkin Inc.; Photographer: Glenn Cormier)*

(anything with patients' names, test results, reports) that will be picked up by a contract vendor for shredding. HIPAA regulations regarding confidential handling of patient data will increase the need for paper shredding.

Clearly, the issue is not just having enough storage but having it where it's needed, so that one does not have to keep getting up to get forms that are frequently used. The countertop should be neither too shallow nor too deep with adequate clear desk space available despite a computer, telephone, stapler, reference books, and possibly a credit card machine. Cubbies for forms are quite useful in keeping the desk clear of clutter for those who require some manual forms.

Casework and Countertops

It has been standard in the design of medical offices to build in all workstations in the business office, insurance, transcription, and similar areas. Lining the perimeter of the room with 24- to 30-inch-deep plastic-laminate-clad countertops takes full advantage of every inch of space in a way that freestanding desks or workstations rarely do, especially in small rooms or irregularly shaped spaces.

Having said that, it is easy to mindlessly draw countertops, turning the 90-degree corner and continuing and placing a task chair every 5 feet, thus giving the client false confidence that an efficient workspace has been carefully developed for each of these persons without truly taking into consideration the tasks each performs and the way in which they interface with patients and coworkers. Staff move into the space and are shocked to learn that their equipment barely fits—or possibly doesn't fit at all. Some examples: the paper feed on their large printer requires a 15-inch grommeted slot in the countertop, there is no space for the hospital printer, and the space between the countertop and the 42-inch-high transaction shelf where two manuals are kept for ready access is half an inch too short. A 5-foot-long countertop space at 24-inch depth does not place the computer screen at an ergonomic viewing distance, the keyboard does not fit on the countertop, and, without a keyboard tray, there is not enough clear workspace to handle papers or write notes.

Ergonomic Considerations

Work surfaces designed for computer monitors should allow the screen to be positioned at least 18 inches from the front of the keyboard tray. Getting it elevated to a comfortable viewing height can be a problem. Despite ergonomic research on optimal distances and conditions, considerable individual variation and preferences exist. *Workrite Ergonomics®* in Petaluma, California (workriteergo.com) offers numerous products that enable workers to meet individual needs. Their website has an exhaustive reference list of journal articles (with direct links) on ergonomics, the health risks associated with sitting for long periods of time

and other interesting research. *Humanscale* (humanscale.com) is another good source for ergonomic seating as well as monitor and keyboard accessories. A useful item is a multiple-adjustment arm that lifts the monitor off the desk, getting it to whatever height the worker desires and also freeing up desk space. A number of vendors are now making adjustable-height work surfaces that enable a worker to easily shift from sitting to standing during the day. This may be difficult at a reception desk in a medical office since the greeting/transaction desk is usually low to provide more openness and a hospitality ambience. *Nurture* by Steelcase has made considerable inroads into the healthcare market with a variety of modular adjustable-height casework pieces (see Figure 7-17).

Although countertops that accommodate computers need to be deep enough to keep a large monitor at the proper ergonomic viewing distance, they must not be so deep that it creates back strain if the employee needs to reach over it to transact business with patients. Keyboard trays and ergonomic task chairs with multiple adjustments reduce workers' compensation claims and absenteeism and increase productivity.

Computer Systems

Practitioners with a "paperless" office will have sophisticated software that handles appointment scheduling, accounts payable and receivable, patient histories, revenue projections, referring physician reports, patient medication data reports, and insurance claims tracking. With an integrated software system, patient data can be tabulated to produce a variety of reports that allow the practitioner to analyze the practice. These may include cross-referencing of diagnoses and procedures and demographic analysis of marketing efforts. Two of the leading vendors of physician practice management systems and clinical EHRs are Epic and Cerner. The latter offers the *PowerChart Touch* mobile solution built for the iPad (Figure 3-42) that enables the physician to review the day's schedule of patients and their medical charts, to respond to routine requests and refills, to review diagnostic and clinical results, to document allergies and problems, and to create and sign progress notes. It provides both an interactive flow of information between the hospital and the medical office and a handy clinical summary page for each patient.

Figure 3-42. Examination room physician/patient interface with physician using handheld computer with patient management and clinical best practices databases, activated by a light pen. *(Photo courtesy: Cerner Corporation, Kansas City, Missouri)*

An IT closet can accommodate both the server and the telephone terminal board. If the office has a dedicated computer that is networked with the hospital, this will generally be located in the front office. Other computers will be proprietary to the medical practice and generally networked to each other. Printers must be carefully placed close to those who use them most to prevent employees from having to continually walk over to the printer to retrieve something.

It is important to be aware of the effects of glare from overhead lighting and from windows when laying out workstations with monitors. Glare causes reflections on the screen that lead to eyestrain and stress.

Bookkeeping

Some practices use an outside bookkeeping service. The daily charges for service and payments received are recorded and forwarded to the bookkeeping service, which, in turn, handles billing and collections. Monthly reports are sent to the physician. In this case, space for

billing and collections can be minimized. Occasionally, a large practice will have its own billing office offsite in less expensive accommodations.

In many offices the bookkeeper is in a separate room adjacent to, but not part of, the business/reception area. Insurance personnel may also have separate offices to provide working conditions with fewer interruptions. The business office of a busy practice is an extremely hectic place. Phones ring continually; people are rushing around. It is not a good place for someone who needs concentration. If space permits, it is always better to provide private offices for the bookkeeper and insurance staff. Sometimes modular workstations are used to provide privacy when private offices are not feasible. These often have paper management accessories and hinged flipper-door storage to make use of vertical surfaces.

Insurance

Most medical treatment is paid by third-party payers—commercial insurance companies. Under managed care, many individuals are enrolled in HMOs whereby a monthly prepaid fee entitles one to receive healthcare, often with a co-pay at each visit. Much has been written about the complexity and mountains of paperwork associated with billing (and collecting from) insurance companies, which is complicated by the lack of uniformity among them in terms of billing formats and procedures. This amounts to a great deal of paperwork, and a medical office of any size usually has at least one full-time employee doing nothing but insurance claims. He or she requires a desk with an L- or U-shaped return, a computer, one or two printers, and access to medical records (if paper) and the copy machine. One or more file cabinets may be needed (fewer, if all is electronic), as well as open-shelf storage for the multitude of business forms and manuals. A guest chair is needed for a patient. It is unknown how state insurance exchanges resulting from the ACA will impact this process. For many years medical offices have been processing claims electronically (paperless) with insurance companies, which speeds the process.

Medical Transcription/Chart Completion

Medium-volume to large-volume practices often have a part-time or full-time medical transcriptionist who works from a dictation device to transcribe physicians' notes. Physicians who are comfortable typing will often chart in the exam room, perhaps on an iPad or PC. Some use voice-recognition software like Dragon Dictate. If a dedicated transcriptionist is used, this task is best accommodated in a separate room since an environment with little distraction is optimal. Only a countertop work surface is required. It should be 30 inches high with a fully adjustable keyboard tray. A small room is adequate, provided it has a window and natural light. In large group practices, chart completion can be accomplished by physicians in hoteling-type niches located away from patient care areas (see Figure 3-18).

Office Manager

Large offices will have an office manager or a business manager who hires personnel, orders supplies and drugs, and assists physicians in secretarial or business matters in the capacity of executive assistant. The office manager should have a private office. It need not be large (10×12 feet is adequate) and is often located so that it faces the business office. Walls facing the business office may have glass, starting 48 inches off the floor, so that the manager can oversee the front office staff if desired.

Medical Records

Although many physician offices still have paper medical charts, these will soon be a thing of the past; therefore, it will not be discussed here. Accommodation for this type of storage has not been provided in most of the space plans in this edition of the book. A high-density motorized (or manual) filing system is often used or shallow-depth metal lateral file cabinets made for this purpose with flip-top doors. Sometimes physicians build them of wood, however, they now have to be lockable.

Electronic Medical Records

Although contemplated as "the future" a number of years ago, the electronic medical record (EMR) has been slow to win the hearts and minds of physicians. It is a lot of work to scan patients' charts, especially for primary care physicians with long-term patient relationships and charts that may be several inches thick. In addition, the software and set-up with computers in each exam room is quite an expense. In large group practices one is more likely to find completely integrated systems of medical records, billing, scheduling, as well as digital diagnostic instruments, weight scales, and instruments for recording vital signs that are networked and record data in real time on the patient's electronic medical record. The physician types on a tablet or laptop computer (see Figures 3-14, 3-22, and 3-42) directly into the patient's chart. When the patient exits the room, all data will have been recorded on the chart. By use of a "smart card" (a small card that can be carried in the wallet with a computer chip that has the patient's medical record), the patient does not have to continually repeat his or her medical history each time a physician is consulted or a visit to the emergency room is made.

Many medical practices offer patients a secure portal for email communication. Patients can receive personal messages that are password protected, view lab reports, schedule appointments, and request refills. Patients may also be able to download a medical family history form and fill it out, but not have to submit it over the Internet. When it is downloaded from the physician's office, it prints with a bar code. When the patient brings it into the physician's office, it is scanned with a bar code scanner that uploads the information to the patient's medical record.

Private Entrance

A medical office, regardless of size, must have two entrances—one for patients and a private one for the doctor, so that he or she can enter the office without meeting patients in the waiting room (see Figures 3-5 and 3-18). In large suites, usually over 3,000 square feet, local building codes may require two exits (separated by a distance equal to one-third the length of the maximum overall diagonal dimension of the area served, measured in a straight line between exits). Occasionally, to save space, the staff entrance is through a room such as the staff lounge or business office. In larger offices an entrance for staff into or near the staff lounge and locker area (see Figure 7-2) is desirable.

Examination Room

Good traffic flow is imperative for the efficiency of a medical office. Several factors influence the location of exam rooms:

1. Nurses (or medical assistants) are responsible for controlling traffic to and from exam rooms, so the nurse station and exam rooms should be clustered together. This enables nurses to prepare the patients in each room quickly, while traveling back and forth to the nurse station for supplies or items needed for the examination (Figures 3-5, 3-20, and 3-45).
2. Patients rarely meet with physicians in their consultation room or private office any more; therefore, placing them in pods or clusters with exam rooms to avoid unnecessary steps is usually not a consideration unless it is a physician preference to be close by. It makes it easy to run in there to take phone calls and check email while seeing patients. In general, it is preferable that patients not pass the consultation room when making their way to the exam room, although this is sometimes unavoidable. In multi-physician offices consultation rooms (private offices) may be clustered in the rear of the suite, in nonpatient areas (Figures 3-43, 7-1, and 7-2).
3. Exam room hallways should be arranged so that patients pass the business office when exiting the suite (see Figure 3-5). This provides control so that future appointments may be booked, medications explained, and payment for services discussed. A convenient feature is a full-height, 15-inch-deep recessed storage

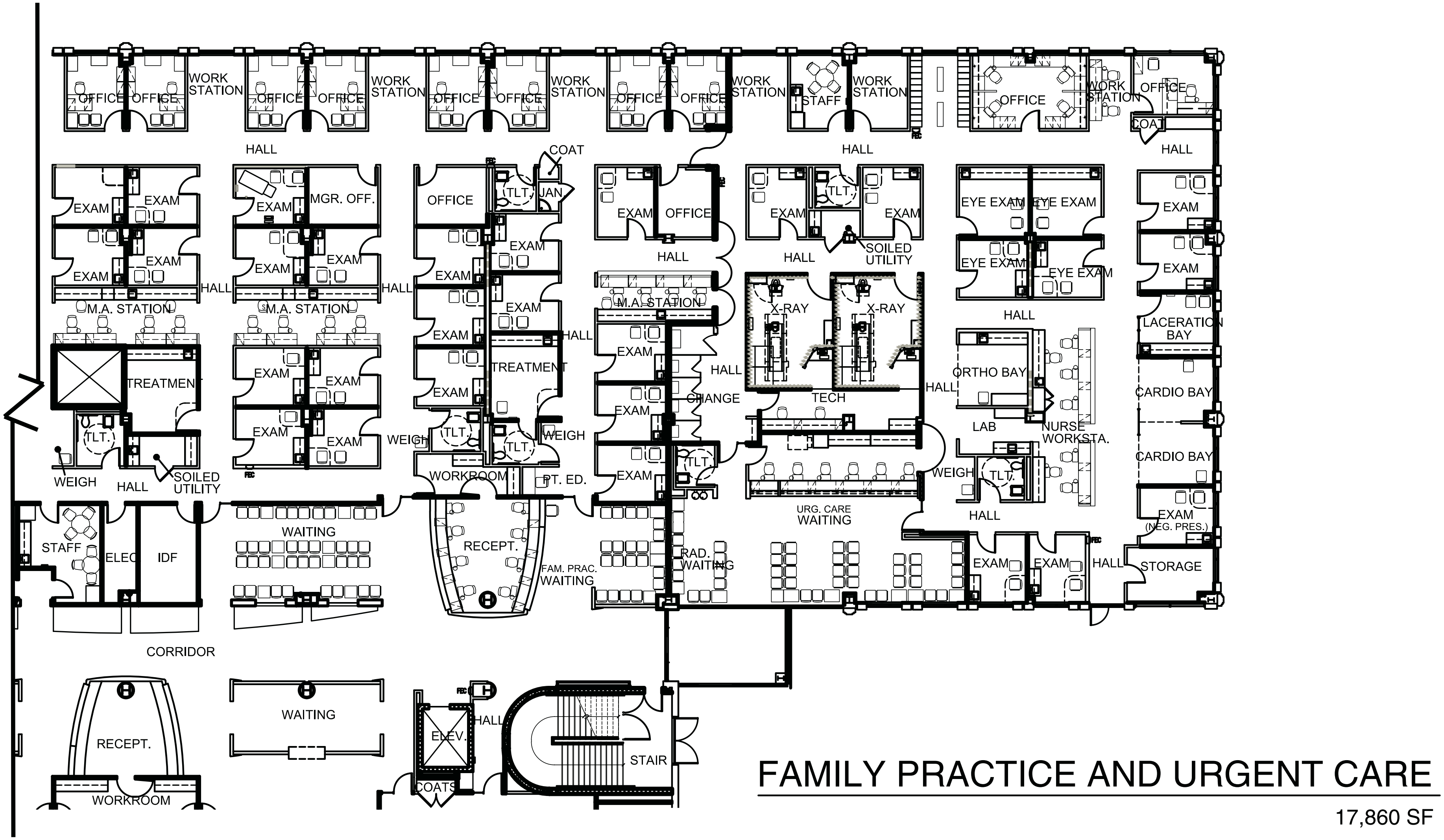


Figure 3-43. Space plan for a family practice and urgent care facility, 17,860 square feet. *(Architecture and Interior Design: Hawley Peterson Snyder)*

cabinet for drug samples located at a nurse station or in the corridor near the check-out area to enable the provider to dispense a product as the patient exits. This is more common in some specialties than others and is also a matter of physician preference whether to dispense samples.

The exam room is the primary setting for diagnosis. As such, it should be designed very functionally, with an understanding of the equipment that will be used and the psychological needs of the patient. If the amenities of the room can help the patient relax (wallcovering, flooring, color, and artwork), it makes the examination easier. It is

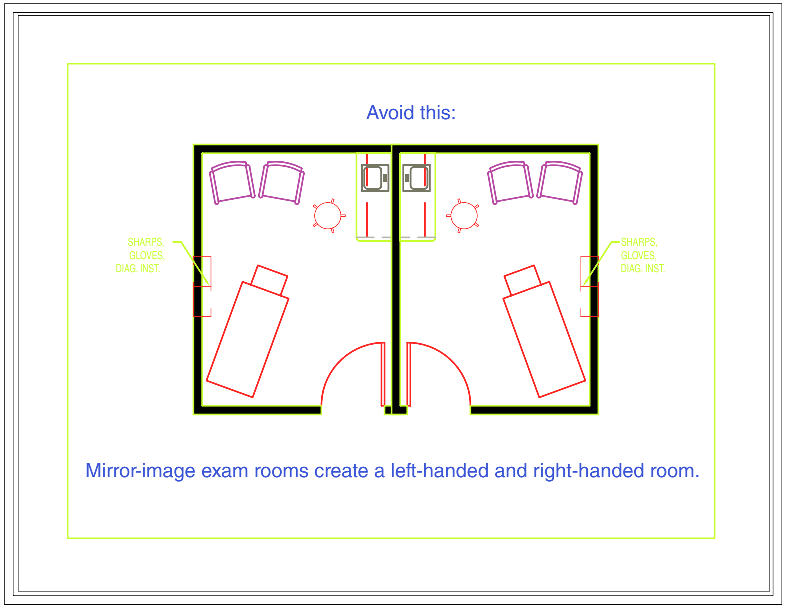


Figure 3-44. Exam layouts depicting mirror-image rooms. *(Design: Jain Malkin Inc.)*

desirable that patients' vital signs (blood pressure, pulse, and so forth) be at normal levels prior to an examination. Anxiety, resulting from fear of a clinical and unfamiliar environment, elevates patients' vital signs and may give false readings. This is often referred to as "white coat syndrome." Numerous journal articles have noted how often this condition leads to elevated blood pressure and results in healthy individuals being treated for hypertension.

Acoustics

It is imperative to have good acoustic attenuation in an exam room. Patients are very concerned about being overheard. They also do not wish to overhear conversation from an adjacent room. Solid-core hinged doors are the most practical; however, sliding barn doors on the outside wall have a contemporary look that some may prefer. The latter is an option that saves space although in an exam room, when it opens, the patient is exposed as opposed to a hinged door that opens to shield the patient (see Figure 3-3). If used, the product must be rated for acoustic integrity (acoustic seal), and have ADA-compliant pulls, such as products made by Aurora Door and Dirtt. Other measures for dealing with acoustic privacy include a device that generates masking noise placed in the plenum above the ceiling and walls that extend 6 inches above the finished ceiling with a blanket of R-13 insulation extending 3 feet on either side of the wall. In addition, the acoustic tile wall angle should be caulked and all return air grilles should have sound boots, if the air return system is an open-plenum one.

Physician/Patient Interface

Times change, and the "standard" 8 × 12 foot examination room is increasingly considered too small to achieve the optimal physician/patient interface that was historically based on a paternalistic model with the patient in a passive role. The patient-centered care movement has encouraged greater patient involvement and a more egalitarian encounter, promoting greater access to information and more transparency. The standard 8 × 12–foot exam room that has become so familiar (see Figure 3-67) does not allow this type of interaction to occur. The recent focus on patient-centered medical homes places importance on a consultation area as the central space for healthcare delivery. In a larger room both an exam and consultation area can be accommodated (see Figures 3-2, 3-3, 3-4a and b, and Color Plate 6, Figure 3-123). In a PCMH, there is a greater need for family to be in the room to understand the care plan and be able to help the patient achieve goals. Another factor placing more emphasis on a consultation or "talking" room is the observation that patients do not always need to undress (Figure 1-1). This is especially true in internal medicine.

Talking Room Suite

A three-room suite as in Figures 3-8, 3-45, 4-19, and 4-20 with two talking rooms on either side of an exam room was a concept originated in a pilot project at Mayo Clinic Gonda building. It was intended to increase throughput by

not tying up an exam room when a “talking room” would be more appropriate. From a psychological perspective, a talking room says to a patient “you do not have to define your problem medically for us to help you.” Such rooms are a “safe” space for conversations without the visual presence of diagnostic instruments. These are used for a variety of patient care activities such as consultation with a variety of care team collaborators: community outreach navigator, pharmacist, psychologist, nutritionist, social worker, and behavioral health counselor. Talking rooms are also used for reviewing test results. Admittedly, having talking rooms requires that a new process flow be introduced, as the scheduling of these will be what makes the concept succeed or fail.

The Mayo “Jack and Jill” rooms are 10 feet wide and have interior doors to the exam room. The diagram in Figure 3-45 is the author’s representation of the design concept based on a presentation at a conference. A light system is used to cue when the exam room is empty. One can tell from outside the room when it is in use. Dr. William Mundell explained that, in general internal medicine, 80 percent of provider time is spent in conversation and 20 percent in examination. He said the Mayo Innovation Center mocked up a number of desk shapes and sizes before they arrived at the gourd-shaped design that was thought to enable a provider to navigate the computer without losing eye contact with the patient. The talking rooms are carpeted and have soft lighting. Patients were said to report that they felt healthier when an exam table was not in the room and they were better able to focus on what the physician said. The room has a 21-inch monitor on an articulating arm.

There is also a need for flexibility. Since all exam rooms now have computers and monitors, the physical placement of the computer should not be driven by the location of wiring rather than its impact on the encounter between provider and patient. An orientation that enables clinicians to maintain visual contact with patients and share health record content is desirable. The ability to use the keyboard and simultaneously verbally communicate without losing eye contact makes the spatial orientation of the room critical. A number of layout options are discussed below.

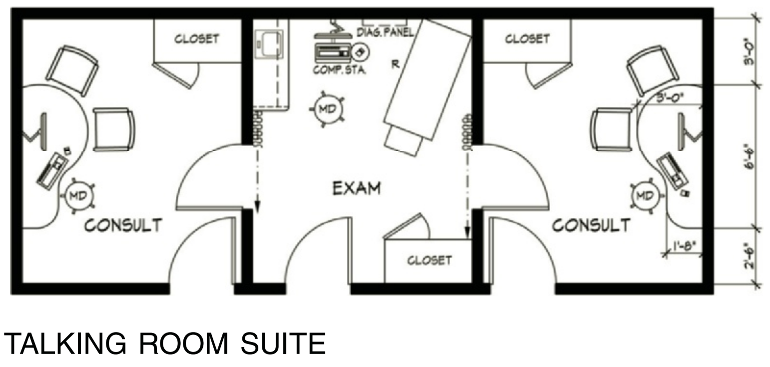


Figure 3-45. Layout of talking room suite. *(Design: Jain Malkin Inc.)*

Questions to Ask

This is a time when many practices will be considering new examination room configurations and new practice models, such as collaborative care, due to legislative policies derived from the Affordable Care Act. The patient-centered medical home model rewards providers for keeping patients healthy, which will result in greater emphasis on consultation and education in the exam room. Therefore, it is a great time to rethink the entire process and the physician/patient relationship. Unfortunately, there is not much research or evidence upon which to make decisions.[10] The research that does exist is focused more on large ambulatory settings, often associated with an academic medical center. The discussion in this chapter focuses on primary care examination rooms; adaptations for specific medical specialties such as ENT, orthopedics, urology, plastic surgery, orthopedics, and hand surgeons, are discussed in Chapter 5. Although these specialties may functionally dictate the positioning of the examination table or chair and the sink cabinet, the issues of communication

[10] Freihoefer, K., Nyberg, G, and Vickery, C. (2013). “Clinic exam room design: Present and future. *Health Environments Research & Design Journal* 6(3), pp. 138-156.

and use of computers in the room will be the same. It is important for a designer/space planner to be proactive in suggesting new options for the exam room. Physicians and nurses can only suggest that with which they are familiar, but they are often delighted to have other options offered. Following are a number of questions that will help the design team to customize the exam room for a specific practice. Knowing how various design strategies might impact behavior and influence provider/patient interaction is an ongoing area of study for which evidence is growing.

Functional

1. What equipment will be in the room?
2. What is the preferred location of the sink cabinet?
3. Is future flexibility important (e.g., converting exam room to an office)?
4. Does the physician work off of a cabinet or a Mayo stand?
5. Do residents see patients?
6. Is there a need for a phone interpreter or one present in the room?
7. Where are portable electronic devices charged and/or docked?
8. To what extent do patients need to undress?
9. Door opening to shield the patient?

Clinical

1. Will care team consults be done in the room?
2. Is the room used for education?
3. Desire to sit alongside patient to chat?
4. Type of computer (tablet, PC, laptop); size and mounting of monitor?
5. Desire to perform multiple tasks in one room?
6. Do you print prescription and educational materials in the exam room or nurse station?
7. Locations for hand sanitizer dispensers?

Patient Comfort

1. Privacy curtain around door?
2. Frequency of family member(s) in room?
3. Dressing: cubicle drape, dressing cabinet enclosure?
4. Need to address bariatric seating? Exam table?

Layout

The exam room is the basic building block of a medical office, which makes it the most important room. Looking at the rooms in Figure 3-3, the physician, upon entering the room, can easily walk to the sink to wash his or her hands, pivot around to face the patient on the exam table and, in the middle room, can reach for instruments on the countertop with the left hand and examine the patient with the right. This room layout puts the physician on the patient's right side, which is standard, even for most left-handed practitioners. Physicians are trained to examine from the right side as this makes it easier to palpate certain organs. It should be noted that an attempt to place plumbing back to back (mirror image) will result in left- and right-handed exam rooms (see Figure 3-44). This is not economical. Every exam room should be identical in layout to maximize efficiency so that the practitioner has the same degree of comfort and orientation in each room. In a "right-handed room," the entry door will be on the right side and the exam table on the left, as one would face the room upon entering. However, in addition, as can be seen in Figures 3-3 and 3-4, there are other layouts that achieve a "right-handed" room.

With a larger room, there are numerous options for room layout. The care suite in Figure 3-20 is one of Cisco LifeConnections' designs, discussed previously. It shows how these care suites "nest." The consult room is 12 × 12 feet and the exam room is 8 × 10 feet. The three-room suite in Figure 3-8 requires a depth of 14 feet and is a

version of the Mayo configuration. The exam area offers a clever way to visually shield family or an interpreter who may be present in the room.

Research done by physician David Sobel at Kaiser Permanente in Oakland, California a number of years ago examined physician/patient communication with respect to increasing patient satisfaction and patient compliance (adherence to treatment and drug regimens and recommendations for lifestyle change). In general, these studies indicated that specific interview techniques can be employed by the practitioner to achieve these goals, but there is another aspect related to the rapport established between doctor and patient. Even a brief encounter of several minutes face to face with the physician can enhance patient satisfaction if the patient feels he or she has the full attention of the physician and if rapport has been established. This has stimulated considerable discussion in recent years that has led to a number of options that place the patient and physician eye to eye to enhance empathy (see Figures 3-9, 3-22, 3-46a and b). Mayo Clinic pioneered the "Mayo Room" (Figure 3-47) many years ago when traditional exam rooms were 8 × 12 feet and had only an exam table and a sink cabinet. Perhaps it came about because their practice was so eminently consultative, with many persons traveling across the country with referrals from their local physicians.

An example of research to understand the extent to which the consultation interaction between patient and provider could be influenced by three specific design layout features involved 65 randomly assigned patient/provider pairs in a study undertaken by Mayo Clinic Center for Innovation.[11] The placement of the computer monitor, the type and position of the desk, and the arrangement of the seats were the three variables. Although not specifically from this study, the images in Figures 3-4a, 3-4b, and 3-9 fairly closely represent the two study conditions of a standard exam room and the experimental room with semicircular desk.

Figure 3-46a. Talking room in community health center, Adelante Healthcare. *(Design: Jain Malkin Inc.; Photographer: Dustin Revella)*

Figure 3-46b. Exam room component of talking room suite in community health center, Adelante Healthcare. *(Design: Jain Malkin Inc.; Photographer: Dustin Revella)*

[11] Almquist, J., Kelly, C., Bromberg, J., et al. (2009). "Consultation room design and the clinical encounter: The space and interaction randomized trial." *Health and Environments Research & Design Journal* 3 (1), pp. 41-78.

Figure 3-47. Combined examination and consultation room known as a "Mayo room" enhances patient/physician rapport by eliminating the traditional desk as a barrier. Built-in flat screen monitor facilitates discussions. Mayo Clinic, Scottsdale, Arizona. *(Architecture and interior design: Hammel Green and Abrahamson, Inc., Minneapolis, MN; Photographer: Mark Boisclair)*

In the latter option, 97 percent of patients said they had experienced excellent involvement in the decision-making process. There was no difference between the rooms on the issue of trust but the experimental room resulted in higher patient satisfaction with the placement of the monitor in that it increased patient involvement in information-intensive encounters and it encouraged clinicians to review medical records on the screen as well as review information from the Internet with patients.

Integrating the Computer and Monitor

One of the primary goals is to integrate a computer and monitor into the exam room, enabling the physician and patient to look at it together. This enables the provider to review X-rays and other studies with the patient to jointly share decisions about care thus empowering the patient. There are numerous options for the computer, whether it is wall-mounted, on a movable cart, or a tablet or laptop. If on a wall, it can be attached to an arm that swivels and extends. Freiheofer and colleagues (cited previously in footnote 10) mention a study by Ventres and others in which it was reported that the positioning of the computer strongly affected the physician's style. When the physician sits directly in front of the screen, little eye contact is made with the patient, whereas sitting adjacent to the patient, with both having the ability to see the screen, resulted in more eye contact (see Figure 3-4b). They also cite a 2006 Mayo Clinic study that found improvement in conversation when physician and patient sat next to each other, rather than across from or perpendicular to one another. Also in the Mayo study, it was noted that providing patients with an identifiable table space for note-taking stimulated engagement. In this room layout (Figure 3-4b) the half-round table allows the physician to have eye contact with a patient while documenting data on the computer. Depending upon the layout of the room, the patient may sit on an exam table or on a guest chair while the physician is taking a history or writing a diagnosis.

In an interesting turn of events, physicians are starting to employ scribes to free themselves from continually having to type which some feel distracts them from focusing on the patient. A 2013 study by the American Medical Association and the Rand Corporation found that EHR was a major contributor to physician dissatisfaction.[12] Companies like ScribeAmerica and PhysAssist that train and supply scribes to hospitals and medical practices see demand quickly rising. For space planners, how will these individuals change the layout or configuration of the exam room and will patients regard this clerical person as an intrusion or violation of their privacy? Physicians who use scribes find they do not have to spend hours at home completing charts each evening.

Regardless of who does the typing, a large monitor is increasingly finding its way into exam rooms. It is possible with a Microsoft Windows® platform to view, on one screen, an X-ray, a lab report, charting notes from a previous visit, and even a video image of an endoscopy procedure. Now that flat screen monitors have become the norm it is easier to integrate them into an exam room. Some practitioners prefer a large one, perhaps a 30-inch screen, mounted on a wall or over a consultation table (see Figures 3-9 and 3-14).

[12] Katie Hafner, "A Busy Doctor's Right Hand, Ever Ready to Type," *New York Times*, January 12, 2014

Size

The first functional consideration is size: 10 × 12 feet is the new "ideal" size for exam rooms (gives a clear dimension of 9 feet 6 inches × 11 feet 6 inches inside the room) as it comfortably allows for an exam table, a built-in sink cabinet with storage above, dressing area if desired, and accommodates any number of arrangements with respect to a conference area. There is room for guest chairs for the patient or family member, a treatment stand (if required), and perhaps a small piece of portable equipment. Given that 70 percent of the nation is either overweight or obese, a larger room accommodates an obese individual as well as a bariatric exam table, which a practice may wish to use in one exam room or procedure room (see Figure 5-58). A standard exam table is 28 inches wide by 60 inches long; with the footrest extended it is 72 inches in length. The "comfort cushion" style of exam table is 33 inches wide (Figures 3-48 and Color Plate 6, Figure 3-125). If "one stop" care is the goal, with practitioners coming to the patient as opposed to sending the patient to them, then a larger room is required.

If the room is used for purposes other than routine examinations, such as stress testing, the room would contain an electrocardiogram (ECG) unit and a treadmill, as well as an exam table, and it should be 10 × 12 feet in size or larger (Figure 3-76). A room for stress testing can be found in an internal medicine suite; this is a dedicated room for this purpose.

The reader may wish to refer to Chapter 2 for a discussion of alternate sizes of exam rooms with respect to planning grids. Practitioners may prefer a somewhat wider exam room (9 × 12 feet) than the standard 8 × 12 feet or even a square 10 × 10–foot room, as in Figure 3-3, although, if these occur on exterior walls and the planning grid is 4 feet, the wall will have to jog 2 feet one way or the other (creating an awkward unusable space in front of the window) to terminate at a mullion. The exam room schematic layouts depicted in this chapter do not show windows and this factor must be taken into account on a project basis. Natural light is always a pleasant feature in an exam room.

Figure 3-48. Midmark 623 Barrier-Free® exam table. *(Photo courtesy: Midmark Corporation)*

Dual Access to Exam Room

Occasionally exam rooms will have dual access with clinical staff entering from a rear "off-stage" corridor and patients entering from the opposite side (see Figures 1-2, 3-4b, 3-18, and 3-20). This gives staff an opportunity to collaborate on patient care without conversations being overheard by patients. It's an expression of the Disney on-stage/off-stage concept.

Dressing Area

If space permits, it is desirable to provide a dressing area for patients. In the past it might have been a 3 × 3–foot

corner area on the wall with the door and surface-mounted drapery cubicle track at the ceiling (with radius corner), with a built-in bench or a chair, clothes hooks, hangers, a mirror, and perhaps a shelf for disposable gowns. In recent years, as the need for a consultation "table" has emerged, the need for a dressing area has sometimes been fulfilled by a door opening to shield the patient and a cubicle drape that can be pulled around the exam table (see Figure 5-4). Most providers knock before entering but, of course, a patient may not know that.

The alternative is that patients must disrobe in the open exam room, with the fear that the nurse or doctor may walk in on them while they are naked or while they are squeezing into pantyhose. Older people, and those with orthopedic girdles or braces, tend to be more sensitive about this than younger people.

There is also the possibility of creating a private dressing alcove with a 30-inch-wide door or panel hinged to the wall. It is perpendicular to the wall when in use and folds flat against the wall when not in use. The chair can be used either inside the dressing area when the hinged panel is extended or outside when the panel is folded flat against the wall. Called the Dressing Nook, such a product is currently manufactured by Midmark Corporation (Figure 3-49). As an alternate, one may place a cubicle drape around the door as in Figure 5-10.

With certain medical specialties, for example, ear, nose, and throat (ENT) or orthopedics, patients rarely undress, or if they do so, they primarily undress just to the waist, so private dressing cubicles would not be a priority in these practices.

It should be noted that cubicle drape fabric is specially fabricated for this purpose. It is 72 inches wide, has two "good" sides in terms of pattern and appearance, and can be washed at a temperature of 160 degrees Fahrenheit. Manufacturers include Maharam, Carnegie, DesignTex, and Momentum to name a few. It is well known from studies in acute care settings that cubicle drapes are a vector for pathogens that are spread by contact, such as *Clostridium difficile* and MRSA. These also occur in the community and in clinic settings. It is also well known that cubicle drapes rarely get washed so this should be taken into consideration before using them in an exam room. There are, however, cubicle drape fabrics that use an antimicrobial to inhibit the growth of bacteria. This should be something that bonds to the fabric permanently as opposed to a surface treatment. For any product of this type it is wise to review the laboratory tests, not just the marketing claims.

Figure 3-49. Exam room Dressing Nook. *(Photo courtesy: Midmark Corporation, Versailles, Ohio)*

Position of Exam Table

The second functional consideration is the position of the examining table. The foot or stirrup end of the table is usually angled away from the door (see Figures 3-3 and 3-4a as well as the wall, so that the doctor has access to all sides of the patient, and the patient is out of view of passersby in the corridor when the door is opened. Related to the position of the exam table is the placement of the

wall-mounted diagnostic instrument panel (see Figures 3-2, 3-3, and 3-50). Physicians have to reach those instruments as they examine a patient.

One of the major manufacturers of exam tables, Midmark, has redesigned its entire line to be ADA accessible (barrier-free) and to be able to go low enough (18 inches is standard chair seat height) for a person to sit on it without needing a step stool (Figure 3-51). This reduces the risk of falling for an elderly or frail individual. Midmark, in their Ritter Barrier-Free® line, has also addressed the bariatric population with a very large table that can support an 850 pound person and also lowers to an 18-inch height (see Figure 5-58).

The door to an exam room is often hinged so that it opens away from the wall (does not stack against the wall) as in Figures 3-3 and 3-4. While this might seem awkward in most rooms, it is desirable in a medical exam room because it shields the patient from corridor traffic, should the door be opened accidentally, and gives the patient more privacy when dressing, since one has to walk around the open door to enter the room. Because ADA requires 18 inches of clear space on the pull side of the door, it is awkward to open the door to shield the patient in a 7-foot-6-inch-wide room as it puts the door almost in the center of the room.

Cabinets

The sink cabinet in a traditional 8 × 12–foot room works best on the long wall, right side, as in diagram far left in Figure 3-3. This is functional in a room in which pelvic or proctologic examinations are done, although in this case the sink should be at the leading end of the cabinet. With larger rooms there are more options for placement as can be seen in Figures 3-3 and 3-4b but this is also a function of the medical specialty and how much they use the sink. In OB-GYN, for example, physicians often place instruments in the sink during the examination and like to be able to reach it with an extended arm. In orthopedic exam rooms the sink cabinet is often small and tucked away on the wall with the door. It is only used for hand-washing.

The sink cabinet need have only a small sink (a 12 × 12-inch stainless steel bar sink works well), as instruments

Figure 3-50. Relationship of diagnostic instrument panel to exam table. Physician is on patient's right side. Welch Allyn Connex® Integrated Wall System. *(Source: Welch Allyn, Inc.)*

Figure 3-51. Ritter 223 Barrier-Free® power exam table. *(Photo courtesy: Midmark Corporation, Versailles, Ohio)*

that are not disposable will be processed elsewhere. In addition, the sink should have a single-lever faucet that may be controlled by an infrared sensor. Having to touch faucet handles compromises infection control. The plastic laminate–clad sink cabinet will usually be a minimum

of 48 inches long, 24 inches deep, and 34 inches high. If space permits to make it longer, it might have a built-in compartment for trash with a grommeted hole in the countertop or a rectangular opening cut into the face of the cabinet door. For a number of years some version of an extended countertop (often with a rounded edge) has become common to provide a place for the physician to write in the chart (see Figures 3-2 and 3-3, far right image). This has evolved into options in which the desk or table is separate from the sink cabinet to provide more room to view the monitor and chat more informally with patients as in Figures 3-4b and 3-14.

An upper cabinet may be provided (48 inches long, 14 inches deep, 36 inches high) over the base cabinet, for storage of disposable gowns, sheets, and other paper products. Shallow drawers in the base cabinet store instruments, syringes, surgical gloves, dressings, tongue depressors, and the like. Paper towel and hand sanitizer dispensers should be mounted on the wall near the sink, as well as a rack for holding boxes of gloves (Figure 3-52).

Figure 3-52. Plexiglas glove box holder. *(Photo courtesy of Custom Comfort, Inc., Orlando, Florida)*

These items are often provided by the paper or supply vendors who service the units but, if the designer does not oversee the installation, they may be placed with no regard for the aesthetics of the room as well as being hung crooked (not level).

Obstetricians and gynecologists often like to warm their specula prior to examinations. For this purpose, an electrical outlet may be provided in the drawer in which the specula are stored. The more expensive pelvic examination tables have a built-in warmer. Disposable specula are increasingly being used which negates the issue entirely.

If the sink cabinet is located on the long wall or the foot wall, the countertop can be extended, and lowered from 34 inches to 30 inches to serve as a writing desk (see Figure 3-3, center image). The exam room in Figure 3-53a is 9 × 12 feet in size with a built-in bench spacious enough for three persons. A rolling stool that stores under the desk when not in use is provided for the physician. It presents an uncluttered appearance and is easy to clean as opposed to having movable guest chairs.

Infection Control Issues

It is not known to the author how frequently exam rooms are disinfected between patients but the rapid turnover of patients—some having communicable diseases—makes one wonder about this. It may be an issue not on the radar screens of medical assistants. Do they wipe down countertops, door handles, and the keyboard pad? The physician washes hands or uses hand sanitizer when he or she comes into the room but then uses the keyboard or other mobile devices during the examination. Some keyboards have antimicrobial "skins." Are the hand-pieces of otoscopes and ophthalmoscopes, or the increasing number of mobile diagnostic instruments, stethoscopes (usually put directly on a patient's skin), or blood pressure cuffs wiped with disinfectant? Posing these questions to two large group practices, one said they only wipe down the room when someone with a communicable disease has been in it; otherwise, they wipe it down at the end of the day; and the other said they wipe it between each patient (the latter was a community health center).

One of the most important infection-control measures is the placement of hand sanitizer dispensers. While research in the medical office setting as to the most effective placement does not exist presently, from acute care patient rooms it is known that placing one at the entry to the room increases compliance. Based on that, this would place one near the entry door to the exam room and another near the sink (which would be equivalent to the headwall of the patient room). In addition, each exam room needs a container for general waste as well as biohazardous waste, a wall-mounted sharps container, glove box holder, and paper towel dispenser. The hands-free waste receptacle in Figure 3-53b is OSHA-approved for hazardous waste (provided appropriate red bags are used) and is more attractive than the more common red receptacle. Refillable soap dispensers are not allowed.

Windows

There is debate over the benefit of windows in exam rooms. There is no need for natural light in an exam room for most specialties (it is recommended for dermatology exam rooms, however), so the inclusion of windows would be either a matter of the physician's preference or a given of the building's architecture. However, natural light makes the room more pleasant, especially if the patient is kept waiting. If present, the glass should start at a height sufficient (generally 42 inches) to afford the patient a measure of privacy. This height is also functionally appropriate for a base cabinet with 4-inch splash to fit under it.

Gray glass is better than bronze since the latter casts an unhealthy tint on a patient's skin. Horizontal slat wooden blinds or mesh blinds are particularly well suited to windows in exam rooms, as the slats can be tilted to provide privacy without cutting off the light or view entirely.

Too many windows in a medical building can make it difficult to lay out the rooms efficiently unless one wishes to have partitions that terminate in the middle of a window, instead of at a wall or a mullion. This is particularly common when the architect who designed the building was not familiar with medical space planning, and a window module was designed that was not compatible with the size of the rooms in a medical office: Basically a 4-foot

Figure 3-53a. Examination room, LifeScape Medical Associates. *(Design: Jain Malkin Inc.; Gary Knight Photography)*

Figure 3-53b. "Red bag" biohazard waste container. *(Photo courtesy of Midmark Corporation, Versailles, Ohio)*

module or one that is divisible by two to achieve a 10-foot-wide exam room. Refer to Chapter 2 for a discussion of building shell design.

Electrical Requirements

Three grounded duplex electrical outlets should be provided in an examination room—one above the cabinet countertop, one at the foot of the table, and one near the head of the table. Except for the outlet over the countertop, which would run horizontally at a height of 42 inches, the other outlets may be a standard 15-inch height. Note that examination tables often require an electrical outlet in the floor, although some models have pneumatic height adjustment that does not require power. Some physicians (especially primary care) use a wall-mounted diagnostic instrument panel that would be positioned on the long wall, at approximately 60-inch height, near the head of the exam table (see Figures 3-7 and 3-50). This unit is made by Welch Allyn and has been ubiquitous in exam rooms for as long as this author can remember. The big news is that the instruments are now available with digital output directly to a patient's EHR. The unit requires an electrical outlet that may be placed low on the wall, or high, depending on how much electrical cord one wants visible. It is ideal to have the panel hard-wired to avoid a cord hanging down. Outlets for the monitor, computer, and for docking stations and recharging of mobile devices need to be placed appropriately. Rooms used for ophthalmic or ENT examinations have special electrical requirements, to be discussed in Chapter 5.

Certain exam rooms, such as pediatric or orthopedic, often require only two electrical outlets, one over the countertop and the other near the foot of the exam table. This is in addition to outlets for the monitor and for recharging portable devices, possibly located at the consultation table if such exists. Outlets in a pediatric exam room must be carefully guarded and located where a child cannot reach them.

Some examinations, such as OB-GYN exams, require an additional light source, which is usually a high-intensity quartz halogen or LED lamp on a mobile floor stand (Figures 3-54 and 3-55). Some practitioners like a ceiling-mounted high-intensity lamp at the foot of the exam table (Figures 3-56 and 3-57). This requires support in the ceiling for mounting it. These lights may be halogen or increasingly, LED, and they may also be mounted to the wall (Figure 3-58).

It may be necessary to shield a specialized exam room (one used for certain types of neurological testing equipment, for example) against electrical interference from surrounding medical offices or equipment.

Figure 3-54. Mobile LED examination light, Green Series™ Exam Light IV. *(Source: Welch Allyn, Inc.)*

Figure 3-55. Mobile examination/procedure light, Ritter. *(Photo courtesy of Midmark Corporation, Versailles, Ohio)*

Figure 3-56. Ceiling-mounted LED procedure light. *(Photo courtesy of Midmark Corporation, Versailles, Ohio)*

Figure 3-57. Ceiling-mounted LED examination/procedure light. Welch Allyn Green Series™ GS 900 procedure light. *(Source: Welch Allyn, Inc.)*

Figure 3-58. Wall-mounted LED examination light. Welch Allyn Green Series™ GS 900 procedure light. *(Source: Welch Allyn, Inc.)*

Exam Table

The standard exam table is 27 to 30 inches wide by 60 inches long plus stirrups (Figure 3-59) if it is to be used for pelvic or urologic examinations. If not used for these purposes, the table will have a pullout footboard that extends the length of the table to about 6 feet. There are specialized tables for cystoscopic (urological) examinations.

The examining table, as described above, will be suitable for most physicians, but some medical specialties require modifications, and these are discussed in future chapters. Most notably, orthopedic surgeons use an 80-inch-long exam table that is more like a physical therapy table, which is sometimes placed against a wall. Pediatricians also often place their exam tables against the wall for safety.

The aforementioned combination consultation and examination room popularized many years ago by the Mayo Clinic (see Figure 3-47) has, after all these years, become the precursor to the current concept of sitting alongside patients to enhance communication. The Mayo brothers were pioneers in exploring options for the design of exam rooms to enhance productivity. Whatever the design of the exam room, the formula for a productive and efficient office is in the flow: to have patients move in the most direct path, in whatever sequence of rooms is appropriate, and ideally not to backtrack when exiting.

Figure 3-59. Midmark 604 full-featured examination table. *(Photo courtesy of Midmark Corporation, Versailles, Ohio)*

Treatment/Minor Surgery

Each family practice suite, and in fact most medical specialties, will have a minor surgery or procedure room (Figure 3-60). It is sometimes called a *treatment room*. It is a large exam room (usually 12 × 12 feet) that serves a variety of

Figure 3-60. Procedure room. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

purposes such as suturing lacerations or removing a foreign body from an eye. It may be used as a cast room, in which case a plaster trap should be provided in the sink, and cabinets should have a bin for casts that have been removed (see Orthopedic Surgery section in Chapter 5). Any type of minor surgery or procedure that can be done with a local anesthetic can be performed in this room. There are different types of treatment tables used depending upon the specialty. The adjustable height table by Midmark in Figure 3-51 can be lowered to enable an elderly person to sit down without having to use a step stool. This also works well for a person in a wheelchair. The table in Figure 5-64 is more like an adjustable height chair that can be moved into numerous positions. It allows dermatologists, plastic surgeons, and ENT specialists to get close to the head and face due to the taper of the cushions and head rest.

The treatment room may be used as an ECG room, as an operating room for minor surgical procedures using local anesthetics, and as an emergency exam room for accident cases. In treating emergencies, the physician may need one or more staff in the room plus specific medical equipment not usually stored in other exam rooms. Add to that family members who may accompany the patient and wish to remain in the treatment room, and the need for an oversized, multipurpose exam room becomes clear.

A minor surgery room should have a 10- to 12-foot length of upper and lower cabinets, one full wall of built-ins. Usually, this room will have a ceiling-mounted surgical light over the treatment table, in addition to standard fluorescent lighting (Figures 3-60 and 3-61). Proper illumination is mandatory for this room.

If the suite is so situated within the layout of the medical building as to make possible a direct entrance to the minor surgery room, this may be desirable, depending upon the physician's practice. Accident cases or those with contagious diseases will not have to walk through the waiting room if they can enter the room directly. This would be an unmarked door in the public corridor of the medical building provided with a buzzer, or the door might simply state *Emergency Entrance—Ring Bell for Service*. The receptionist taking the emergency call would ask the patient to go to the door marked *Emergency Entrance* and ring the bell.

Consultation Room/Private Office

This room functions as a private office for the most part, but some physicians do consult with patients here.

Figure 3-61. Procedure room with full wall casework. *(Design: Jain Malkin Inc.; Photo: Jain Malkin)*

Routine consultation can be handled in a well-designed exam room, saving the physician the trouble of continually returning to his or her private office with each patient.

Certain physicians (e.g., internists, oncologists) spend a good deal of time interviewing patients on the initial visit. In such cases, physicians may feel that the consultation room provides a more conducive atmosphere for establishing the relationship or for discussing serious illnesses. Surgeons also tend to use their private offices for consultation with patients, but this remains a matter of individual preference for each physician.

The consultation room is also used by the physician for reading, returning phone calls, charting, or just relaxing. The minimum size for this room is 10 × 12 feet, but 12 × 12 feet is better. The room must accommodate a desk with computer, credenza, bookshelves for the doctor's library,

Figure 3-62. Diplomas, attractively framed. *(Design: Jain Malkin Inc.; Photographer: Michael Denny)*

two guest chairs, a coat closet (optional), and perhaps a private bathroom. The room is often furnished like a living room or study with cut pile carpet, fabric wallcovering, comfortable furniture, and artwork. If the doctor has a hobby that lends itself to expression in room décor, this is the one room in the suite that can be highly personalized. Family photos, armed forces honors, and personal memorabilia humanize the doctor's image and provide a clue to him or her as a person, apart from the medical practice. The physician's diplomas and credentials should be nicely framed and displayed in the consultation room. If grouped artistically (Figure 3-62), they can complement the room's décor.

A consultation room should have natural light. In addition, table lamps or indirect lighting may add to the room's homelike ambience. It is desirable to locate the consultation room at the rear of the suite to give the physician more privacy and to ensure that patients do not pass it on their way to the examining room. It may be possible to locate an outdoor exit in the private office to enable the physician to enter or leave without being seen by patients. If such a door is not possible then a private rear entrance to the suite, as previously discussed, is important.

In certain suites, such as pediatrics, the consultation room is used so minimally that several physicians may share one. Their combined medical library would be

stored here, and each doctor would have a small desk and telephone (see Figures 3-100, , and 5-113. In fact, shared offices are becoming increasingly common as reimbursement is cut and there is more focus on reducing overhead.

At the other extreme, a physician will occasionally request a consultation room with a sofa large enough to sleep on, a table with reading lamp, a refrigerator, and bathroom with shower, in addition to the usual components of a private office. Such an office may serve a cardiac surgeon who, due to many emergency surgeries, may have to spend the night at the office (if it is near the hospital) or just catch up on sleep during the day between surgeries (Figure 5-124).

Figure 3-63. Nurse station and lab, Village Family Medicine. *(McMillan Pazdan Smith Architects; Photography by Kris Decker/Firewater Photography)*

Nurse Station and Laboratory

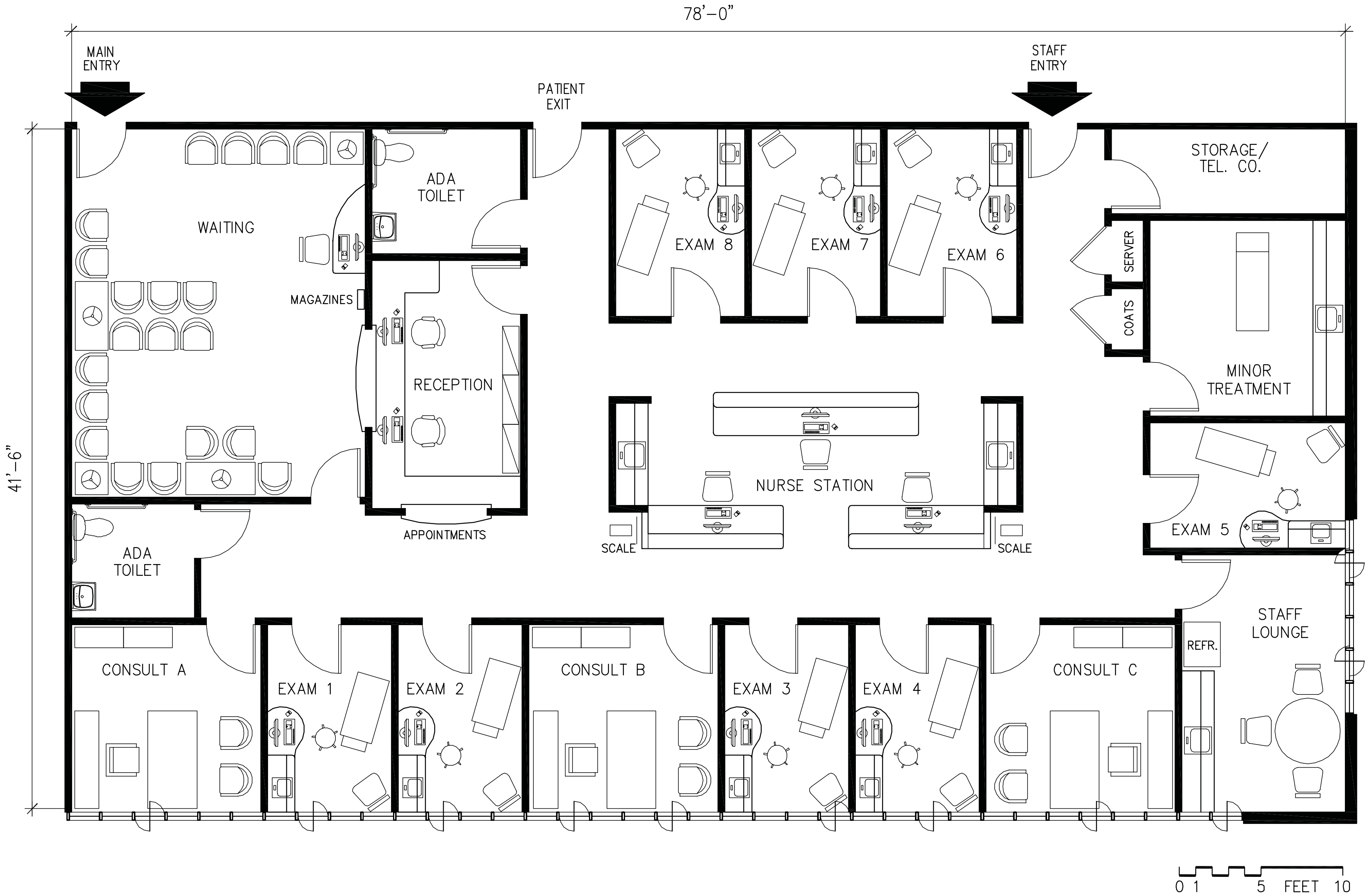
The nurse station is an area where the doctor's nurses or assistants perform a variety of tasks such as weighing patients, sterilizing instruments, dispensing drug samples, giving injections, recording vital signs (if not done in the exam room), performing routine lab tests, communicating with patients by telephone, or handling office paperwork (see Figures 3-30, 3-31, and 3-43).

The nurse station may be only a 6-foot length of countertop (with cabinets below and above) recessed in a niche in the corridor (see Figure 3-20), or it may be an 8 ×12–foot room or area adjacent to the exam rooms (Figures 3-5, 3-63, and 3-64). The size of the nurse station depends on the number of nurses or aides who will use it, the functions to be performed by those individuals, and the type of medical practice. The nurse station in Figure 3-64 offers physicians maximum access to nurses and numerous stand-up-height transaction surfaces for jotting notes.

The number of physician extenders can be estimated on the basis of each doctor requiring one or two assistants, depending on whether the practice is a high-volume specialty. This person, depending on training, may assist the physician in the exam room or may actually perform certain examinations. Obstetricians and gynecologists have been using nurse practitioners in this expanded role for routine pelvic and gynecologic examinations. Since OB-GYN is a high-volume specialty, the use of nurse practitioners saves the physician time on routine examinations and permits him or her to concentrate on patients with more demanding medical conditions.

The nurse station in an OB-GYN suite must be large enough to accommodate the nurse practitioners and other aides who need a knee space for sitting down and writing notes, one or two scales (all OB-GYN patients are weighed each visit), with a writing shelf nearby. A space of approximately 24 inches should be allowed for each scale. This is the floor space necessary to accommodate a standard medical scale with balance rod. Occasionally nurse practitioners have private offices.

There is an advantage to locating the nurse station near the front of the suite in a small office (under 1,500 square



FAMILY PRACTICE

3300 SF

Figure 3-64. Space plan family practice, 3,300 square feet. *(Design: Jain Malkin Inc.)*

feet). The nurse has easy access to patients as he or she leads them from the waiting room to the exam room, and the nurse can cover for business office staff when they are momentarily away from their desks. In larger suites, each doctor may have a nurse or medical assistant working from a nurse station convenient to his or her pod of exam rooms (see Figures 3-5, 3-6, 7-1, and 7-2).

In some medical offices, the nurse station is combined with the laboratory (Figure 3-65). In otolaryngology (ENT), for example, this is true since few lab tests are performed in the office. The nurse station/lab would be used for preparing throat cultures and for cleanup of instruments in the sink or for sterilizing instruments. With the widespread use of disposable syringes, gowns, sheets, and even many examination instruments, relatively few items have to be washed or sterilized. The lab in Figure 3-66 supports a large concierge model clinic associated with a hospital.

In an OB-GYN practice, the laboratory would usually be a separate room because a good deal of lab work is generated in the suite (see Figure 5-2). Each patient supplies a urine sample for analysis, which is performed in the lab, and each patient having a pelvic exam and Pap smear will have a tissue culture that will have to be prepared for sending to a cytology lab.

A number of other routine tests would be performed within the lab, plus many gynecologists do D&Cs (dilation and curettage) and other types of minor surgery procedures in a well-equipped minor surgery room in the office. These procedures can be messy and require an adequate area for cleanup and a good-sized nurse station, plus lab support facilities.

A lab should have a double-compartment sink or a single large compartment sink, a knee space area for a microscope, and a full-size refrigerator if necessary (otherwise an undercounter one). It may also have a blood drawing station with a specialized blood draw chair (Figure 3-67). It is advisable to shield the patient whose blood is being drawn from the sight of other patients, who may become faint upon observing the procedure (Figure 3-68). The blood may be drawn in the exam room to provide more privacy for patients. The countertop will have a centrifuge for spinning down blood before sending it out to a lab and may have (if more lab work is done within the suite) a countertop analyzer. Refer to Chapter 6 for photos of clinical analyzers.

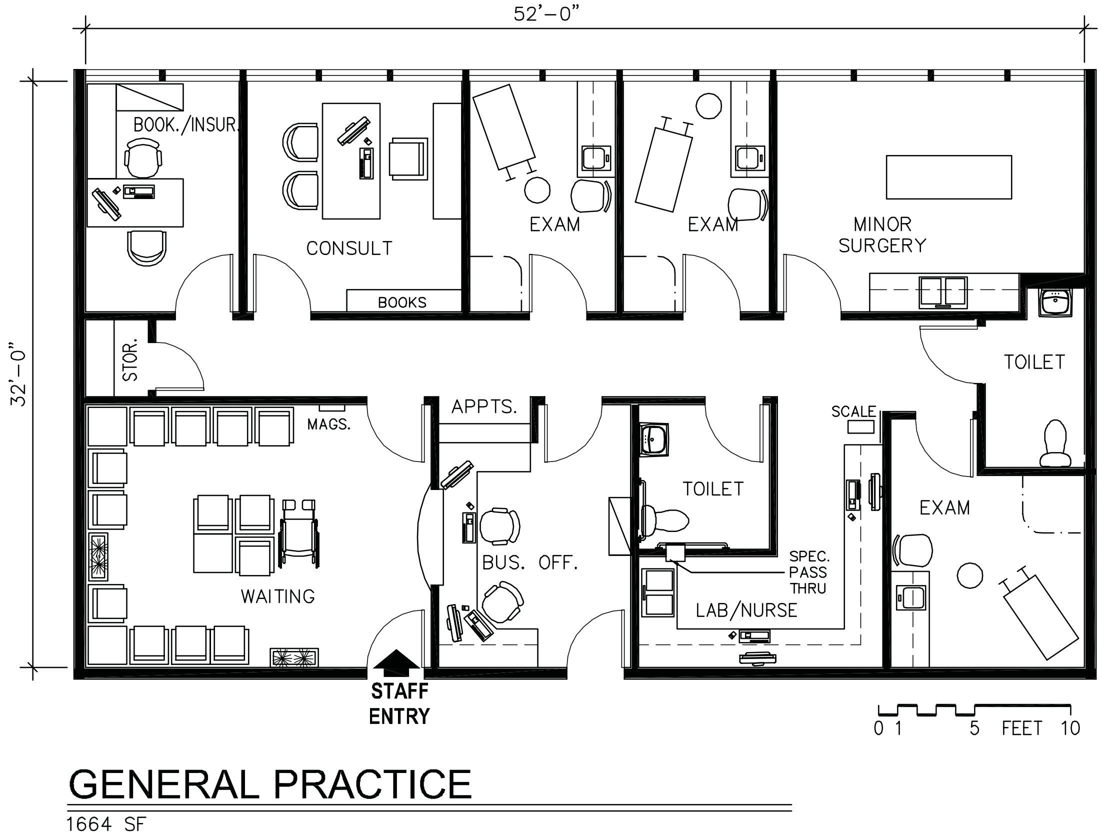


Figure 3-65. Space plan general practice, 1,664 square feet. *(Design: Jain Malkin Inc.)*

It is desirable to have at least one toilet room adjacent to the lab so that a specimen pass-through door in the wall can give the lab technician access to urine specimens without leaving the lab (see Figures 3-5, 3-20, 3-30, 3-65). The reader is referred to Chapter 6 for more detailed specifications of a small laboratory.

The nurse station of an orthopedic surgery suite would be of minimal size since there are no lab tests performed, and no blood is drawn. The supplies needed for examinations or for making or removing casts would be stored in

Figure 3-66. Lab, primary care suite. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

Figure 3-67. Pneumatic blood draw chair. *(Photo courtesy of Custom Comfort, Inc., Orlando, Florida)*

Figure 3-68. Blood draw station in clinical lab. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

the respective rooms, and very little would have to be carried into a room for a procedure. In fact, orthopedic offices have tech workstations rather than nurse stations.

By contrast, a family practice or G.P. suite would have a large nurse station. Since such a wide variety of medical procedures are performed and there is such a wide range of patients, it would be impractical to store in each exam room all the supplies one might need. Therefore, the nurse prepares the exam room with any special supplies, injections, dressings, and instruments that she anticipates will be required. A good many of these items will be stored in the nurse station, and each nurse station might have its own autoclave for sterilization of instruments. In addition, the nurse might give allergy or other injections at the nurse station; blood might be drawn for tests to be done in the suite's own lab or sent out for processing; patients are weighed at each visit; and many other routine tasks are carried out here.

A nurse station should always have a sink and often has an undercounter refrigerator and a knee-space work area with telephone (see Figure 3-63). Most nurse stations have a scale space, with a nearby shelf, for recording weight in the patient's chart (see Figure 3-64). The reader is referred to Chapter 5 for nurse station requirements for each medical specialty.

Legislation Affecting In-House Labs

Regarding the laboratory, the physician decides whether to do lab tests within the office or to send the work out. Some do not even like to draw blood in their office, preferring to send the patient to a lab if one is conveniently located in the medical building.

Stark Legislation

In the past, physicians may have had a financial interest in a lab to which they referred patients, but with the federal Stark legislation enacted a number of years ago this is rare. Only under the "safe harbor" provision, and under certain conditions, for example in rural areas where an independent lab may not be available, may physicians own a lab. Otherwise, financial interest in a lab or other ancillary services is viewed as a potential conflict of interest.

It is estimated that today fewer than 10 percent of medical practices do lab work in house, as CLIA (Clinical Laboratory Improvement Act) federal legislation enacted in 1988, imposes a level of compliance that results in high overhead and—with the decrease in reimbursement—it becomes a drain, rather than an economic incentive. Also, under managed care, a patient's insurance may dictate what lab must be used.

CLIA Compliance

Lab tests physicians may commonly do in their offices, and are allowed to do without a CLIA Certificate of Compliance are referred to as "waived tests," defined as "simple laboratory examinations and procedures with insignificant risk of an erroneous result" (www.cms.gov/Regulations-and-Guidance/legislation/CLIA/downloads/HowObtainCLIACertificate). However, these laboratories still need to register with CLIA to obtain a Certificate of Waiver. There are compact clinical analyzers that can be found in physician labs that do waived tests. The *QBC STAR*™ centrifugal hematology system is small and sits on a countertop (Figure 3-69). It does a complete blood count and does not require reagents; they are contained

Figure 3-69. QBC STAR™ centrifugal hematology system. *(Image courtesy of QBC® Diagnostics)*

Figure 3-70. Small but powerful chemistry analyzer for primary care and internal medicine offices, including urgent care. Piccolo xpress™ registered trademark of Abaxis, Inc. *(Courtesy of Abaxis–Medical Division)*

Figure 3-71. Handheld blood analyzer used for point-of-care diagnosis. i-STAT® system handheld is a registered trademark of Abbott Group of Companies in various jurisdictions. *(Courtesy of Abbott Point-of-Care)*

within the STAR tubes. The *Piccolo xpress*™ chemistry analyzer by Abaxis (marketed in the United States by Abbott Point-of-Care) has 26 waived tests across 11 panels, including the only waived comprehensive metabolic panel (Figure 3-70). The menu of tests includes lipids, liver, kidney, metabolic function, and numerous specialty tests. This analyzer can be found in primary care and internal medicine offices, urgent care, oncology and pediatric offices, radiology and dermatology practices, and other specialist medical facilities. The handheld iSTAT® blood analyzer system by Abbott Point-of-Care enables physicians to make on-the-spot treatment decisions (Figure 3-71). It does numerous tests, some of which are waived.

Physicians who elect to do what are called "nonwaived" tests in the office would come under CLIA regulations. The most commonly performed tests include blood counts, glucose tolerance tests, kidney and liver function tests, and cholesterol testing or a full lipid panel. This work would require benchtop hematology and chemistry analyzers. See Chapter 6 for photos of automated analyzers and more detailed information about laboratories.

Drug Testing

Large family practice suites and clinical laboratories may wish to do testing for drugs as part of employment-required physical exams. A toilet room designed for this purpose is discussed in Chapter 6.

OSHA Issues

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor protects workers from occupational hazards and risks. It publishes guidelines, standards, and regulations governing a multitude of settings, products, and situations, most of which have to do with processes and procedures, none of which come under the purview of the architect or designer. OSHA also evaluates products such as sharps disposal containers to determine if they meet OSHA standards. Periodically worksites, including medical and dental offices, may be visited by OSHA inspectors. Designers should be aware of the following issues:

1. Personal-use or edible items cannot be stored in the same refrigerator as blood or tissue samples. However, according to OSHA, refrigerators containing medications or other substances stored for medical procedures (e.g., challenge solutions for glucose tolerance tests) are not subject to the restriction.
2. An eyewash device is required in any workplace where the eyes of the employee may be exposed to injurious materials. These are often placed in a dental sterilization area, an oncology lab in which chemotherapy drugs are prepared, and similar locations. A large primary-care office might have one; urgent-care clinics (for walk-in patients) and ophthalmologists often have one for patients. The device must meet American National Standards Institute (ANSI) Z358.1-2009 (see Figures 6-64 and 10-10).
3. In offices where staff is exposed to bloodborne pathogens, they are required to remove their lab coats prior to leaving the suite. The idea is to not carry home organisms on one's clothing. OSHA requires this in dental offices. Although not required by OSHA, depending on the specialty, the practitioner may wish to provide a locker room and change area for staff. Disposable items with bodily fluids must be red-bagged and labeled "biohazardous waste" and collected by a service. A biohazardous storage room, usually near the staff entrance to the suite, will house the waste until it is picked up. It can also be stored in a soiled utility room.
4. Occupational exposure to bloodborne pathogens, including hepatitis B and C viruses as well as human immunodeficiency virus (HIV), poses great risk to healthcare workers. Needle-stick injuries are a serious hazard and OSHA has researched every aspect of this problem and published numerous standards and documents relating to how injuries occur and how they can be reduced. Standards for selecting the safest sharps disposal container and suggestions for training staff are covered in the "Occupational Exposure to Bloodborne Pathogens" Standard.

Placement of Sharps Disposal Containers

One of the three factors most often related to sharps injuries is inappropriate placement of the sharps container. It should be visible and placed at an arm's reach and below eye level at the point of use. According to OSHA, the fixture should be below the eye level of 95 percent of adult female workers, which results in an optimal installation range of 56 to 52 inches at a standing workstation and 42 to 38 inches for a seated workstation.

A word of warning: When a physician's office staff conveys to the designer OSHA standards and regulations

Figure 3-72. Digital radiography room with control station. *(Courtesy of Boulder Associates; Photography, copyright © LaCasse Photography)*

that must be met, it is advisable that the designer confirm all information by calling OSHA. In the author's experience much of the time either no regulation exists or, if it does, its effect on the built environment has been misunderstood. The problem is that individual OSHA inspectors may cite a facility for a perceived infraction that cannot be found in a literal reading of the OSHA text. In addition, each state has its own OSHA interpretations. Physicians' office staffs are right to treat employee safety issues seriously and to want to address them to the letter of the law since the liability and risks are substantial for noncompliance. However, much of the compliance deals with staff training, keeping procedure manuals updated, and making certain the staff actively follow the procedures they have outlined to protect patients and employees. In that regard, an excellent resource for OSHA compliance training, consulting, and compliance products is HPTC (www.hptcinc.com).

Other Support Services

X-Ray Room

This discussion will focus on the one-room radiography unit that can be found in a family practice or internal medicine suite and in an orthopedic practice (see Figures 3-5, 3-18, 3-30, and 3-72). Rather simple radiographic examinations are performed here—films of extremities, chests, gallbladders, appendixes, and so forth. More complicated studies will be performed in a radiology office. A large internal medicine practice might have a suite of radiographic rooms within its facility with a full-time radiologist on staff. But a patient who requires GI (gastrointestinal) studies, thyroid scans, computed tomography (CT) scans, or other specialized or complicated diagnostic imaging procedures will be referred to a local hospital as an outpatient or to a nearby radiology clinic.

A 15 × 18–foot room is adequate (not taking into account dressing or control areas) for most X-ray machines used in a family practice or internal medicine office, although a slightly larger room would be more comfortable. A 9-foot ceiling height is required. There should be a place inside

or outside the room for a patient to dress (ideally a 3 × 4–foot alcove with a drapery or door for privacy), a control area for the technologist, and a place for the tech to check the films on a small PACS monitor. Although the equipment breaks down into components, it is advisable to provide a minimum 42-inch-wide door in this room for ease in moving the equipment. Although new imaging equipment is digital and filmless, physicians may have existing equipment that is not. It is unlikely most will trade it in as long as it's still serviceable and can possibly be upgraded for digital output. Refer to Orthopedics section in Chapter 5 for a discussion on this topic and also to Chapter 6.

The radiography room does not need a sink or prep area unless GI studies are performed or contrast media are used, in which case a bathroom must be located close to the radiographic room (see Figures 6-15 and 6-19).

Two or more walls of an X-ray room will have to be shielded with lead to protect office occupants as well as passersby from radiation scatter. It is necessary to obtain a radiation physicist's report, which takes into account the type of equipment and the location of the room within the suite and within the medical office building, in order to know which walls must be shielded, the thickness of the lead, and the height of the lead panels. Frequently, the door to the room must also be lead-lined. Such a door is very heavy and must have a heavy-duty door closer. The control partition, if located within the room, must also be lead-lined. It is possible to buy prefabricated, lead-lined control partitions with glass viewing panels from X-ray supply houses.

If the control area is located outside the X-ray room, there must be a lead-lined glass window to enable the operator to observe the patient at all times. The control area need not be large—4 × 5 feet is generally adequate (see Figure 3-72).

There are considerable variations in size of radiology equipment, power requirements, and other specifications from one manufacturer to another. Therefore, it is advisable to obtain planning guides for each piece of equipment before proceeding. The manufacturer's literature will specify utility requirements and critical distances between equipment. Additional support is usually needed in the ceiling to support the tube stand. The X-ray unit, if new, will often be supplied by a local distributor who will assist the designer in locating the equipment in the room. Or, if the physician is relocating existing equipment to a new office, it will usually be moved and reinstalled by a skilled technician, who can offer assistance as to the equipment's requirements.

Storage

Medical offices should have a storage room at least 8 feet square with two or more walls of adjustable shelves for storage of office supplies, sterile supplies, pharmaceutical items, housekeeping supplies, and cartons of toilet paper, hand towels, and facial tissue. If the office does not use a janitorial service, the vacuum cleaner and mop and pail would be stored here. Larger offices may have a janitor's closet with sink.

Staff Lounge/Break Room

Any suite with more than two employees should have a staff lounge. The room need not be larger than 10 × 12 feet with a built-in sink cabinet 6 to 8 feet in length, an undercounter refrigerator, microwave oven, garbage disposal, a small table and chairs, and possibly lockers for personal effects (see Figure 10-104). Do not underestimate the countertop area required considering coffee maker, appliances, dish drying rack, and space for the box of doughnuts. Remember that a refrigerator with an ice maker will require a water line. A larger staff lounge might include a sofa where an employee can lie down as well as a full-size refrigerator. This is a private room where the staff may take coffee breaks or eat their lunch. A staff lounge is an amenity that pleases employees and makes their jobs a little more pleasant. Furthermore, one does not want staff eating food in the nurse station, in the lab, or at the reception desk.

INTERNAL MEDICINE

The practice of internal medicine is broad. It encompasses subspecialties such as pulmonary disease, nephrology, oncology, hematology, gastroenterology, endocrinology,

Table 3-2.
Analysis of Program
Internal Medicine

No. of Physicians:		2		3		4
Consultation Rm./ Private Office	2 @	12 × 12 = 288	3 @	12 × 12 = 432	4 @	12 × 12 = 576
Exam Rooms/Talking Rooms	6 @	10 × 12 = 720	8 @	10 × 12 = 960	10 @	10 × 12 = 1,200
Waiting Room		14 × 18 = 252		20 × 20 = 400		20 × 24 = 480
Business Office[a]		16 × 20 = 320		20 × 20 = 400		24 × 26 = 624
Office Manager		10 × 12 = 120		10 × 12 = 120		10 × 12 = 120
Nurse Stations	2 @	10 × 10 = 200	3 @	10 × 10 = 300	4 @	10 × 10 = 400
M.A. Workstation		6 × 10 = 60		6 × 10 = 60		6 × 12 = 72
Storage		8 × 8 = 64		8 × 10 = 80		8 ×10 = 80
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192	4 @	8 × 8 = 256
Flex Sig. Room[b]		300 SF		300 SF		300 SF
Staff Break Room		10 × 12 = 120		12 × 12 = 144		12 × 16 = 192
Laboratory		12 × 20 = 240		300 SF		400 SF
Toilet		8 × 8 = 64		8 × 8 = 64		8 × 8 = 64
ECG/Treadmill		12 × 12 = 144		12 × 12 = 144		12 × 12 = 144
ECG Tech Workstation		6 × 6 = 36		6 × 6 = 36		6 × 6 = 36
Pulmonary Function Testing		—		(Optional)		14 × 20 = 280
Echo Exam & Holter		10 × 14 = 140		10 × 14 = 140		10 × 14 = 140
Radiology[c]		—		16 × 20 = 320		16 × 20 = 320
Tech workstation		—		5 × 6 = 30		5 × 6 = 30
Tel. Equip./ Server Closet		4 × 5 = 20		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16		4 × 4 = 16
Subtotal		3,232 SF		4,458 SF		5,750 SF
20% Circulation		646		891		1,150
Total		3,878 SF		5,349 SF		6,900 SF

[a]Includes reception, appointments, bookkeeping, and insurance/collection.
[b]Includes scope workroom and toilet; used for various types of special procedures.
[c]Includes control and radiography room.
Note: Consultation rooms (private offices) may be smaller (10 × 12) or shared (two physicians in a 12 × 12 room. Exam rooms and talking rooms are the same size but furnished differently.

and cardiovascular disease—the major emphases. Before planning an internal medicine suite, it is important to analyze the physicians' respective specialties and practice schedules. Internists often function as general practice primary care physicians for adults, providing a full spectrum of care (generally excluding gynecological examinations), or they may practice only their subspecialty such as cardiology, pulmonology, or endocrinology. The combinations of subspecialties in a group practice will obviously influence the program of rooms. Table 3-2 provides a general idea of a typical complement of rooms and Figure 3-73 shows the relationship of rooms.

With such a broad range of areas of expertise, it is common for internists to practice in groups rather than as solo practitioners. A designer must also understand the structure of a physician's workday. Physicians tend to visit their hospitalized patients in the morning, before office hours. Office hours typically begin at 9 A.M. and continue until noon. Medical offices are usually closed from noon to 2 P.M. and open again from 2 to 5 P.M. Surgeons try to do the bulk of their surgery in the morning and reserve the afternoon for office visits with patients.

In a five-person practice, for example, physicians' schedules will usually be arranged so that no more than three are in the office at any one time (see Figure 3-5). This negates the need for each of the five to have the use of exam rooms all at the same time. By efficiently coordinating their schedules, the group can function well in less space, without sacrificing income or service to patients. One doctor may have a day off, while a second may be seeing patients at a satellite office, and a third may be seeing patients at the hospital, leaving the other two in our hypothetical group of five in the primary office. At a busier point in the day, schedules may be arranged so that three or four of the internists are in the primary office seeing patients.

Internal medicine is a medium-volume practice. It is based on diagnosis, which requires long history-taking interviews by the physician and sometimes a complicated battery of tests. The internist, being primarily a diagnostician, spends a good deal of time with a patient. However, follow-up visits may be considerably shorter, so overall a well-organized, efficient practice can accommodate a

fairly high volume of patients each day. Some internists prefer to do the initial interview in the consultation room, whereas others find it more efficient to do it in the exam room. If the consultation room is used, it should be large—12 × 12 feet—with comfortable seating.

There is a lot of lab work associated with internal medicine, and one must determine which tests are to be done within the suite and which are to be sent out. If a substantial number of tests are to be done within the suite, a 12 × 12–foot minimum size lab should be set up. The reader is referred to Chapter 6, the section titled Small Laboratory, for further details. Remember, however, the previous comments about CLIA regulations and how few physicians currently do lab work in their offices.

A solo internist needs *three* exam rooms or *five* for each two physicians, provided there is a procedure room that can also be used. Ten exam rooms should suffice for a group of five physicians, allowing that at least one person is absent at any time and a second person may be absent for certain periods of the day.

A small X-ray room should be provided for chest films. Gallbladder and gastrointestinal studies are referred to a radiologist or, as appropriate, are performed in an endoscopy suite, discussed later in this chapter. Refer to the Family Practice section within this chapter for details of the X-ray suite.

A large storage room may be needed for storing specialized, seldom used equipment and for storing X-ray films from analog machines. At some point the aged films will be sent to an offsite warehouse and the new X-ray machine will be digital.

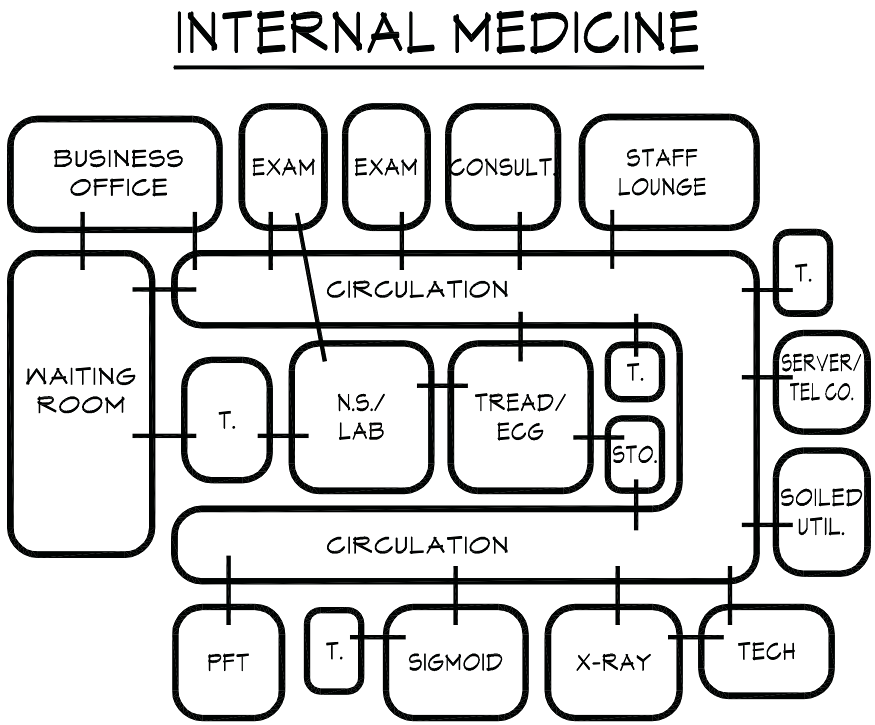


Figure 3-73. Schematic diagram of internal medicine suite.

Electrocardiograph Room

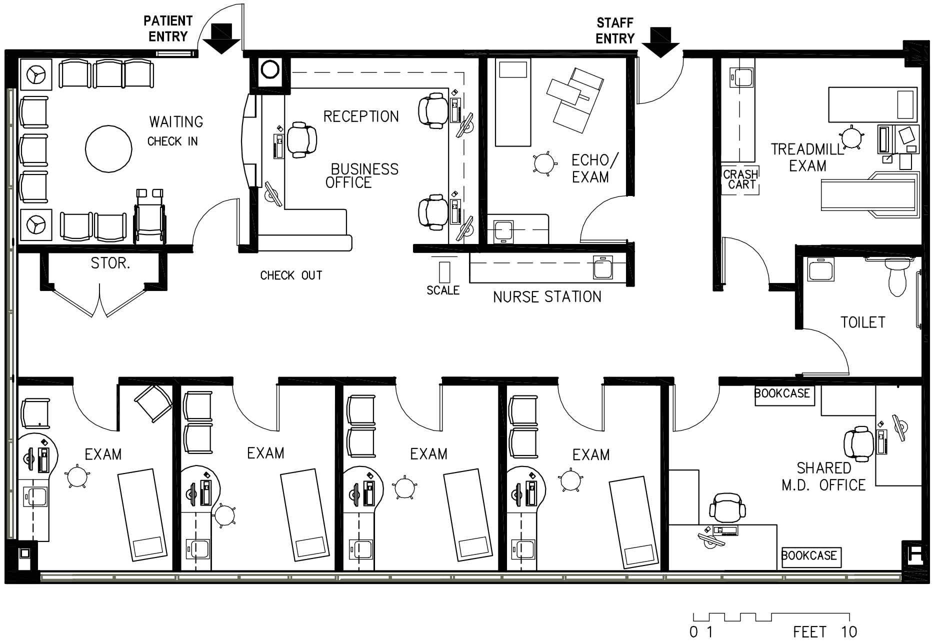
A standard exam room (10 × 10 or 10 × 12 feet) can be used for electrocardiograph (ECG) studies. Some physicians dedicate a special room to this function, while others feel that dedicated rooms result in a loss of flexibility. Since the equipment is portable, it can be moved from room to room as needed. A monitoring unit on a mobile cart is brought to the patient and electrodes attached to wires on the machine are placed on the patient's chest, leg, and wrist (Figure 3-74). The patient lies on a physical therapy–type table (or exam table) for this procedure. The instrument records the changes in electrical potential occurring during the heartbeat by imaging the vibrations and producing a printout—the electrocardiogram—which is then interpreted by the internist. This test is often performed by a nurse.

This type of ECG (where the patient lies supine) is called *static*. By contrast, a *dynamic* ECG involves an active patient whose heartbeat is monitored while he or she is walking on a motorized treadmill that is hardwired to the ECG machine and monitor, which control the elevation and speed of the treadmill (Figure 3-75). One can program the remote control for the desired protocol. The treadmill is not easy to move around, so if dynamic ECGs are done

Figure 3-75. Treadmill and electrocardiography for stress test, Midmark IQstress®. *(Photo courtesy of Midmark Corporation, Versailles, Ohio)*

Figure 3-74. Mobile electrocardiograph machine on cart with printer, Welch Allyn CP 300™. *(Source: Welch Allyn, Inc.)*

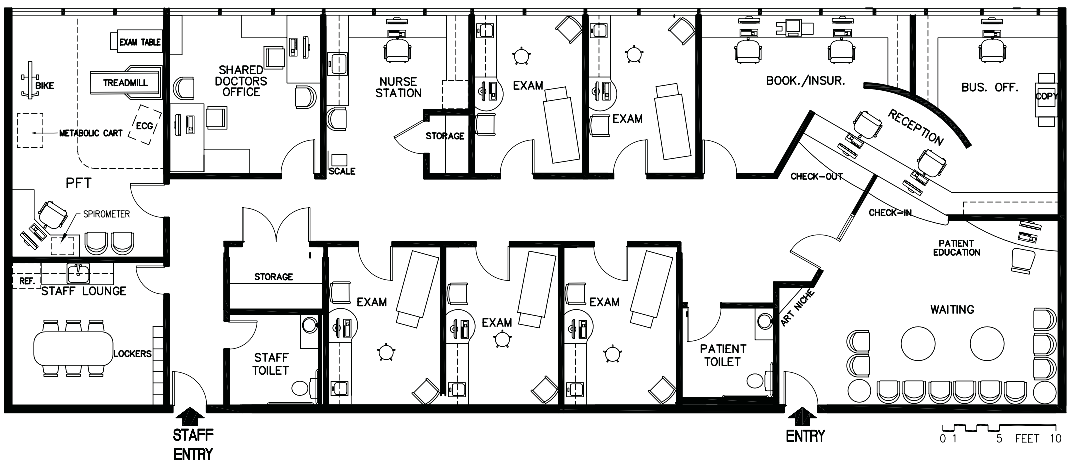
it is better to locate the equipment in one room and leave it there. Space for a "crash" cart with defibrillator and portable oxygen is required wherever stress testing is done (Figure 3-76). In addition, a treadmill room also requires an exam table where the patient can lie down during the recovery phase (Figures 3-76 and 3-77). Working to maximum exertion can cause dizziness or nausea. In positioning the treadmill, there needs to be a wall in front of the patient for a "perceived exertion" chart, and the exam table must be near the treadmill in case the patient feels lightheaded or unstable. The physician and tech need ready access to the right side of the patient to quickly replace an electrode that might have fallen off if the patient starts to perspire profusely. Therefore, the ECG cart is always to the right of the treadmill in laying out this room. A cardiologist is always present during a treadmill test.



CARDIOLOGY

1900 SF

Figure 3-76. Space plan of cardiology suite, 1,600 square feet. *(Design: Jain Malkin Inc.)*



INTERNAL MEDICINE

2640 SF

Figure 3-77. Space plan of internal medicine, 2,640 square feet. *(Design: Jain Malkin Inc.)*

Figure 3-78. Philips HeartStart FRx AED portable defibrillator. *(Philips Healthcare, a division of Philips Electronics North America, Corporation)*

Figure 3-79. Echocardiography ultrasound, Philips iE33 xMATRIX. *(Philips Healthcare, a division of Philips Electronics North America, Corporation)*

An ECG room without a treadmill can be the size of a standard exam room with space for a 2 × 6–foot table for the patient to lie on, the portable monitoring equipment, and the standard exam room sink cabinet. All output is digital and can upload directly to the patient's EHR or print a waveform tracing on paper. The cart also stores the silver chloride disposable electrodes. Patients remove only their shirts or blouse for a static ECG procedure. The room needs to be larger if there is a treadmill in addition to an exam table.

Automated External Defibrillator (AED)

A portable cardiac defibrillator like the Philips *HeartStart AED* should be readily available in all medical offices, mounted in a visible location in a main corridor (Figure 3-78). It can be placed inside a semi-recessed case.

Echocardiography and Ultrasound

Echocardiography is a noninvasive procedure that images the heart with ultrasound technology. The unit is portable and sits on a cart with a VCR and image printer and, in the case of the *Philips iE33 xMATRIX* echocardiography system (Figure 3-79), offers 2D and 3D image quality on the same transducer (the probe). Sometimes the test is done while the patient is on a treadmill. When performed in a standard examination room it requires absolute quiet. The patient lies on a flat table with the technician working from the patient's right side. Room lights should be dimmable.

The sonographer listens to sounds as they are coming toward and away from the probe; thus, extraneous noise makes it difficult to isolate the sounds although some sonographers wear headphones. "2D echo plus Doppler" means two-dimensional imaging plus sound. Doppler determines the speed and direction of blood flow. It is important to eliminate glare on the video screen. These studies are stored in a compressed digital format.

The ultrasound machine in Figure 3-80, the Siemens *ACUSON SC2000*™ is a high-performance machine that has 2D, 3D, and Doppler and can be customized for

Figure 3-80. Mobile ultrasound unit, ACUSON SC2000™. *(Copyright © Siemens Healthcare 2013)*

any number of clinical examinations: abdominal, cardiac (including echocardiography), OB/GYN, breast, and vascular system. It can also do a stress echocardiography exam with the patient on a treadmill.

Holter Monitoring

Holter monitoring is a noninvasive procedure for recording cardiac activity on a 24-hour basis. Electrodes applied to the patient's chest are connected via lead wires to a Holter recording unit worn on the patient's belt (Figures 3-81 and 3-82). The data are recorded digitally and uploaded to a computer for analysis. In addition, the patient keeps a written diary of activities and symptoms that is later correlated with the data recorded.

The patient can be fitted for the monitoring equipment in any standard exam room. This is done by an ECG or Holter technician who will need a workstation with a computer somewhere in the office. Before the patient is sent away the tech needs to verify that the recording will be good quality, which means they have to connect it to an ECG machine. The Holter monitor does nonstop recording and has a display. The exam room can have a physical therapy–type table or a standard one, and the room should have some cabinetry for storing supplies unless they are stored in the tech's workstation. When the patient returns, the compact SD card goes into a reader or, alternatively, the machine will be put into a docking station and the memory is downloaded via a USB interface to the PC software. The scanning and editing and preparing of a report for the doctor is done at a sit-down desk. There is a need for storage of prep kits, electrodes, and razors. These items need to be stored where there is a stable temperature, away from sunlight and heat. Note the relationship of test rooms in Figure 3-5 in the central core of the suite with a workstation for the tech who does echo, ECG, and Holter monitoring. The X-ray facility is also in the core with a subwaiting area.

Vascular Lab

Diagnostic studies of the blood vessels are performed in a vascular lab to detect blood clots, calcium buildup, and fatty deposits. A vascular lab might be set up with two rooms, one for carotid artery studies of the neck and one for studies of the extremities. A third room would be an office for the sonographers (Figure 3-83).

Figure 3-81. Woman wearing Holter heart monitoring device, DigiTrak XT Holter monitoring system. *(Philips Healthcare, a division of Philips Electronics North America, Corporation)*

Figure 3-82. DigiTrak XT Holter monitoring system. *(Philips Healthcare, a division of Philips Electronics North America, Corporation)*

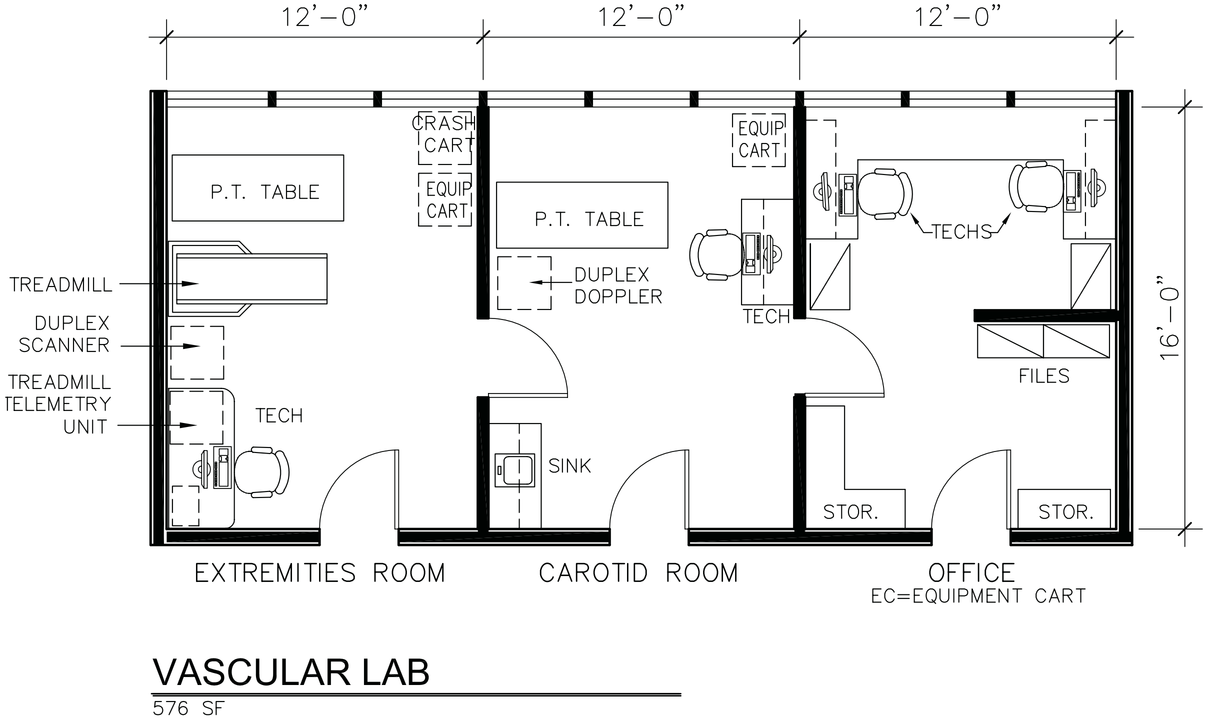


Figure 3-83. Space plan of vascular lab.

A three-room suite as described above might handle approximately 14 to 20 cases per day. The time required with each patient varies, but the norm is a 20- to 30-minute patient history-taking and 30- to 40-minute test period, with data uploaded to a computer for analysis and a report. Patients are usually gowned for tests, but procedures are noninvasive.

The carotid room uses a duplex Doppler ultrasonic imaging system (see Figure 3-79). As a point of information, power Doppler detects flow, duplex Doppler gives direction of flow. A color photo of the blood vessel can be produced, which may be placed in the patient's chart. The room also needs a desk for the sonographer and a sink cabinet, with storage above, for supplies and linen. A nice amenity to relax patients is a back-lit film transparency overhead with a view of nature.

The extremities room uses a Stryker gurney cart that is mobile and allows for flexible positioning of the patient. There would be a treadmill alongside the tech's desk, with the treadmill telemetry unit on the desk. The duplex Doppler imaging scanner would be on one side of the bed. A resuscitation cart should be nearby. Other equipment can be stored on a mobile cart. The room needs to be large enough to accommodate all this equipment. The same considerations with respect to dimming of room lights, quiet, and control of glare are as true for a vascular lab as for echocardiography.

A portable ultrasound unit, *SonoSite The Edge*®, that can be used in a vascular lab, in the operating room (OR), or in a physician's office for basic examinations has become popular (Figure 3-84). As with many medical devices, everything has been getting smaller and more portable but at the same time more powerful. With different transducers, this unit can be used for examining the abdomen, the vascular system, for OB/GYN, prostate, musculoskeletal system, breast, and other specialties such as cardiology. Exam presets exist within the system. For example, if one plugs in a transvaginal probe, one will automatically access the exams appropriate for that transducer. Therefore, this instrument can be used in a variety of settings. It has *Color HD*™ and *SonoMB*™ multibeam imaging, and a silicone keyboard to minimize the growth of pathogens.

Figure 3-84. Portable ultrasound unit for use in a variety of settings, Edge®. *(Courtesy of FUJIFILM SonoSite, Inc.)*

Pulmonary Function Testing

People with impaired lung functions are diagnosed in the pulmonary function lab. Pulmonary dysfunction may be acute or chronic. A patient recovering from pneumonia, for example, may need assessment and nebulizer treatment for a finite period but a patient with lung cancer or emphysema may need long-term evaluation and treatment for the remainder of his or her life. The composition of a pulmonary specialist's practice (age of patients, volume of patients, proximity to a hospital's outpatient respiratory therapy unit) will determine the extent, if any, to which inhalation therapy is done within the office.

The spirometer, an instrument for measuring *lung capacity* (Figure 3-85), is the basic tool for pulmonary function studies. A patient breathes into the device and, by way of a USB connection, the report uploads to a laptop. It, along with an analysis of blood gases and other clinical tests, helps the physician evaluate the extent and nature

Figure 3-85. Digital spirometer connects to PC. *(Photograph courtesy of AMD Global Telemedicine Inc., 2013)*

Figure 3-86. Body plethysmograph used in pulmonary function testing, Platinum Elite™. *(Courtesy of MGC Diagnostics)*

of lung damage. A bronchodilator medication is often administered when spirometer studies are performed.

Pulmonary function studies are noninvasive and can be performed quickly and inexpensively with computer calculations and comparisons to predicted normal values. These studies allow the physician to monitor the course of disease and to measure the effects of therapeutic intervention.

Those seeking treatment may complain of shortness of breath, chronic cough, allergic manifestations, or dizziness, or they may suffer from exposure to noxious dusts and fumes. Spirometry is generally included in annual routine health examinations, and is required by law as part of the mandated screening program for people who are occupationally exposed to hazardous fumes. Pulmonary function testing (also called PFT) provides a quantitative estimate of lung impairment.

In this specialty, as in many others, declining reimbursement in recent years has led physicians to make fewer investments in equipment and the additional space that may be required to accommodate it. Patients requiring more complicated tests would likely be referred to a hospital's outpatient pulmonary medicine department.

Most pulmonologists will have, in their offices, spirometry, ECG, and a method of measuring stress on the heart and lungs via a bike or treadmill hooked up to a sophisticated instrument that can measure and integrate several modalities.

In recent years, spirometers have become miniaturized. With pneumotachometers, spirometers also measure the flow of expired air from the lungs. Diagnostic instruments may be combined in a microprocessor-based complete pulmonary function system (Figure 3-86) that measures lung volume, residual volume, and diffusion (how gases pass into the blood). The metabolic analyzer (also called a metabolic "cart") measures oxygen consumption and carbon dioxide production. Used with an exercise bike or a treadmill (Figure 3-87), it measures, through expired gases, the cardiopulmonary stress response to a graduated workload. It is also used in sports medicine facilities to train athletes and in rehab settings. Arterial blood gases may be measured before, during, and after exercise testing. The machine in Figure 3-87 is enhanced with Mortara®

Figure 3-87. Metabolic gas exchange analysis system used in pulmonary function testing, Ultima™ CardiO2®. *(Courtesy of MGC Diagnostics)*

software to do automatic arrhythmia detection and event marking. With the wireless ECG option it eliminates interference caused by cable movement as the patient moves on the treadmill.

Although many pulmonologists would not have this equipment in their offices, one would find a body *plethysmograph* or “body box” (see Figure 3-86) in a large clinic setting. Along with complete pulmonary function capabilities, it measures thoracic lung volumes, airway resistance, and specific airway conductance. The technician sits outside to observe and coach the patient who is seated inside the pressure-type body box. The unit is approximately 30 × 42 inches in size.

Once the patient has been screened, the treatment phase would be called *inhalation* or *respiratory therapy*. The treatment generally consists of breathing mechanically pressurized air with medication. Currently, most patients’ treatment can be managed by the use of nebulizers (inhalers) in the home. Nebulizers are devices for aerosolizing metered doses of medications such as antibiotics and bronchodilators to the lungs to thin mucous secretions. The treatment might also consist of chest physiotherapy, in which a patient lies on an angled bed and gravity flow drains different lobes of the lung. The therapist, after administering bronchodilator medication, cups the patient’s back, and the patient coughs up the mucous.

Layout of Rooms

There is no generally accepted standard layout for a pulmonary function lab because it depends largely on the specific pieces of equipment the practitioner has and whether cardiovascular screening will be included. In the last instance, it is called a *cardiopulmonary lab*. Figure 3-77 shows a layout in which PFT and cardiopulmonary screening are performed.

Typically, in such a combined setting, one might have an ergometer exercise bicycle, a treadmill, telemetry, a physical therapy–type table, ECG, spirometer, a crash cart with defibrillator and oxygen, and a desk for the tech. One may also find a computerized metabolic testing unit used primarily with an exercise bike, occasionally with a

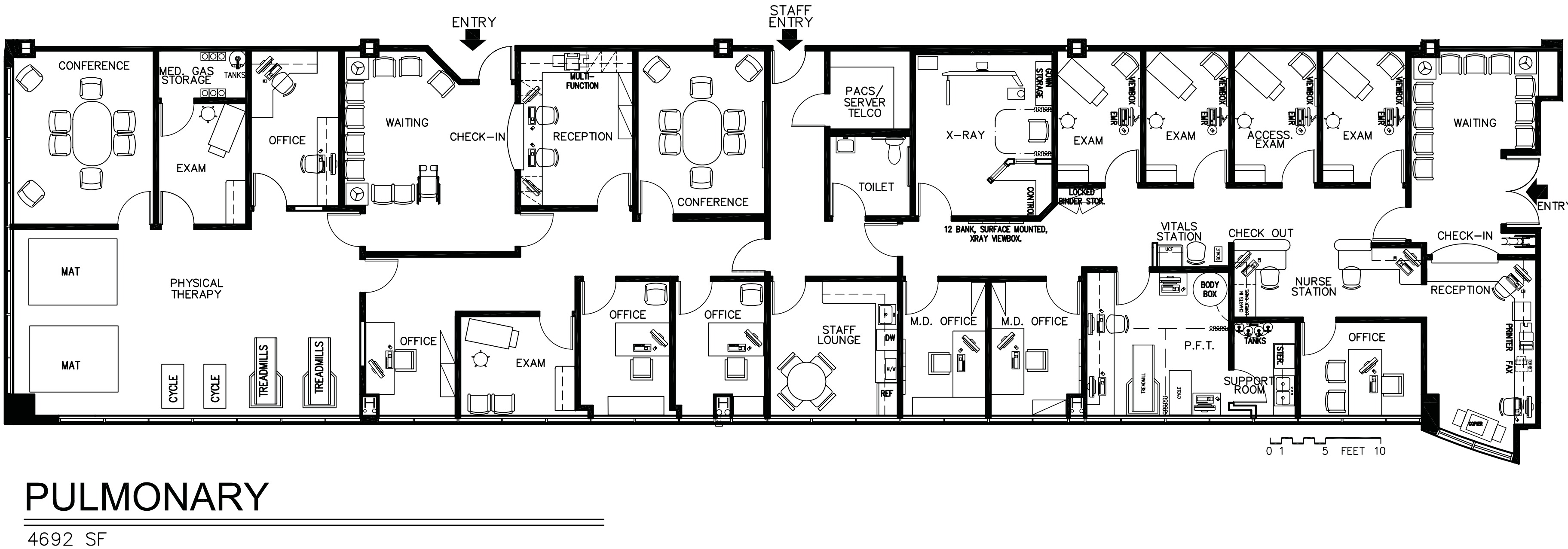


Figure 3-88. Space plan pulmonary suite, 4,692 square feet. *(Design: Jain Malkin Inc.)*

treadmill, previously discussed. The majority of pulmonologists do only diagnostic testing in their offices and then refer the patient to a hospital outpatient facility for inhalation therapy if home treatment is not effective.

Accommodating the equipment included in the PFT lab shown in Figure 3-88 requires considerable space as each patient needs privacy. If no partitions, screens, or curtains exist in the room, then it can only be used for one patient at a time, despite the inventory of equipment and diagnostic instrumentation.

Tech Work Areas

In general, technicians are able to operate multiple types of diagnostic instruments since equipment is so automated it requires little training. Pulmonary function studies, and certainly respiratory therapy, require a trained respiratory therapist or nurse or an aide with PFT training. The volume of patients would determine staffing for ECG, Holter, echocardiography, and pulmonary testing. Techs often have workstations or desks in the room with the equipment so they can monitor the patient while doing desk work. Their work areas need to have space for supplies used in the procedures, a place to store equipment manuals, and a computer and monitor. It is assumed all is digital, which means storage for printed test results and reports is likely not needed.

Physicians' Consults

Physicians are always present or nearby when stress testing is done. Therefore, consultation rooms for the cardiologists and pulmonologists associated with the testing should be adjacent to the test area (see Figure 3-90).

Sigmoidoscopy

Both a general internal medicine physician who does not have a subspecialty in gastroenterology and a family practice physician would likely use a multipurpose procedure room for the occasional need to look at an unprepped colon. The patient would be given a Fleet enema prior to the procedure to empty the lower portion of the colon and this would enable the physician to check for anal fissures, bleeding, or a tear in the sphincter. Patients would be referred to a colon and rectal surgeon if any repair was indicated.

Internists with a subspecialty in gastroenterology (whether in a subspecialty practice or part of a general internal medicine practice) would most likely have a dedicated room for what is called “flex sig” examinations of the lower colon with a flexible sigmoidoscope, a tube with fiber-optic light, an eyepiece at one end, and a tiny camera at the other. The patient is asked to adhere to a liquid diet the day before the procedure, then “prepare” the colon with a Fleet enema for the procedure, usually scheduled the next morning. The patient is not sedated and the procedure causes only mild and momentary discomfort. Therefore, no prep or recovery rooms are required; however, a workroom (8 × 8 feet) opening onto the procedure room is ideal (see Figure 3-5) to provide suitable accommodation for washing and drying the scopes, which are very expensive and delicate and must be handled with care. A toilet room should open onto the flex sig room (see Figure 3-5).

Layout of Procedure Room

A procedure room 10 × 12 feet in size is adequate. In this instance, the scopes are soaked in trays containing glutaraldehyde (a powerful disinfectant) placed on the countertop (see Figure 5-133 and 5-134). Glutaraldehyde has a strong odor that must be exhausted from the room (note air grille running horizontally in the sink backsplash) in Figure 5-135 to the exterior of the building. With adequate ventilation, there is no detectable chemical odor. A tall cabinet contains drying racks for the scopes. Details are covered in the Endoscopy section of this chapter.

The examination table used for a sigmoid procedure is usually larger than a standard exam table and is often motorized to adjust the height and position of the patient. In laying out the exam table and casework in this room, it is important to note that the patient lies on his or her left side with knees bent with the physician working from behind the patient. A nurse usually stands at the patient’s head to help relax the patient and provide reassurance.

Internal Medicine—Summary

A large internal medicine suite (5,000 to 7,000 square feet) will have a sigmoidoscopy room, an ECG room with treadmill, and a lab with its own waiting area, blood draw, and toilet with specimen pass-through. Certain types of X-rays may be done in the office and, if so, an X-ray room with adjoining control and viewing area will be included in the suite (see Figure 3-5). The business office in a suite of this size will be composed of separate rooms for the office manager, insurance personnel, and bookkeeper. A sizable staff lounge should also be included. The reader is referred to Chapter 7 for guidance in designing suites of this size.

Endoscopy

The development of fiber optics has made possible the examination of the colon, the lungs (bronchoscopy), and the upper gastrointestinal tract with an endoscope. This noninvasive instrument has revolutionized surgery, by reducing problems from invasive surgery and helping doctors detect, and in some cases treat, diseases at an early stage. These 4- to 5-foot-long flexible “tubes” have powerful fiber-optic lights and allow viewing through an eyepiece (fiberscope) or, most often, on a separate video monitor (videoscope). Light is transmitted down the tube to enable the internist to examine the colon, for example, in search of tumors or polyps. The procedure is viewed in real time on a video monitor placed on a cart or a ceiling-mounted arm, visible to both patient and physician during the procedure (Figure 3-89). At any point the physician can print a photo to give to the patient or save an image

Figure 3-89. Endocscopy equipment cart. *(Photo: Jain Malkin Inc.)*

to a computer for later use and comparison. The flexible tubes carry electronics to capture the video image, cables that control the flexible tip, and channels through which are passed devices to remove polyps or sample tissue.

Endoscopies would generally not be performed in a physician's office unless it was a large clinic with a specialized suite designed to meet all life safety and accreditation requirements. A medical office building may have an endoscopy center set up as an independent business for the convenience of gastroenterologists in the building. It would most likely be owned by gastroenterologists and, if the center is properly designed and accredited, any qualified physician could have privileges there. Sometimes endoscopies are performed in ambulatory surgery centers in procedure rooms dedicated to this purpose.

Endoscopy on the Rise

In recent years, colon cancer has been given considerable exposure in the news media, greatly increasing the volume of procedures both for flex sig (examining the lower 6 inches of the colon) and for colonoscopy (examining the upper and lower colon with the scope penetrating as far as 6 feet). Because many precancerous polyps occur in the upper colon where they cannot be seen in a flex sig procedure, many now view that procedure with skepticism as it may give a false sense of security. Despite this, because it is a relatively inexpensive screening tool, flex sigs are often performed as part of a comprehensive physical examination for adults.

For all of these reasons, including the aging population demographic, the volume of endoscopy procedures will steadily increase as will the need to design efficient suites.

Components of an Endoscopy Suite

An endoscopy suite would include:

- Procedure room
- Dressing area with lockers for male/female staff
- Dressing area with lockers for patients
- Toilet rooms (patients and staff)
- Workroom (scope processing) between procedure rooms
- Prep and recovery room
- Physicians' dictation/charting
- Reception/administration/waiting
- Family consult room
- Linen storage/drop-off and pickup
- Janitor's closet
- Mechanical room
- Wheelchair storage
- Meds storage with undercounter refrigerator

Procedure Room

The same procedure room can be used by pulmonologists to do bronchoscopies and by gastroenterologists to examine the upper GI tract (esophagus, duodenum, and stomach) and the lower GI tract (colon). As a point of information, endoscopy procedure rooms are not considered sterile.

In a medical office building or a multispecialty ambulatory clinic, one might find a layout of rooms similar to that shown in Figure 3-90. The number of procedure rooms is related to the projected volume of cases (Figure 3-91). Procedure rooms must be large enough to accommodate a Stryker cart or gurney, the endoscopy cart with video monitor, considerable storage for clean linen and supplies, and a resuscitation cart (if not in the room, very nearby) as in Figure 3-92. In Figure 3-93, the crash cart and blanket warmer are in a niche outside the procedure rooms. Hampers for soiled linen and a clock with second hand are also required. The floor should be made of resilient sheet goods with a self-coved base that will withstand cleaning with germicidal agents. Ceilings need to be smooth and able to be cleaned with chemicals. Gypsum board is probably best although certain types of hung ceilings may be used if smooth, without crevices, and are gasketed. The door to the room must be wide enough (48 inches wide) to accommodate gurney traffic. According to the Facilities Guidelines Institute, procedure rooms must be at least 200 square feet, clear space. Rooms need central oxygen and suction, ideally coming from the ceiling. There are typically two monitors on the endoscopy cart, one is video for the procedure and the other for patient information. The patient is given conscious sedation through a vein in his or her arm or hand. The patient may intermittently wake up and watch the procedure, then doze off, but there is no memory of pain or discomfort afterward.

Procedure Room Lighting. Room lighting is darkened during this procedure. Indirect perimeter lighting that can be dimmed, combined with standard 2 × 4 fluorescents overhead when more light is required, would be ideal.

Fluoroscopic Examinations. Fluoroscopy may be used in a large procedure room with a C-arm X-ray to explore bile ducts and the pancreas during an upper GI exam. These organs are accessed through the duodenum with tools that feed through the scope tube into those small ducts where the camera on the end of the scope won't fit. Contrast media are injected into the organ. This is called endoscopic retrograde colangio-pancreatography (ERCP).

Flow

Patients are typically prepped and recovered in the same area. Figure 3-90 shows a prep/recovery area in a medical office building endoscopy center. Patients often remove their clothes and change into a gown with the cubicle curtain closed and their clothes are stored in a basket under the gurney, which then follows the patient into the procedure room, negating the need for dressing rooms. While this is an option, both facilities in Figures 3-90 and 3-91 also have dressing rooms. The gurney is usually used as the procedure table since it can be adjusted in height and saves time in not having to transfer the patient to another table. The nurse sets up the patient in the prep area to be monitored for blood pressure and pulse oximetry and this monitor follows the patient into the procedure room. A monitor that attaches to the gurney is best so that two people (one for the gurney and one for the monitor stand) do not have to transport the patient into the procedure room and back again.

The patient is continually monitored during the procedure and given oxygen as needed. The recovery period is generally 30 minutes, during which time patients are monitored and observed by a nurse. Physicians will often dictate between patients or after several are seen. These procedures are often performed in the morning for the convenience of patients, who are required to fast and not drink water.

Workroom for Cleaning Scopes

This is one of the most important rooms in the suite. All equipment is cleaned and readied for use in this room(s). Supplies are stored here, as are the cleaned scopes (in a separate room), which are typically hung in a long cabinet with glass doors (Figure 3-94). Scopes are very expensive and are handled with great care.

Due to the types of body cavities they enter, flexible endoscopes acquire high levels of microbial contamination. According to the CDC, "more healthcare-associated outbreaks have been linked to contaminated endoscopes than to any other medical device."[13] The problem is that

[13] Guidelines for Disinfection and Sterilization in Healthcare Facilities, 2008, CDC gov; accessed May 25, 2013.

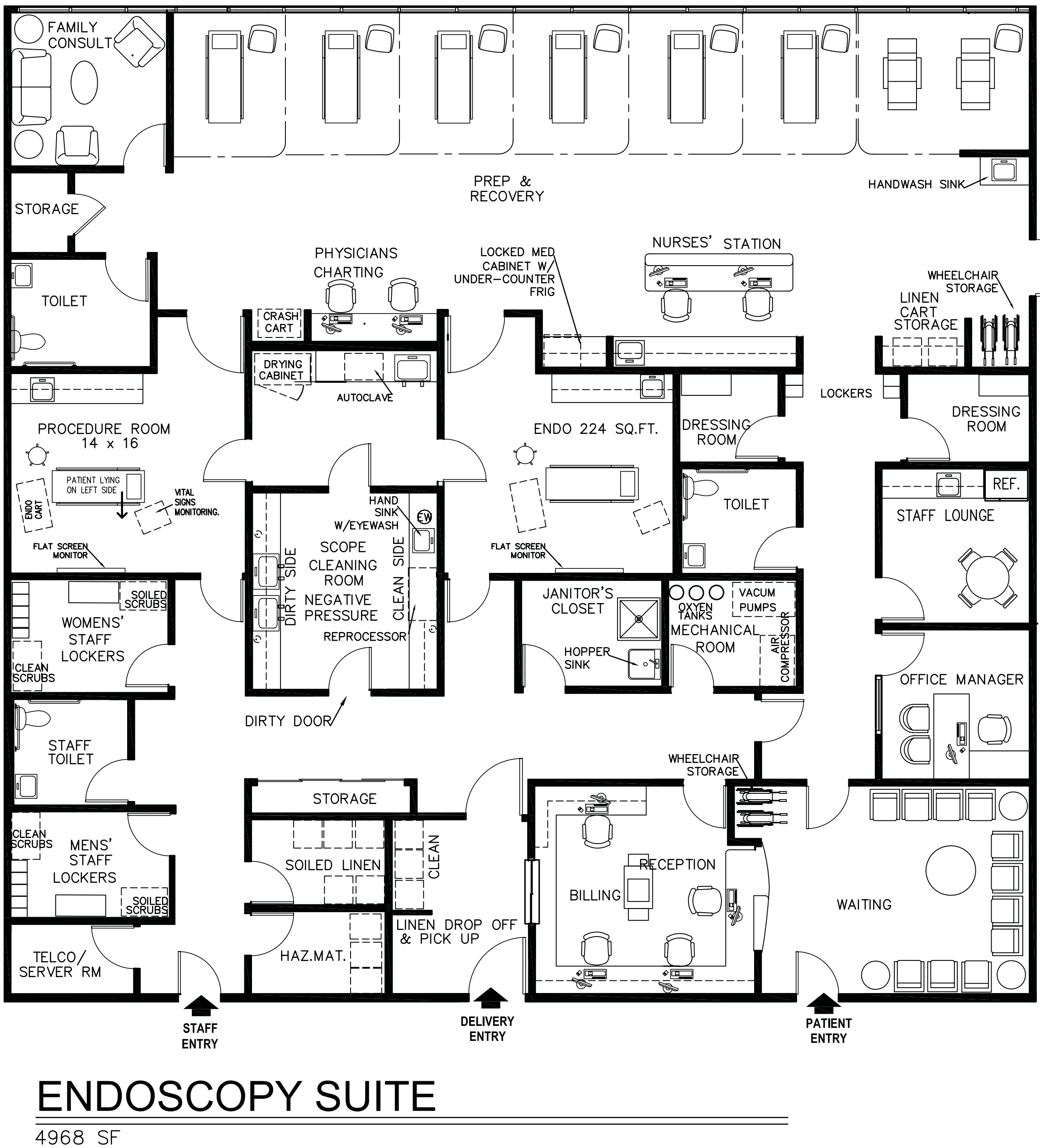
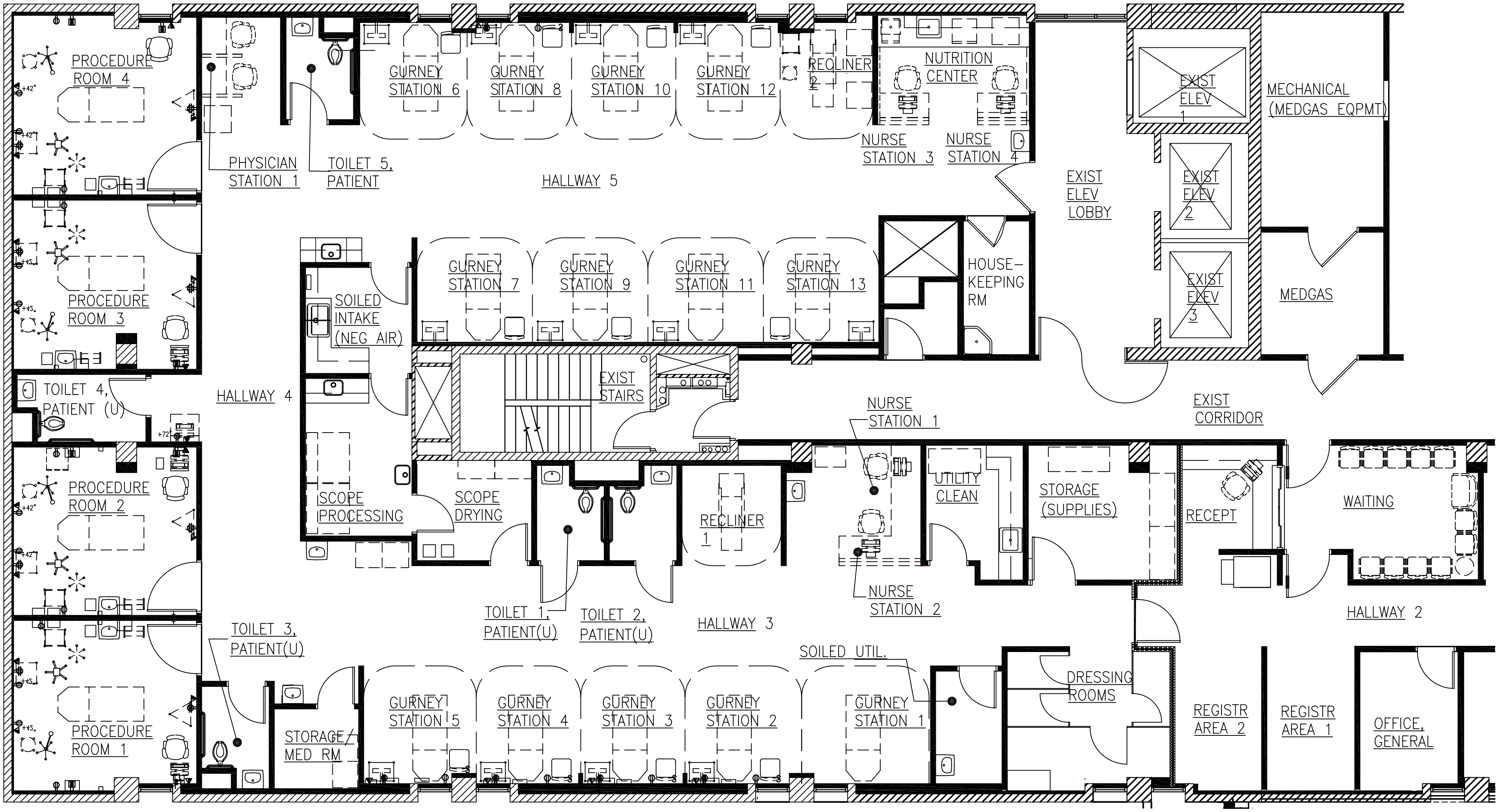


Figure 3-90. Space plan endoscopy suite, 4,968 square feet. *(Design: Jain Malkin Inc.)*



ENDOSCOPY SUITE

8386 SF

Figure 3-91. Space plan endoscopy suite, 8,386 square feet. *(Courtesy of Next Design; Stanford Lee, Honolulu, Hawaii)*

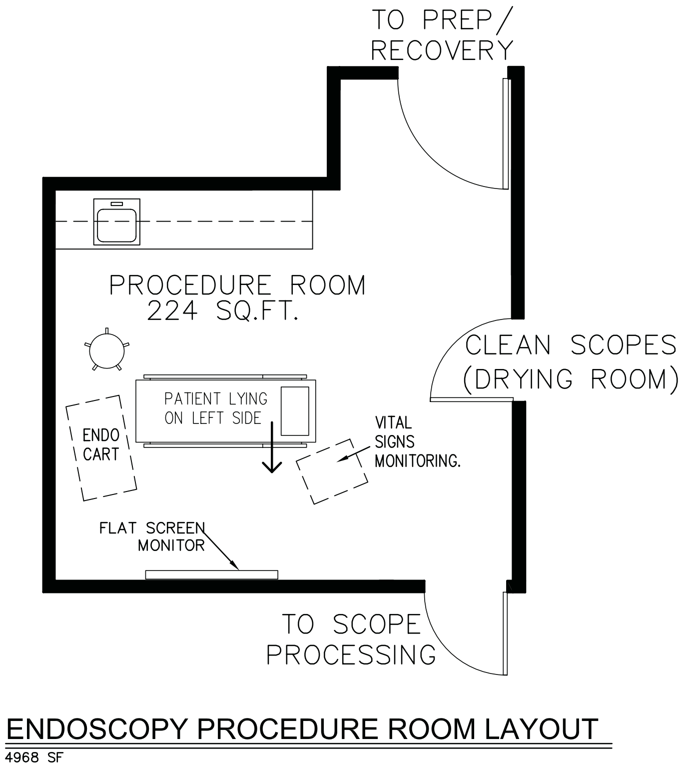


Figure 3-92. Endoscopy procedure room. *(Design: Jain Malkin Inc.)*

Figure 3-93. Resuscitation cart and blanket warmer. *(Photo: Jain Malkin)*

one cannot visually see into the internal channels of the scope after first-stage decontamination and cleaning; gross organic debris can remain. An additional issue is the wear and tear on very delicate and fragile scopes as they are subjected to huge ranges of motion, being bent and twisted, inserted and extracted many times, taking on body fluids, and then being exposed to harsh chemical germicidal agents. In fact, hospitals sometimes contract with a specialized consulting company to periodically inspect their scopes and replace them when needed.

Infection Control Safety Risks A major conference, called The Medical Device Reprocessing Summit, occurred in October 2011, and was hosted jointly by the FDA and the Association for the Advancement of Medical Instrumentation (AAMI) to discuss these issues. A report of the summit proceedings[14] includes articles by experts in the field such as Martha Vockly, who commented "the ECRI Institute put cross-contamination of endoscopes in third place on its 2011 'Top 10 Health Technology Hazards' list." According to the vice-chair of AAMI's Technology Management Council

[14] Martha Vockly: "Probing the Challenges of Endoscopes," (aami.org/publications/summits/2011_reprocessing_summit_publication); accessed July 15, 2013.

Figure 3-94. Fiber-optic scope drying rack. *(Image courtesy of Olympus America, Inc.)*

"endoscopes are now probably the most politically charged devices within an organization,"[15] referring to the fact that healthcare executives are hugely concerned about the risks and liabilities. Other comments from the AAMI report include: "There is a lack of awareness about potential patient safety risks from inadequately processed medical devices." Yet huge growth of these procedures is predicted. Nancy Chobin, the executive director of the Certification Board for Sterile Processing and Distribution (CBSPD.org) attributes much of the problem to the fact that few states have competency exams or certification requirements for the techs who do this type of work. It usually involves low-wage, low-skilled individuals despite the required exacting adherence to protocols and good technique. As but one example, insufficient rinsing as a last step to remove all traces of glutaraldehyde can damage mucous membranes of patients and cause colitis and diarrhea.

The design of the reprocessing room (or rooms) requires a great deal of thought. It is often designed improperly, which means it is not efficiently laid out for those who work there and/or it might compromise infection control. It often does not have enough countertop space for all the bottles of chemicals and supplies. The overarching idea is that the flow for dirty scopes should be separated from clean. When the procedure is finished, bedside cleaning occurs in the procedure room as it is important to immediately submerge the scope in a detergent solution and suction it with a syringe. Dirty scopes are then carried on a cart from the procedure room into the soiled workroom (Figure 3-95) and from there, after a specific process, eventually make their way into the reprocessor machine. Among industry experts in scope reprocessing and operating room nurse managers who oversee these facilities, there seems to be two divergent views about how to plan the scope reprocessing (cleaning/sterilizing) area. It is common at smaller sites perhaps located in medical office buildings (as opposed to hospital-based facilities) to have one room with a dirty side and a clean side and a separate drying room (which is a clean area), as in Figure 3-95. For all the obvious reasons, the technique for cleaning and processing scopes is of utmost importance because, whether used for upper or lower GI examinations, the potential for serious infections is huge.

The idea of the single room actually makes sense when understanding that, after the initial decontamination cleaning with brushes (inserted into the channel of the tubes), the tech needs to be able to turn around and place

[15] Ibid

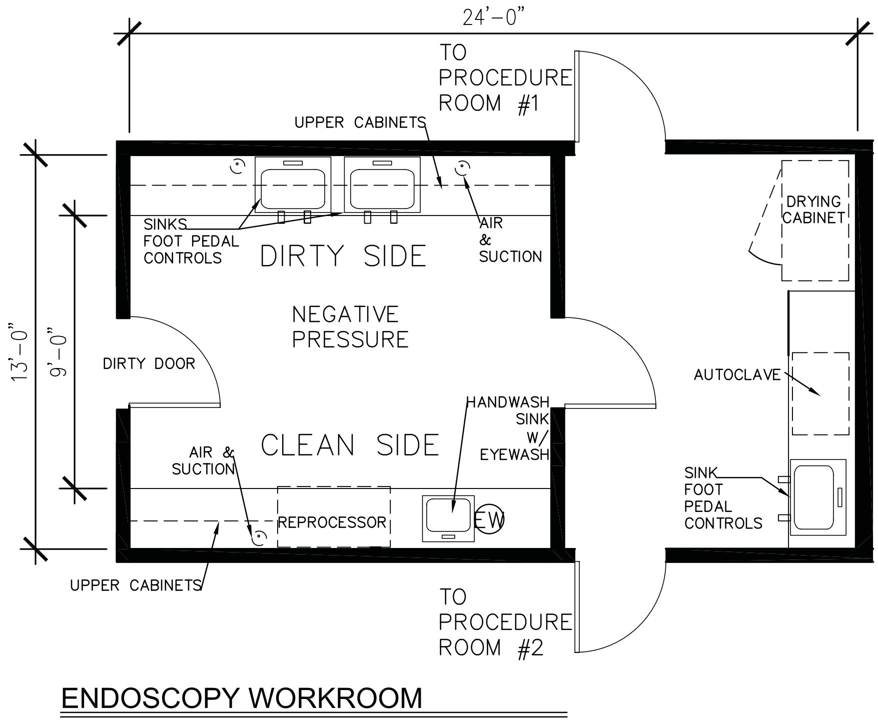


Figure 3-95. Endoscopy workroom. *(Design: Jain Malkin Inc.)*

Figure 3-96. MEDIVATORS® Advantage Plus endoscope reprocessing system. *(Medivators, a Cantel Medical Company)*

it into the reprocessor without having to touch doors or walk with a dripping scope.

The large endoscopy facility in Figure 3-91 is hospital-based (under the hospital's license) but located in a medical office building on campus. In this plan, there is total separation of soiled intake, scope processing, and scope drying with three separate rooms, each with a door and negative air pressure in the soiled intake room.

It is possible to follow a totally manual process for the cleaning of scopes, and that is how some facilities may still do it, but most now use an automated reprocessor, which has many quality assurance features built into the equipment such as channel blockage monitoring, which provides feedback throughout the cleaning cycle. It does digital leak testing and, after bedside cleaning, according to the FDA, the manual cleaning first step (see below) can actually be eliminated.

The endoscopy tech starts by precleaning and leak-testing the scope after each procedure (this is always done manually), then puts the scope in an AER (automated endoscope reprocessor). This machine may be a floor model (Figure 3-96) or a countertop model (Figure 3-97) depending upon volume. After the scopes are brushed and washed, compressed air is used to make sure all debris is out of the scope. Somewhere in the suite there needs to be deep cabinets for storing disposables, room for the scope transport cases (these look like hard-shell briefcases), and shelves for large binders for storing the forceps used in biopsies. Each forceps is specific to each size scope, and these are often color-coded by the staff into binders for easy retrieval. Alternatively, they may be stored in sealed clear plastic sleeves in Plexiglas wall racks in the procedure room (see left side of photo Figure 3-89).

The workroom is a busy area packed with instruments, sterilization equipment, bottles of solutions, racks, and

Figure 3-97. MEDIVATORS® CER Optima automated endoscope reprocessor. *(Medivators, a Cantel Medical Company)*

more. It can easily become cluttered and therefore the room should not be undersized (Figure 3-98a). A room 10 × 17 feet is the minimum functional size.

Infection Control Issues. Endoscopic procedure rooms are clean, but not sterile. GI scopes are cleaned with liquid chemical germicide (LCG) using a very specific procedure, which can be facilitated or impeded by the layout of the room, the height of the sink, and the locations of air and suction. Scopes used for bronchoscopies are usually cleaned by sterile technique. Proper reprocessing of endoscopes cannot and should not be underestimated as this enhances and contributes to patient safety. Attention to reprocessing equipment, procedures, and facility design can have enormous economic benefits or drawbacks.

Cleaning Process—Overview. Scopes must be reprocessed with a protocol developed by the scope's

Figure 3-98a. Endoscopy scope workroom. *(Photo: Jain Malkin)*

manufacturer, LCG manufacturer, AER manufacturer, appropriate professional organizations such as SGNA (Society of Gastroenterology Nurses and Associates, Inc.) and AORN (Association of periOperative Registered Nurses), and all appropriate regulatory bodies as well as following the CDC guidelines for infection control. Scopes

Figure 3-98b. Vital signs cart on wheels. *(Photo: Jain Malkin)*

are always precleaned by drawing water and detergent into them, soaking, washing, scrubbing, and inserting a cleaning brush through the channels as part of the process. They are leak-tested in the sink. At this point they can be high-level disinfected by manually soaking in trays containing glutaraldehyde or in an automated endoscope reprocessor. In the manual process scopes are rinsed off after soaking, then taken to the "clean side" to blow out with compressed air, and hung in a cabinet to dry. This is often how scopes are cleaned in ENT offices, urology, and other physician practices in which the expense of an automated reprocessor may be a deterrent (see Figure 5-133 and 5-134 for countertop soak trays in a urology office).

Liquid chemical germicides recently introduced into the market have reduced soak times in the AER to as low as 5 minutes (from previous lows of 20 minutes). Ten air exchanges per hour or a filter device to limit vapor exposure are usually recommended when using glutaraldehyde and other LCGs. Although neutralization is seldom required the LCG can usually be neutralized in a 5-gallon carboy and then dumped down the drain (a floor drain facilitates the process). AERs include detergent, disinfectant, filtered water, air, and alcohol treatment cycles. They are designed to minimize chemical vapors and exposure and ensure a uniformly reprocessed instrument. Each AER usually requires a ½-inch water line with an accessible shutoff valve capable of providing 2 to 4 gallons of flow per minute, potable cold or hot water, a floor drain, and typically 120 volts ac (alternating current) with a 20-ampere line (fused and dedicated circuit). Suction and air connections are not required. The machines have internal air compressors that inject air through the endoscope channels. The countertop model in Figure 3-97 is designed for facilities that process more than 100 scopes per month, whereas the dual-basin floor model in Figure 3-96 is intended for higher volume.

Biopsy forceps and endotherapy devices introduced down the scope channels are of the one-time disposable or reusable type. The reprocessing protocol involves immersion in detergent, ultrasonic cleaning, rinsing and lubrication, followed by steam sterilization in an autoclave.

Glutaraldehyde Ventilation Strategies. Glutaraldehyde is used for cold sterilization and high-level disinfection of medical instruments. It is used in soak trays for manual disinfection of scopes and may also be used in AERs. Although not proven to be a carcinogenic agent it is an

irritant that can be absorbed by inhalation, by ingestion, and through the skin. It has a strong odor and requires specific ventilation measures including:

- 10 air exchanges per hour
- A room large enough to ensure adequate dilution of vapors
- Exhaust vents located at the source of the vapor discharge
- Additional exhaust vents at floor level (glutaraldehyde vapors are heavier than air and this pulls the vapors down away from the breathing zone)
- Fresh air supply at ceiling across from (opposite) exhaust vents
- Elimination of cross-draft effects
- Consideration of outside air intakes, windows, or other openings to prevent reentry of discharged vapor or exposure to other occupancies—this air must not be recirculated
- Employing scope cleaning procedures and taking air samples to monitor vapor levels at completion of construction
- Routine maintenance and surveillance[16]

Layout of Workroom. The room should have a dirty side and a clean side. This may be two parallel work counters or a U-shaped configuration but be mindful of the path from the procedure rooms with dirty scopes and the path out of the processing room with clean scopes removed from the AER headed for the drying cabinet (which should be located far from the decontamination area). In Figure 3-90, dirty scopes are carried out of the doors on the south wall and enter the decontamination area by the door marked "dirty." After they are removed from the reprocessor the clean scopes are moved into the clean room with the drying cabinet. When clean scopes are needed they are brought into the procedure rooms through the side doors that are only used for carrying clean scopes into the rooms. Attention to changing gowns, gloves, and bonnet before walking into the drying room is important.

Dirty Side. The soiled workroom (or dirty side) requires two sinks set into countertops, one for each procedure room, with countertop space in-between if space permits. The sinks need to be deep and should be *lower* than the standard 34-inch-high countertop. For most people a 30-inch height is fine. As the scopes are long and require quite a bit of handling to properly clean, the lowered sink is more comfortable and functional.

The deep, large sink at 30-inch height would have a countertop space on the right and left. The dirty scope would be laid down on the left, held in the sink to be manually washed with brushes, then placed in the automatic disinfector reprocessor or soaked in trays to the right of the sink. Suction should be placed on the right side of the sink. The autoclave can be placed on the clean or dirty side. After the scopes are disinfected they are rinsed off, flushed with 70 percent alcohol, then carried to the countertop on the clean side to blow out with forced air and hung to dry. Even with the automatic reprocessor scopes need to be hung in a drying cabinet. Locate a rack for gloves near the sink.

Clean Side. The sink should be on the right side with most of the countertop on the left, although this depends upon the layout of the room and the position of the AER. Alcohol is used in the final stage of reprocessing. It is induced into the channels of the scope by syringe to dry any remaining water. Then the channels must be purged by air. Compressed air is needed on the right side of the sink. The air compressor fits under the sink. Bacteria grow quickly in damp, dark places. Therefore, air is used to blow dry all of the channels, and scopes must be hung in a tall cabinet so they can be fully extended whether manual or automatic reprocessing (see Figure 3-94). This side also needs a rack for gloves near the sink.

[16]The above recommendations are from *The Safe and Effective Handling of Glutaraldehyde Solutions*, SGNA Monograph Series, copyright © 1996 Society of Gastroenterology Nurses and Associates, Inc., Chicago.

Hopper. A flush hopper is needed for emptying bodily fluids from the suction canister at the end of each day. For good infection control, it should be located in a soiled utility room or in a janitor's closet as in Figure 3-92 and not in the scope processing room (see Figure 3-98a) due to aerosol contamination.

Miscellaneous Considerations. City water needs to be filtered, it's too contaminated. Along with automatic reprocessor machines, leave space for an external prefiltration system. Foot-pedal control for water at both sinks is ideal, but it must be a high-quality unit that has good temperature control and provides adequate flow.

Storage. Provide adequate storage in the workroom for boxes of gloves, masks, and disposable gowns (which provide a better barrier than linen). Storage for many gallon bottles of solutions must be accommodated.

Regulatory Agencies. Endoscopy facilities are state licensed, require Medicare certification, and are usually accredited by JCAHO or AAAHC (see Chapter 14).

Finishes. Ceilings have to be smooth and able to be cleaned with germicidal agents. Flooring for procedure rooms must be made of resilient sheet goods that can be coved up the wall for base and must be durable enough to withstand harsh chemicals used to clean it. It should also not be slippery when wet.

Prep and Recovery Room

The prep and recovery room is standard in all respects, with oxygen and suction at each bed and privacy curtains separating each patient. Recovery time is normally half an hour, and recovering patients should be in view of nursing staff. Each bed will have a vital signs monitor. At intake, the nurse will likely use a computer on wheels (Figure 3-98b). Allow three beds per procedure room: one for prepping a patient, one for the patient in the procedure room, and the third for recovery. A couple of recliner chairs may be provided for patients who need a bit more recovery time in order to free up the beds to keep the flow moving. In the facility in Figure 3-90, this means eight beds/chairs for two procedure rooms. A sink is needed for every four bed stations per the Facilities Guidelines.

Interior Design

The interior design of an internal medicine suite should be tailored to the functional needs of the patient population. If the internist is a cardiologist or a pulmonologist, for example, those patients for the most part may be elderly. Therefore, a conservative color palette and furnishings might be appropriate. An oncologist, on the other hand, would have a broad age range of patients and a more upbeat design might be in order. A more important consideration is the socioeconomic level of the patients served; the design should be tuned to their expectations and comfort.

PEDIATRICS

A pediatrician treats children from birth through adolescence (age 18). The office visits are frequent and of relatively short duration in the exam room but may involve a protracted period in the waiting room. This is a high-volume specialty and the practice is almost always composed of two or more physicians. It is rare to find more than three pediatricians working in the same office, although a busy practice may staff a second or third office. Figure 3-99 is a schematic diagram of a pediatric suite.

Waiting Room

Waiting rooms must be larger than for other specialties as parents often bring all their children and sometimes a grandparent when one child has to visit the doctor. Pediatric offices often have a *sick-baby*, or contagious, waiting room and a *well-baby* waiting room (see Figure 3-100). The reason for this is to limit contagion. Since physicians do not make house calls, children with infectious diseases are brought into the office, where well children who are waiting for a routine checkup or an injection are vulnerable to contracting them.

If space is limited, a sick-baby waiting room can be devised by direct entry into an exam room (Figure 3-101). One exam room would have a door to the outside

Table 3-3.
Analysis of Program
Pediatrics

No. of Physicians:		2		3
Business Office		16 × 20 = 320		16 × 20 = 320
Exam Rooms[a]	6 @	10 × 10 = 600	9 @	10 × 10 = 900
Adolescent Exam		10 × 12 = 120		10 × 12 = 96
Minor Surgery		12 × 12 = 144		12 × 12 = 144
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Private Office (shared)		12 × 12 = 144		12 × 16 = 192
Nurse Station & Shots		12 × 18 = 216		12 × 18 = 216
Staff Lounge		10 × 12 = 120		10 × 12 = 120
Waiting Room/Sick		14 × 16 = 224		16 × 16 = 256
Well Waiting		18 × 20 = 360		20 × 26 = 520
Storage		8 × 8 = 64		8 × 8 = 64
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		2,476 SF		3,056 SF
20% Circulation		495		611
Total		2,971 SF		3,667 SF

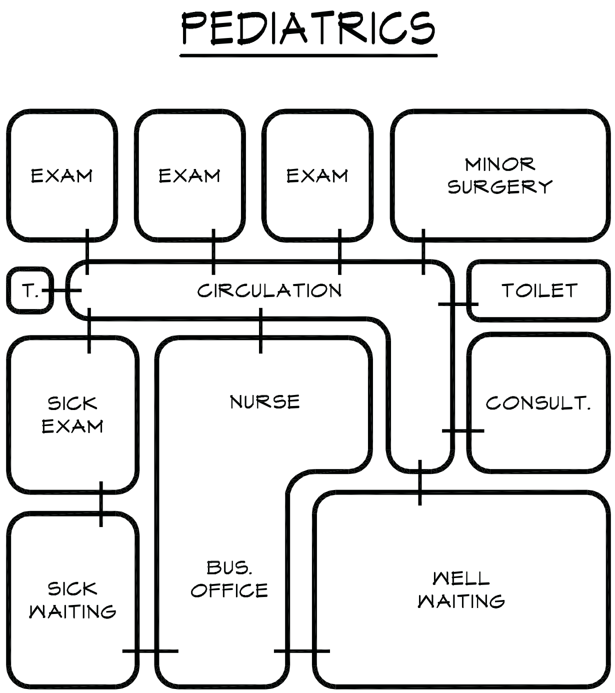


Figure 3-99. Schematic diagram of a pediatric suite.

or building corridor, as the case may be, and would have a buzzer or bell to summon the nurse for entry. The nurse would tell the mother, over the phone, to come to that door and buzz. The door would be marked *Contagious Entrance*. The sick-baby exam should be near a toilet and the room must have a sink.

If the suite is large enough to have a contagious waiting room, one exam room in close proximity to the waiting room may be designated as a sick-baby exam room with a sink cabinet and a toilet nearby. The other exam rooms should be clustered around the nurse station (see Figure 3-100).

In this specialty it is a good idea to have a toilet accessible from the waiting room so that parents can change diapers in advance of entering the exam room and the staff is not continually interrupted in order to direct children to the bathroom (Figure 3-102). The bathroom should have a sink countertop large enough to change diapers on, a shelf for disposable diapers, talcum and paper towels, and a large trash receptacle. An amenity is a wall-mounted, drop-down baby changing station (Figure 3-103). A wall-mounted seat keeps toddlers secure while a parent uses the restroom (Figure 3-104). A compactor for dirty diapers, purchased at a baby store, would be useful.

Doctors disagree on the practicality of having a child's-height drinking fountain in the waiting room. If the room is not well supervised, it can lead to mayhem.

The waiting room should contain some tables or flat areas within the seating where parents can put down an infant in a carrier without occupying an adult's seat. A pediatric waiting room may be as large as space and budget permit. Each patient is often accompanied by one to three persons. Children can get pretty rowdy playing in a pediatrician's waiting room, so an effort should be made to

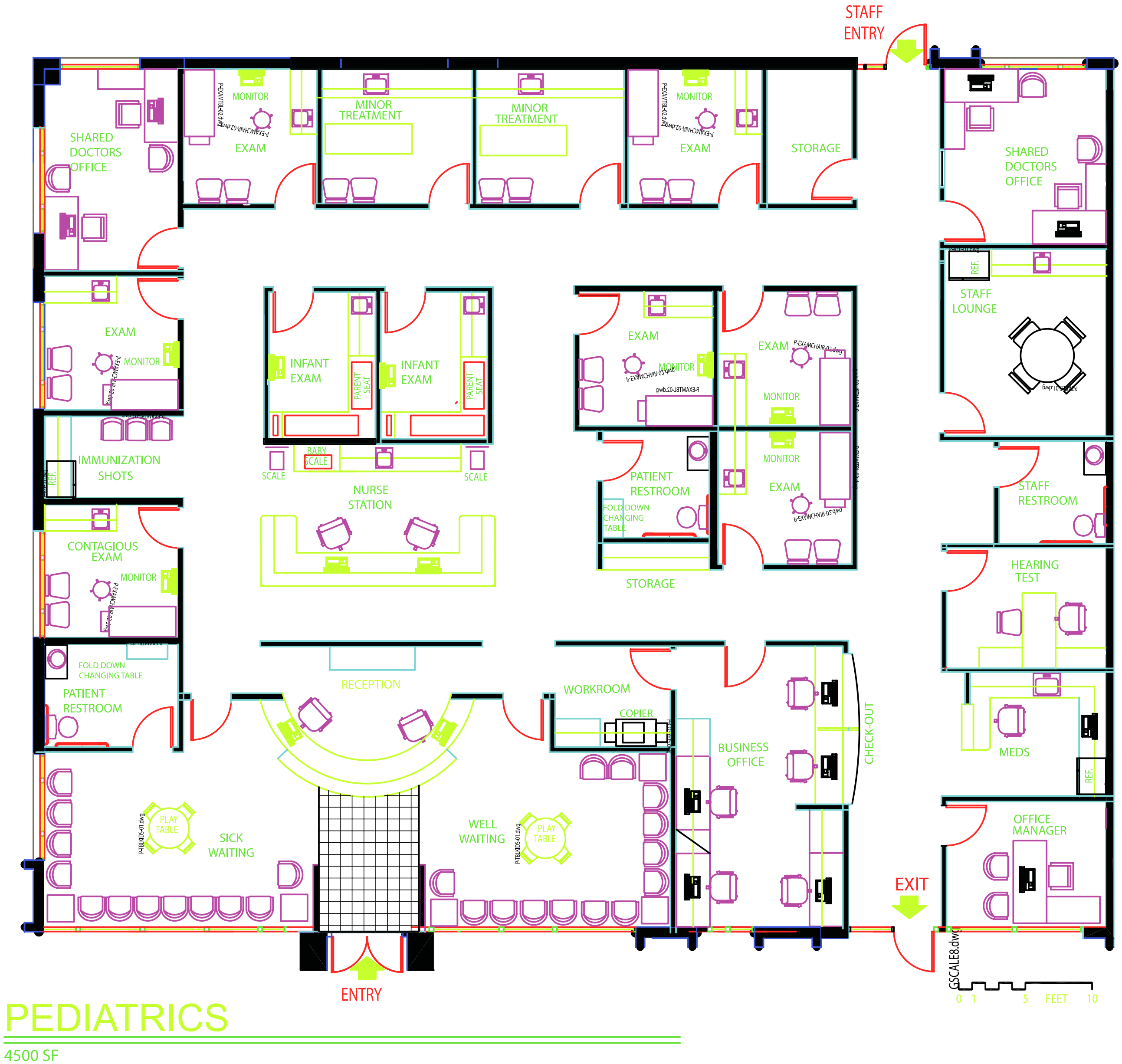
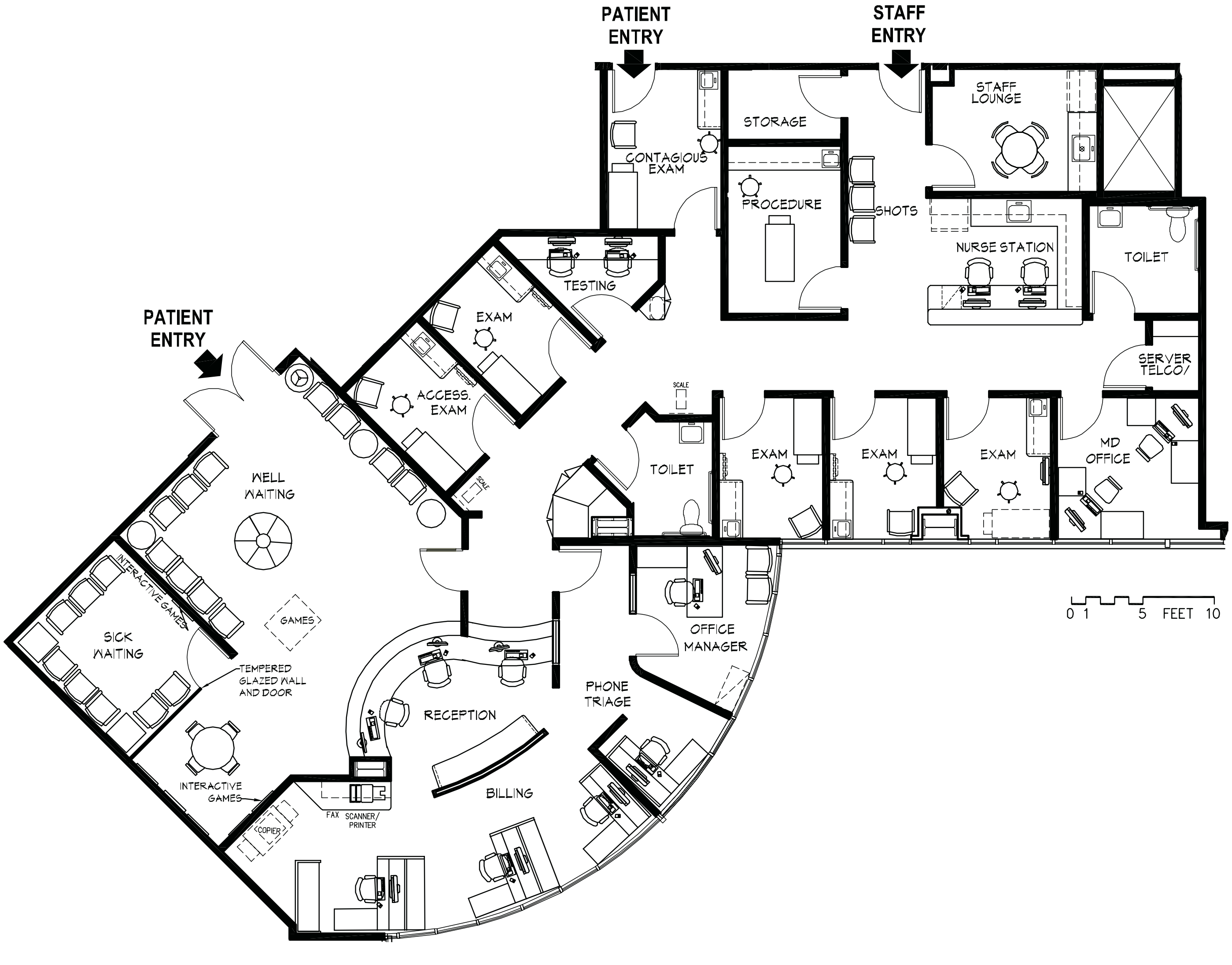


Figure 3-100. Space plan pediatric suite, 4,500 square feet. *(Design: Jain Malkin Inc.)*



PEDIATRICS

2800 SF

Figure 3-101. Space plan pediatric suite, 2,800 square feet. *(Design: Jain Malkin Inc.)*

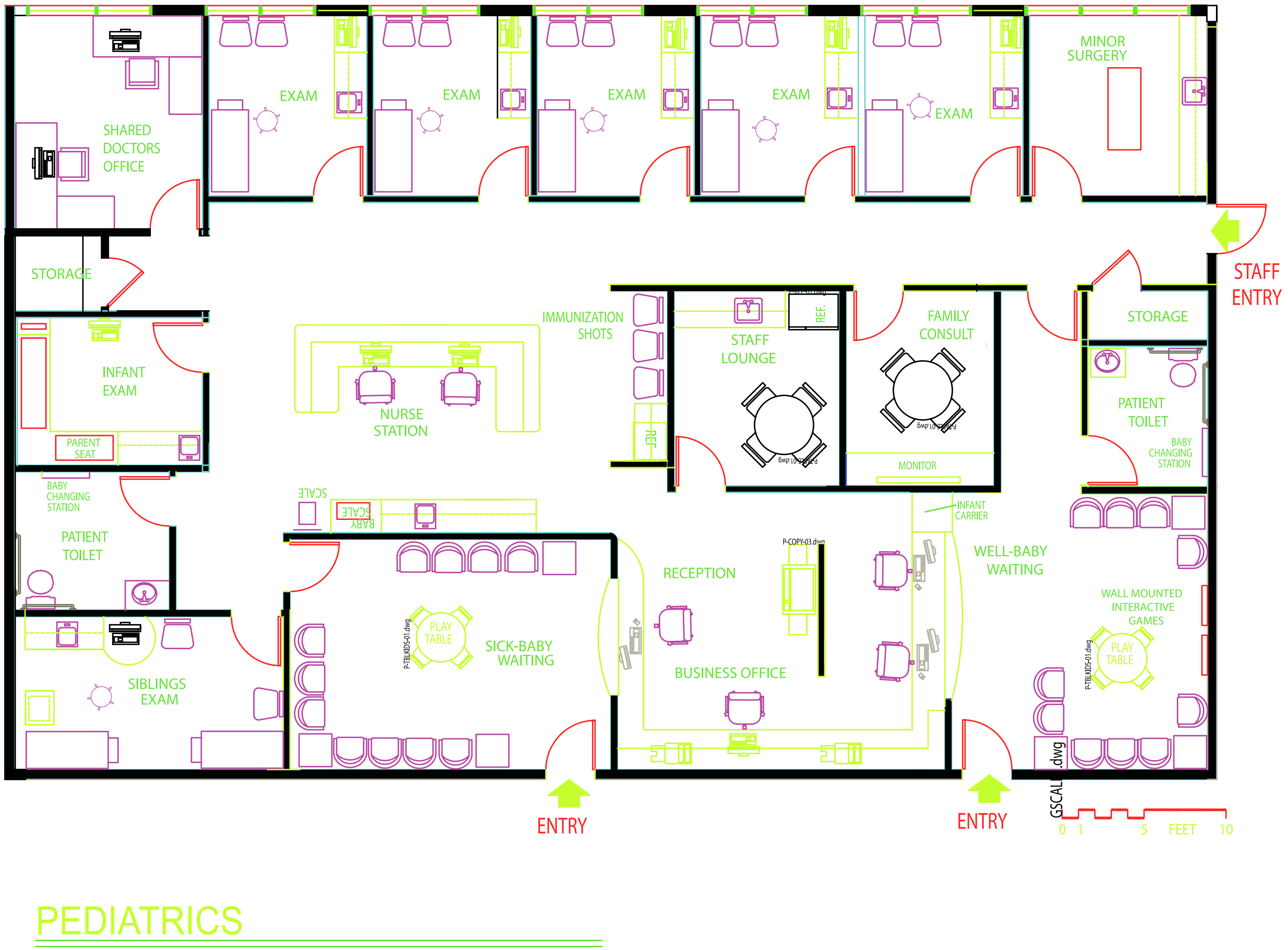


Figure 3-102. Space plan pediatric suite, 3,320 square feet. *(Design: Jain Malkin Inc.)*

Figure 3-103. Fold-down baby changing station. *(Photo courtesy of Koala Corporation, Denver, Colorado)*

Figure 3-104. Toddler seat. *(Photo courtesy of Koala Corporation, Denver, Colorado)*

Figure 3-105. Pediatric waiting room with train set to entertain children. *(Architecture and Interior Design: Hawley Peterson Snyder; Photographs by David Wakely)*

occupy them with something unique. Their pent-up energy can be released while "driving" a fire truck (see Figure 3-34) or riding "Nessie" (see Figure 3-35). Custom play furniture must be designed to eliminate sharp corners and edges against which a toddler may fall and become injured. The train set in Figure 3-105 will have appeal for all ages.

The waiting room should also contain bins for toys and racks for magazines at a height accessible to children. Pediatricians disagree in their choice of toys for this room. Some pediatricians feel that toys spread infection (drooling on toys, fingers in mouth, and so forth) and will limit the type of amusements they condone. Others seem to be more relaxed and iconoclastic (many do not wear white

coats for fear of frightening children) and feel that germs are everywhere and inevitable. If a child is not exposed to germs in the office, he or she will surely be exposed to infection from playmates. Refer to Chapter 4, Adelante Healthcare (pediatric waiting area) for examples of interactive educational pediatric art and also games and fun things to climb on.

In a pediatric waiting room one may break the rule about providing individual chairs. One may take liberties in furnishings here since it is a homogeneous population—mostly parents from the same community, approximately the same age, and sharing a common interest—their children. Thus, parents do not seem to mind sitting next to each other in continuous (common seat and back) seating, which saves space and accommodates a maximum number of people in a small waiting room. Whatever the type of seating provided, one may wish to provide a few standard-height chairs with arms, for pregnant women, who often find it difficult to get out of low, lounge-type seating.

A clever wall-mounted unit by People Friendly Places, Inc., keeps toddlers engaged (see Figure 3-33), while a puppet theater appeals to somewhat older kids (Figure 3-106). Custom-designed educational and interactive art can be created as in Figures 4-26a and b and 4-33. Colorful wall murals based on children's art would be appropriate for a young patient population (Figure 3-107). A unique destination treatment, with celestial theme, cues wayfinding (Figure 3-108) in a large outpatient setting. There is no end to the fanciful design ideas that can be implemented in a pediatric office. In the Victor Yacktman outpatient pediatric facility, (Figures 3-108 and 3-109), public areas feature photos of physicians wearing odd hats and making funny faces. The reader is referred to Chapter 11 for additional information on furnishings and interior finish specifications.

Figure 3-106. Puppet theater in waiting room keeps children occupied. *(Design: Jain Malkin Inc.; Photographer: Jain Malkin)*

Examination Rooms

Number of Exam Rooms. Each pediatrician should have a minimum of three exam rooms but four is better. It is important to plan for growth. A pediatric practice grows rapidly and before long, a two-physician practice with five or six exam rooms will be able to use eight. Thus, the designer should guide the client at the outset to lease a large enough space. Since examinations are short, the physician can quickly move on to the next patient while the mother is dressing the child and the nurse cleaning up the exam room.

It is a good idea to make one exam room large enough to accommodate an infant exam table and a child's table since it is more efficient to examine two siblings in the same room (see Figure 3-102).

Figure 3-107. Children's art makes wonderful wallgraphics. *(Design: Jain Malkin Inc.; Photographer: John Waggaman)*

Figure 3-108. Destination treatment, Victor Yacktman Children's Pavilion, Park Ridge, Ilinois. *(Architecture and Interior Design: Watkins Hamilton Ross Architects, Inc., Houston, Texas; Photographer: Jud Haggard)*

Adolescent Patients. Most pediatric practices (particularly true with older physicians who have been in practice a number of years) must accommodate a number of adolescent patients. A standard-sized adult exam room (8 × 12 or 10 × 12 feet) should be provided with a standard-sized pelvic exam table and decor suitable to a teenager. Care must be taken in the interior design of the office not to gear it too much to infants and toddlers, as it may offend older patients who are sensitive about being considered children. Rooms designed to accommodate older children should have a floor scale. Since children may be shy or modest about being weighed at the nurse station it is best to have a scale in the exam room. The family-centered exam room in Figure 3-109 allows a sick child to lie down close to the parent and also works for two parents and a child or one parent and two or three children.

Location of Sinks. Some physicians consider it unnecessary to have a sink in every exam room, if a sink is available nearby in the corridor. However, it is more efficient to have a sink in each exam room, since children may vomit or urinate during an examination and having a sink in the room saves time by eliminating the need to leave the room in order to clean it up or wash hands. Today, with extreme

Figure 3-109. Pediatric examination room with built-in seat for parent and child, Victor Yacktman Children's Pavilion, Park Ridge, Illinois. *(Architecture and Interior Design: Watkins Hamilton Ross Architects, Inc., Houston, Texas; Photographer: Jud Haggard)*

concern about infection control, a sink in the exam room seems mandatory.

Size of Rooms. Pediatric exam rooms may be small, particularly a dedicated infant room. They need not have a door that opens to shield the patient. In fact, exam rooms may be so small that a pocket door is the most practical solution. An infant room may be no more than 8 × 8 feet. For a standard (noninfant) exam room, 10 × 10 feet is a good size. A guest chair for the parent should be included and a small desk for the doctor that may be used for a computer and monitor if charting is electronic. The monitor may also hang on an adjustable wall-mount track. The rooms in some of these space plans may seem small but pediatricians sometimes prefer to make the exam rooms small in order to squeeze in an extra room.

Exam Tables. Pediatric exam tables are available as manufactured items (Figures 3-110, 3-111, and 3-112a), but may be custom-built with storage underneath (Figure 3-112b). The table must also have a paper roll holder inside the cabinet with a slot in the tabletop so that a continuous roll of paper can be pulled over the vinyl-covered exam table pad and quickly changed between patients.

The size is 2 × 4 feet for an infant table (this increases to 6 feet if a lowered portion for a baby scale is included)

Figure 3-110. Zebra pediatric examination table. *(Photo courtesy of Good Time Medical, Chicago, Illinois)*

Figure 3-111. Pediatric exam table with built-in measuring device and space for infant scale. *(Photo courtesy of Good Time Medical, Chicago, Illinois)*

Figure 3-112a. Pediatric exam room. Child climbs stairs at foot end of fire truck to reach the tabletop. Exam table by Good Time Medical, Chicago, Illinois. *(Design: Jain Malkin Inc.; Photographer: Jain Malkin)*

Figure 3-112b. Infant exam room with custom-built exam table with lowered section to accommodate infant scale. *(Design: Jain Malkin Inc.; Photographer: Michael Denny)*

or 2 × 6 feet for a child's table. The table is always placed against a wall to minimize the hazard of a child falling off. It should be positioned so that the doctor can examine from the right side of the patient unless the doctor is left-handed and examines with the left hand. It is better, however, to reserve this lowered portion of the sink cabinet for a doctor's writing desk. The infant/pediatric exam table in Figure 3-113 has a digital scale.

Any storage that is accessible to children in an exam room should be secured. Otherwise, they will empty the cabinets or possibly catch their fingers in the doors or drawers.

Some method by which to measure an infant's length may be incorporated into the exam table. The length of the table on one side can be routed with a slot for a yardstick and a sliding wooden arm may be pushed up to the baby's feet to hold the child steady and, at the same time, indicate on the tape the child's length. A table that weighs and measures infants is sometimes located in the nurse station.

Interior Design. Exam rooms may be whimsically decorated with one or two walls of colorful patterned

Figure 3-113. Pediatric examination table with digital scale. *(Photo courtesy of Midmark Corporation, Versailles, Ohio)*

wallcovering or art placed at a height where children can notice it. Pediatric exam rooms should never be carpeted. Sheet vinyl is recommended. Wallcovering even catches the attention of infants and serves to distract them, thus making the doctor's examination that much easier. In Figure 4-28 a mural with a great deal of detail created by an artist serves several functions. This is a "talking" room (discussed under the Family Practice section of this chapter) and the art allows children from toddlers to probably age 8 to be distracted by looking at it or by being asked to find something as in "Where's Waldo?" Pictorial art images with a lot of detail (items to identify, count, or name the color) can be used by nurses and child life specialists to gauge the developmental status of a young child. Whatever art is selected, it should be placed on the long wall behind the exam table so that babies can see it while lying down.

Nurse Station

Pediatric suites require large nurse stations because nurses administer many injections. After an injection a patient must be observed for 15 to 20 minutes in order to note any negative reaction to the drug. A few chairs or a bench must be provided in the corridor adjacent to the nurse station (see Figure 3-102). The nurse can attend to other business but still keep a watchful eye on the patient. A full-size refrigerator must be accommodated in the nurse station. Pediatricians who administer allergy shots should have a nurse station located near the front of the suite so that patients coming just for injections can enter and leave without adding to the congestion in the examination area of the suite. The nurse station should have a knee space area with telephone, space for a microscope, and a double sink.

Business Office

The pediatric business office should have a reception window facing both the sick and the well waiting rooms (see Figure 3-102). The appointment/cashier counter needs to have a wide shelf or a secure niche in the wall where a parent may put an infant in a carrier while he or she is making a payment or chatting with the staff (see Figure 3-102).

A busy practice with perhaps three physicians seeing patients simultaneously benefits greatly from a separation of incoming and outgoing traffic. The suite in Figure 3-100 is designed for patients to enter through one door and leave through another, without exiting through the waiting room. This greatly enhances productivity and reduces crowding. Note that both the reception and the checkout

counters are wide to accommodate a number of transactions simultaneously.

Consultation Room

Pediatricians spend little time in a consultation room and seldom see patients there. Therefore, it is not uncommon for two physicians to share a private office. Generally, it is used for medical reference books and for returning phone calls. Pediatricians dispense a lot of literature and pamphlets on child care so a wall rack should be provided for the organized storage of these materials either at the nurse station or in the corridor adjacent to exam rooms.

Vision Screening

One corridor should be selected for a 20-foot refraction lane. An eye chart would be affixed to a door or placed on the wall at the end of the corridor for a brief eye test. A circle inset into the carpet can mark where the child's heels should be placed to ensure a distance of 20 feet. An alternative to this is an automated refractor that sits on a 2 × 4–foot table with the patient on one side and the aide or tech on the other or a handheld automated refractor, which is even quicker. A small room may be set aside for testing as in Figure 3-101.

Hearing Test Room

Some pediatricians like to do a preliminary hearing test to screen patients who need to be referred to an ENT specialist. Sometimes this can be set up in a dual-purpose room. The hearing test can be performed in a multipurpose consulting room or in a small 8 × 8–foot room dedicated to that purpose. One needs a table 24 × 48 inches on which to place the equipment, a chair for the patient and parent, and one for the technician. Walls of the room must have sound insulation and inside the room, walls may be covered with a wall carpet to provide further sound attenuation. The room should be located at the rear of the suite away from the hectic front office (see Figure 3-100).

Storage

The office needs a small storage room, 8 × 8 feet, for drug samples, disposable supplies, office forms and stationery, and handout pamphlets.

Interior Design

The suite should be colorful and imaginatively designed to reduce the children's anxiety and make them forget any negative associations they may have had about visiting the doctor. All rooms except exam rooms may be carpeted. Corridors may have colorful graphics or art.

URGENT CARE CENTERS

Urgent care centers are big business, with numerous proprietary companies specializing in this facility type and fulfilling a need for unscheduled primary care that would otherwise find its way into hospital emergency departments. Treating everything from broken limbs to influenza, workers' comp industrial accidents, asthma, cardiac arrhythmia, infusion for dehydration, or antibiotics, these facilities are feeders to local hospitals, which make them appealing to both not-for-profit and proprietary healthcare organizations alike. A hospital can "plant its flag" in a competitor's market and by so doing capture patient referrals for surgery, diagnostic imaging studies, and extended lab work that goes beyond the capabilities of the urgent care center. Patients find these facilities convenient and their "one stop shopping" experience generally far superior than waiting hours to be seen in an emergency room. Many times these are very nicely designed. The discussion in this chapter is not intended to be in-depth about best practices but, rather, to present a typical space plan (Figure 3-114) and to present a facility by Adventist Health in the state's Central Valley, in Dinuba, California that has exceptional design.

The 7,532-square-foot freestanding facility shown in Figure 3-115 represents an innovative approach to

Figure 3-114. Space plan of urgent care center, 4,925 square feet. *(Design: Jain Malkin Inc.)*

Figure 3-115. Space plan urgent care center, Adventist Health, 7,532 square feet. *(Courtesy of Boulder Associates)*

Figure 3-116a and b. Lobby of urgent care center, Adventist Health. *(Courtesy of Boulder Associates; Design experience consultant: Starizon; Photo: Copyright © LaCasse Photography)*

urgent care, offering occupational health services, lab, and an imaging center with X-ray, CT, and ultrasound. The owner was keen on creating a great patient experience and brought in Starizon Studios to consult with Boulder Associates Architects. The robust use of color and interesting ceiling design (Color Plate 4, Figures 3-116a and b) are totally unexpected in an urgent care center. In the lobby, a refreshment bar sells healthy snacks. Note the stylish banquettes. Another facility that goes beyond expectations for design is shown in Color Plate 5, and Figures 3-117 and 3-118. Although this is actually an ambulatory surgical center, the waiting area and treatment bay are appropriate for urgent care. The space plan for this facility can be seen in Figure 8-4. Large-scale nature photographs by Henry Domke help to relieve anxiety in waiting areas and the treatment bay.

The urgent care center in Figure 3-43 is integrated with a family practice clinic, sharing lab and radiology.

EMPLOYEE HEALTH AND WELLNESS CENTERS

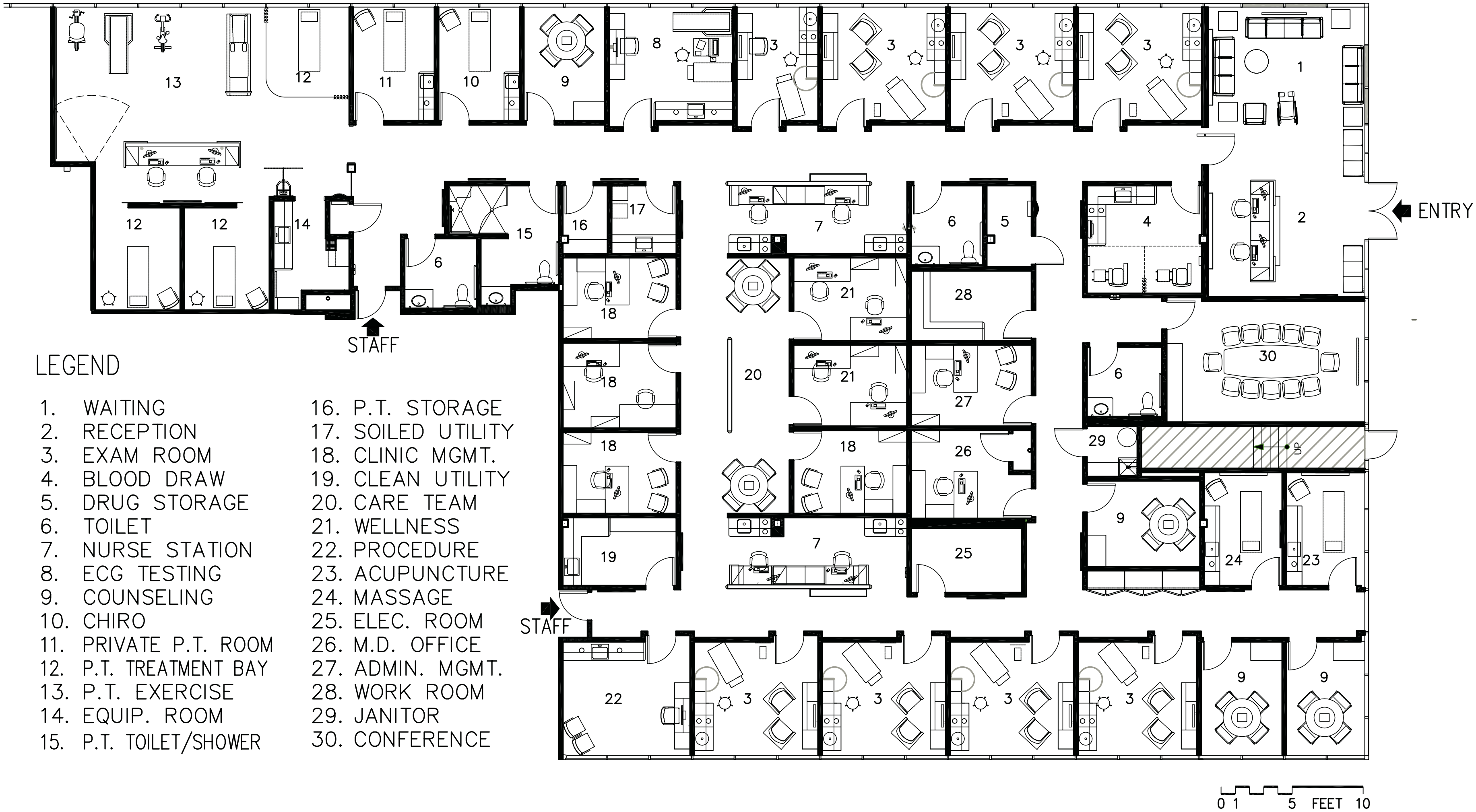
Large employers have incentives to want to develop an employee health and wellness center on their campus.

Figure 3-117. Waiting area for ambulatory surgical center has interesting ceilings, lighting, and color palette. SCA La Veta. *(Courtesy of Boulder Associates; Copyright © LaCasse Photography)*

Figure 3-118. Pre-op area with large-scale photos of nature in ambulatory surgical center, SCA La Veta. *(Courtesy of Boulder Associates; Photo: Copyright © LaCasse Photography)*

Most are self-insured, which provides an incentive to keep people healthy and out of hospitals. They also want to make it convenient for their employees to seek medical care without wasting time traveling offsite and encountering what might be a less than enjoyable experience. There is, in addition, the desire to manage employees' health by actively engaging them in a wellness program and measuring outcomes. Earlier in this chapter, Cisco LifeConnections was presented. This has become a benchmark facility in terms of design that has attracted the attention of many Fortune 500 companies that have toured it. It was designated a healthcare facility "icon" in 2013 for its innovation in the care suite concept and overall design character. (This is a program headed by noted healthcare architects Don McKahan and Kirk Hamilton.) It is a good example of a proactive approach to managing employee health.

Another prominent technology company sought to develop a "concierge care" model with a large exam/consult room, 12 × 12 feet, that combines in one room certain aspects of the Cisco care suite (Figure 3-119). Half of the room is consultation with patient and provider sitting side by side in lounge chairs facing a large monitor while the other half of the room has an exam table and casework. Everything is built into the casework, including the sharps container and waste receptacles, for a sleek appearance. It is a collaborative care model with an area for the team that includes a nutritionist, psychologist, and wellness coaches. Physical therapy, acupuncture, chiropractic care, and massage therapy are offered. The



CORPORATE HEALTH AND WELLNESS CENTER

8300 SF

Figure 3-119. Space plan corporate health and wellness center, 8,300 square feet. *(Space planning and design: Jain Malkin Inc.)*

interior design offers polished concrete floors, the use of both maple and dark wood in various design features and ceilings, white walls, and very large panels of nature photography such as giant blades of glass, flowers, and water lilies in corridors.

INTEGRATIVE MEDICINE

Some might say this is the best of both worlds—a merging of allopathic (Western) medicine and complementary therapies, sometimes called "alternative" medicine. The term "alternative" implies either/or, that it would take the place of allopathic medicine, which many years ago led to the acronym "CAM," for complementary and alternative medicine. It would be risky business to decide to only pursue CAM therapy for a disease or illness. The benefit in integrative medicine is that the practitioner, usually an internist, seamlessly blends a personalized "prescription" for an individual starting with an intensive history-taking, an examination, lab tests, and possible diagnostic imaging studies (if the disorder demands it) and then integrating some combination of perhaps Chinese herbs, naturopathic supplements, acupuncture, homeopathy, nutrition counseling, and relaxation therapy or advice on meditation in trying to relieve the patient's symptoms. Practitioners may be skilled in some form of Asian medicine, perhaps Ayurveda, and trained to read the radial pulses (by placing three fingers on the inner wrist) to diagnose imbalances. Every practice is different but a common denominator is that it is a holistic approach to health, aimed at bringing balance to the individual by a skillful interweaving of allopathic and CAM modalities.

For a number of years there has been movement toward establishing an evidence-based foundation for integrative medicine. One of the organizations leading this effort is the Samueli Institute in Alexandria, Virginia, stating on their website they are "dedicated to the scientific exploration of healing." Wayne Jonas, MD, is the president and CEO of this organization. The work of Dr. David Eisenberg at Harvard will be of interest to anyone following this field. He was the first American physician to travel to China in the mid-1990s to study traditional Chinese medicine: herbal medicine, acupuncture used for surgery, energy medicine, and more. The journalist and TV documentary film producer, Bill Moyers, produced a six-part feature that aired on PBS called "Healing and the Mind" in the mid-1990s in which Dr. Eisenberg's travels were documented. At that time there was great skepticism among U.S. physicians and many had closed minds even about acupuncture. Dr. Andrew Weil was lecturing and publishing his work at this time, largely based on the nutritional value of plants and a path to health through lifestyle change.

Today, however, there are integrative medicine centers at numerous hospitals and health centers, often modest in size and with fragile budgets but slowly making inroads as an increasing number of people search for wellness and guidance on living a more healthy life.

The Scripps Center for Integrative Medicine

Founded by Dr. Erminia ("Mimi") Guarneri, an interventional cardiologist who became a dedicated and passionate practitioner of integrative medicine, the Scripps Center for Integrative Medicine (SCIM) on the campus of Scripps Clinic, La Jolla, California, is known worldwide for its success in using lifestyle change to reverse and treat heart disease. After years of putting stents into blocked arteries, sometimes repeatedly for the same person, she thought there had to be a more effective treatment. Her investigations led to Dr. Dean Ornish and his nutrition program for reversing heart disease. As time went on Dr. Guarneri developed a total lifestyle change program that incorporates yoga, acupuncture, meditation, group therapy, nutrition, medicinal herbs, and exercise. She lectures, writes books, and leads workshops on integrative medicine.

The design of the facility is based on the Golden Mean, a mathematical proportion found throughout nature and even in the double helix of DNA. The chambered nautilus shell is considered to be a perfect expression of this and it shapes the space plan, ceiling design, and other

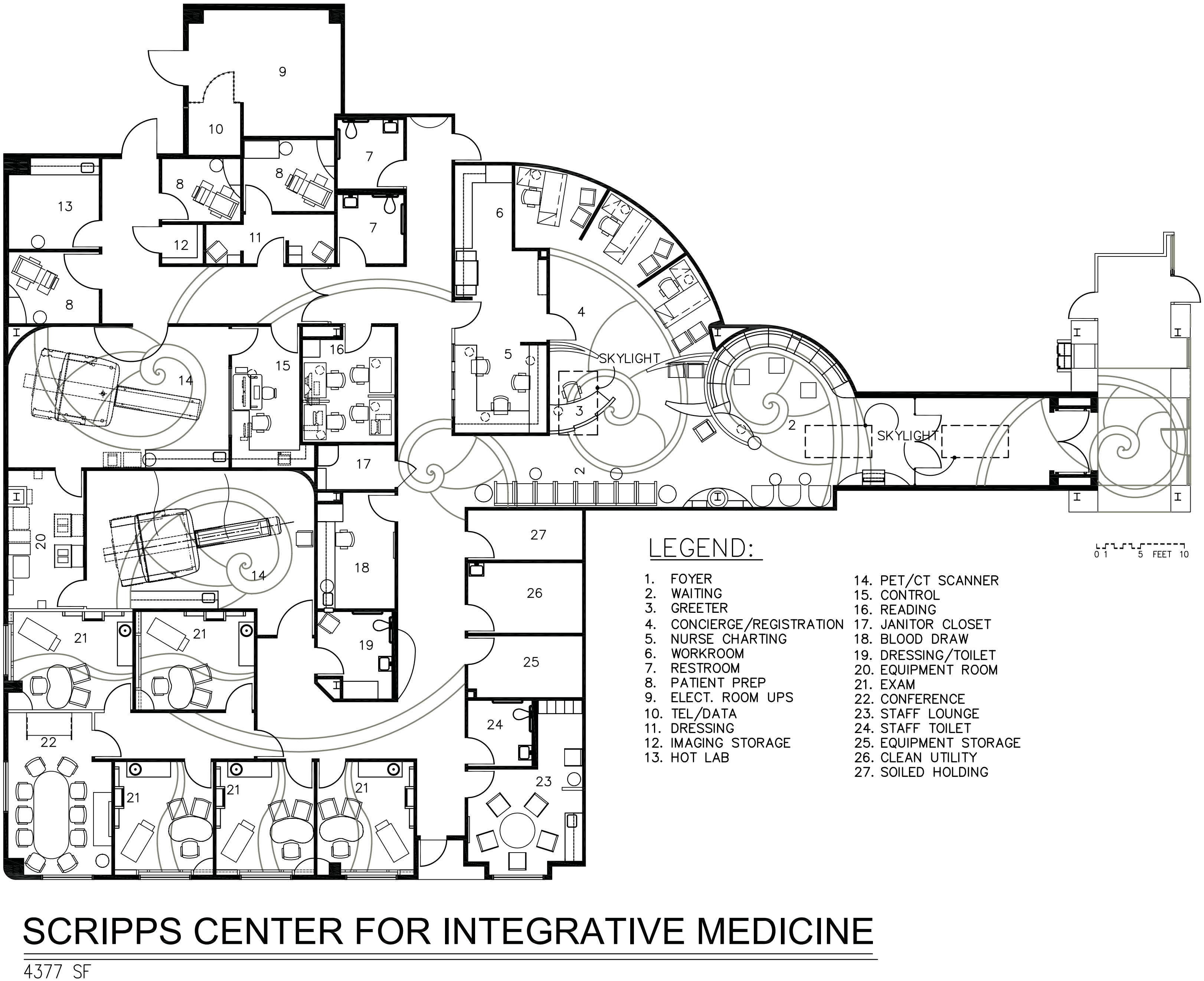


Figure 3-120. Space plan of integrative medicine center, 4,377 square feet. *(Design: Jain Malkin Inc.)*

Figure 3-121. Waiting room, Scripps Center for Integrative Medicine. *(Design: Jain Malkin Inc.; Photographer: Michael Campos)*

Figure 3-122. Clinic core, Scripps Center for Integrative Medicine. *(Design: Jain Malkin Inc.,TAYLOR Architects; Photographer: Ryan Beck Photography™)*

Figure 3-123. Exam/consultation room, Scripps Center for Integrative Medicine. *(Design: Jain Malkin Inc.; Photographer: Michael Campos)*

features (Figure 3-120, 3-121, and Color Plate 6, Figure 3-122) such as the PET/CT ceiling (see Figure 6-11). Fiber-optic lighting cycles through several colors as it outlines segments of the "nautilus shell" gypsum board ceiling of the scanner room. Patients with advanced heart disease often arrive at this facility hoping for a miracle. When they walk in the door they are drawn into the space by rays of light from a skylight over the reception desk (Figure 3-121). This glazing has a film with a prism that creates rainbow patterns as the Earth moves around the sun. Rainbows are almost universally viewed as a sign of hope. Every few minutes the color spectrum changes shape and location, creating interactive art and a positive distraction. Occasionally the rainbow runs across a person who is seated, which usually brings an expression of delight. In the waiting area there are options for seating, one being a cozy upholstered banquette. The entry has a wall fountain on the left and the room has sculptural designs in the ceiling in various shapes with indirect lighting. The nautilus motif is expressed in carpet inset designs in the clinical core (see Color Plate 6, Figure 3-122), and ceilings of

Figure 3-124 and b. Rehab Center, Scripps Center for Integrative Medicine. *(Design: Jain Malkin Inc.; TAYLOR Architects; Photographer: Ryan Beck Photography™)*

wood and gypsum board follow the proportions of the Golden Mean.

The exam room is divided into a carpeted consultation area and an examination space in which all diagnostic instrumentation is concealed behind roll-top doors until needed (see Color Plate 6, Figure 3-123). The sharps container and glove boxes are also concealed. The sink cabinet is designed more like a piece of furniture on legs with a granite top and vessel sink.

On the lower level a former concrete block basketball court was remodeled into a stylish cardiac rehab center with acoustic treatment on walls and ceiling to enable several functions to occur at once (Figures 3-124a and b). Men's and women's locker rooms lead to an outdoor swimming pool. While walking the labyrinth one can enjoy views of the Pacific Ocean just yards away and also peek at the famed Torrey Pines Golf Course.

Also on the lower level are a naturopathic pharmacy and retail space, massage rooms also used for therapeutic touch, and a large multipurpose space (Figure 3-125) used for cooking classes, yoga, and lectures. The backlit shoji screen wall treatment gives the illusion of exterior windows. A Sanskrit "ohm" is inset in the ceiling.

Figure 3-125. Yoga studio and conference center, Scripps Center for Integrative Medicine. *(Design: Jain Malkin Inc.; TAYLOR Architects; Photographer: Ryan Beck Photography™)*

CHAPTER 4

Community Health Centers

OVERVIEW

The 2012 election is in the rearview mirror and the endless debate about the status of the Accountable Care Act (ACA) has ended. It is here to stay and will expand coverage to 32 million individuals in 2014, half through Medicaid expansion and half through health insurance exchanges with safety-net providers granted most-favored-nation status. States like California that are actively implementing insurance exchanges are trying to get more people covered, conducting value-based purchasing to encourage delivery reform and expanding the safety-net delivery system. There is no better time to be talking about the value of safety-net clinics (also known as Community Health Centers) because they are an ideal model for primary care reform in this country. The good news is the ACA has made money available for the development and expansion of community health centers; thus, looking at ways to optimize this model of care is definitely worthwhile.

Safety-net clinics, by definition, serve the underserved, underinsured, uninsured, migrant workers, and undocumented immigrants. Occasionally an individual community health center is able to attract individuals covered by insurance who choose to use that facility because of the comprehensive care, the coordination and collaboration among providers, ease of access, and attention to the whole person. As an example, Adelante Healthcare in Phoenix, at two of its locations, is able to draw patients from a nearby Sunbelt retirement community because of its outstanding clinical care, as well as the comfortable and attractive design of its facilities. This change in payer mix helps to subsidize uncompensated care and sliding fee discounts made for low-income individuals who are unable to pay full fee for their care.

There is a fundamental restructuring of primary care occurring in the United States and it is largely focused on the Patient-Centered Medical Home (PCMH), which is a foundational piece of the Accountable Care Organization (ACO). The onslaught of patients who will have coverage through the ACA may not have access unless a fundamental shift in care management occurs. Valuable lessons can be learned from the approach to holistic care at two ends of the spectrum—safety-net community health centers and physicians who practice membership-based direct care, sometimes referred to as "concierge care," the latter are discussed in Chapter 3. Both achieve a high level of continuity of care, create a medical home for patients, and offer prompt access and coordination of care for patients who have chronic or complex medical conditions. The ACA will ramp up the need for primary care and the deployment of many more community health centers and ambulatory care facilities, but the physical design and clinical workflow will be distinctly different from existing models. Clearly the focus is on wellness, management of chronic conditions, team-based care delivery, an optimized and personalized patient experience, and measurement of performance in health outcomes. Experiments are going on around the nation as physicians try to respond to the new normal of reduced reimbursement, the steady increase and complexity of chronic disease management, the focus on prevention, and the tsunami of newly insured patients heading their way. It's an exciting time to be working in healthcare as it is reshaped and reformed in ways that will hopefully achieve the Triple Aim of the Institute for Healthcare Improvement:

- Improving the patient experience
- Improving the health of populations
- Reducing the per capita cost

Community health centers are an efficient and practical model for the delivery of health and wellness. The coordination of care and collaboration among a team of clinicians (see Figures 3-15, 3-16, 3-17, and 4-21) enable patients to receive a multidisciplinary assessment with a focus on prevention and wellness. The goal is to provide as much care as necessary at each visit. Behavioral health is often included in these settings because approximately 70 percent of patients require it. If they are referred out, they often do not return. Dental care is also frequently found. It may not be widely known but a large number of patients report to emergency departments for a dental abscess or other problems arising from lack of dental care until an extreme condition arises. An ED cannot help these individuals, they can only treat the pain which is a very temporary fix. Poor dental care leads to serious periodontal disease that can cause severe heart damage and other health problems.

It is interesting that the redesign of primary care in the United States is looking a lot like that of community health centers. Refer to Chapter 1 for a discussion of the report *The Building Blocks of High-Performing Primary Care: Lessons from the Field*, published by the California HealthCare Foundation, which is a very detailed and specific guide to improving primary care based on a study of seven high-performance primary care centers, five of which were community health centers. The entire report can be downloaded from www.chcf.org (see the "Resources" sidebar later in this chapter).

Features of community health centers that make them unique are:

1. Comprehensive care at one location
2. Patient navigator for referrals to subspecialists and community resources
3. Same-day access; do as much as possible in one visit
4. Continuity of care; proactive management and follow-up
5. Team collaboration with each professional working to the limit of their license
6. Focus on wellness and prevention (nutrition counseling, cooking classes, exercise programs, chronic disease group visits)

Characteristics of "Safety-Net" Community Health Centers

Community health centers are an efficient model of care because they treat the whole person and focus on continuity among a multidisciplinary group of providers that may include physicians, physician assistants, nurses, nurse practitioners, behavioral health specialists, nutritionists, dentists, pharmacists, social workers, and navigators who coordinate specialist care and connect patients to community outreach programs. This is very different from the episodic care that characterizes most primary care visits today. This care model has a proactive focus in terms of following up with patients and, once they arrive for an appointment, making sure the patient is up to date on vaccinations, required diagnostic tests, prescriptions, annual gynecological exams, and even dental exams and hygiene. It is characterized by collaborative team care that leads to more informed decision making, and this has space plan implications to be discussed later. There is a focus on accommodation of family in exam rooms and in consultation spaces and the need to make children feel welcome with appropriate artwork and play activities in waiting areas. There is a high priority to influence patients by educating them about good nutrition, cessation of smoking, and making lifestyle changes that will create better health. There may be cooking classes or demonstrations, an onsite vegetable garden to teach children how vegetables are grown, or a weekly farmers market to bring fresh produce to neighborhoods that are poorly served by supermarkets. The overall goal is to provide patients with a very personalized healthcare experience, one in which they are an active participant in decision making.

Community health centers may be small (5,000 square feet) or large enough to accommodate the full range of services: family medicine, pediatrics, OB/GYN, dental care, internal medicine, dermatology, ENT, podiatry, pharmacy, audiology, speech therapy, café, nutrition, lab, radiology, and community meeting rooms. By virtue of having little money to devote to facility construction and design, safety-net clinics have often been cobbled together with donated materials and whatever was available at the lowest cost. In recent years; however, a number of imaginatively designed facilities have opened that use color,

lighting, and attractive exterior design to enhance the patient experience and many of these are even LEED® certified. Design practitioners are also applying evidence-based principles to the design of these facilities.

Patient-Centered Medical Homes

A fundamental aspect of primary care reform is the creation of patient-centered medical homes. The concept actually parallels in a more formal way the characteristics of safety-net health centers in terms of delivery of care. To be designated a PCMH according to Transformed CEO, Terry McGeeney, "primary care practices are expected to provide comprehensive primary care including care management, care coordination, enhanced access, patient engagement, and proactive patient planning and are expected to be NCQA (National Committee for Quality Assurance Level 3 or an equivalent (i.e., complete medical homes) and meaningful use certified." (This statement was downloaded from transformed.com/ceoreports/comprehensive_primary_care_initiative.cfm. accessed October 2, 2013.)

In 2007 leading primary care associations endorsed the *Joint Principles of the Patient-Centered Medical Home* as a goal for the organization and delivery of care throughout the healthcare system. It requires a high level of information technology, provider payment reform that rewards outcomes, and team-based education and training of the health professions workforce (pcpcc.net/what-we-do). In 2008 the Commonwealth Fund launched the five-year *Safety-Net Medical Home Initiative* to help 65 community health centers transform into patient-centered medical homes. In 2010 the ACA included substantial support for medical home initiatives, including the CMS *Advanced Primary Care Practice Demonstration*, bringing together for the first time public and private health plans to examine the effectiveness of medical homes. As of January 2012, 41 states had adopted medical home programs; however, they structure their definitions and priorities differently. In some states, payments to providers may vary depending on the number of chronic conditions a patient has and if there is a language barrier or mental illness. In other states, payments are based on a maximum per member per month that varies with the payer type (Medicare Advantage Plans, Medicaid, commercial payers) and may vary based on medical home effectiveness. A state may pay primary care providers for remote consultations with hospital-based specialists to improve care for complex patients or they may receive funding for establishing a registry for tracking important patient data to develop a system for sharing clinical information perhaps with a key hospital.

Some community health centers are considered Federally Qualified Health Centers (FQHC), which is a reimbursement designation from the Bureau of Primary Health Care and Centers for Medicare and Medicaid Services of the U.S. Department of Health and Human Services. These health centers serve a variety of medically underserved populations with some receiving special funding to provide services to migrant and seasonal agricultural workers or residents of public housing, or to offer healthcare for the homeless programs.

There are various accreditation agencies for PCMH each with a set of standards and specific criteria. The Joint Commission, in 2011, launched the *Primary Care Medical Home Certification* option for its accredited ambulatory care organizations. In addition, the Accreditation Association for Ambulatory Health Care (AAAHC) offers accreditation for medical homes. There is the *National Center for Medical Home Implementation Accreditation* and the *National Committee for Quality Assurance (NCQA) PCMH Recognition* designation, which has three levels of achievement.

Financial Benefits of Medical Homes

Leading insurance payers, such as WellPoint and United Healthcare, expect that PCMHs have the potential to save twice as much as they cost with estimates of 70 percent reduction in ED visits and 40 percent lower hospital readmissions. See the tables in the noted source for outcome measures for several of the 41 states engaged in PCMH demonstration projects.[1] In addition, the Agency for Healthcare Research and Quality (www.ahrq.gov/research/primarix.htm) awarded, in 2010, 14 two-year "transforming primary

[1] Marci Nielsen and others, "Benefits of Implementing the Primary Care Patient-Centered Medical Home: A Review of Cost & Quality Results," September 2012: Patient-Centered Primary Care Collaborative, www.pcpcc.org/sites/default/files/media/benefits_implementing_the_primary_care_pcmh.pdf.

care" grants to selected organizations to study the transformation of primary care practices to PCMHs. A description of each project's diverse objectives can be found on the AHRQ Web site (www.ahrq.gov/research/transpcaw.htm).

An Evidence-Based Approach to Safety-Net Clinic Design

The Center for Health Design, in recognizing the importance and role of safety-net clinics in 2011, funded by a grant from the California HealthCare Foundation, published five white papers on various aspects of clinic design available for download on the CHD website (healthdesign.org):

Promising Practices in Safety-Net Clinic Design (Overview)

Designing Safety-Net Clinics for Flexibility

Designing Safety-Net Clinics for Cultural Sensitivity

Improving the Patient Experience

Designing Safety-Net Clinics for Innovative Care Delivery Models

Figure 4-1. Corridor in community health center displays photographic art taken by children in the community. Grace Hill Neighborhood Health Center—Water Tower, St. Louis, Missouri. *(Architecture and Interior Design by Arcturis; Photographer: Sam Fentress)*

This was followed by development of a Clinic Design module on their website that, among other things, features exemplary facilities, videos, and PowerPoint slides from several regional learning collaboratives. One of the most helpful areas of the clinic design module is the interactive *Design & Construction Process Toolkit*, which enables one to review various recommendations at each stage of the design process, while the *Cost-Benefit Analysis Tool* allows one to determine the probable cost of a number of variables such as the number and size of exam rooms, cost of staffing, increases or decreases in clinic size, the cost-benefit of green design features, and more. One can enter the size of a waiting room space and find out how many seats it will accommodate or model different options of parking lot lighting to evaluate the cost of different types of lamps. This tool is found on the Clinic Design site under "MySNC."

The question is: Does design of the built environment have the same importance in a community health center as we know it to have in other settings that mostly serve patients who have insurance? According to healthcare futurist Ian Morrison, facilities can be a service competitiveness differentiator if you have to "earn" the newly covered individuals. The quality of the environment sends a powerful message to patients and staff about how they are valued and respected. Patients receiving care in a comfortable and attractive environment that respects their privacy and dignity are apt to be more receptive to suggestions for improving their health and perhaps even be more compliant with medications and follow-up appointments. They may actually look forward to return visits and view the health center as a place to receive education, to join groups for management of chronic conditions, and as a link to community resources. And we know that good design supports quality and patient safety; it makes it easier to do things right.

Figure 4-2. Team collaboration area of community health center. Hennepin County Medical Center's Whittier Clinic, Minneapolis. *(Courtesy of HGA Architects and Engineers)*

Overall Considerations

1. Aim for 90 percent of spaces having natural light through windows, clerestories, Sonotubes, and skylights (Figures 4-1 and 4-2).
2. Study the demographics of the population served to understand customs, cultural preferences, levels of literacy, and to be able to develop a color palette and design concept that resonates for that community (see Color Plate 7, Figures 4-3 and 4-4).
3. Avoid jogs in circulation paths that make it difficult to see department entries. If space planning is well executed, wayfinding requires little signage (Figure 4-5 and Color Plate 8, Figures 4-6, 4-7, and 4-10).

Figure 4-3. Vibrant lobby of community health center, West County Health Center, Richmond, California. *(Architecture and Interior Design by Hawley Peterson Snyder; Photographs by David Wakely)*

Figure 4-4. Exterior of La Maestra Community Health Center is an expression of the multicultural community it serves. *(Photo courtesy of Richard Yen & Associates, Architects and Planners)*

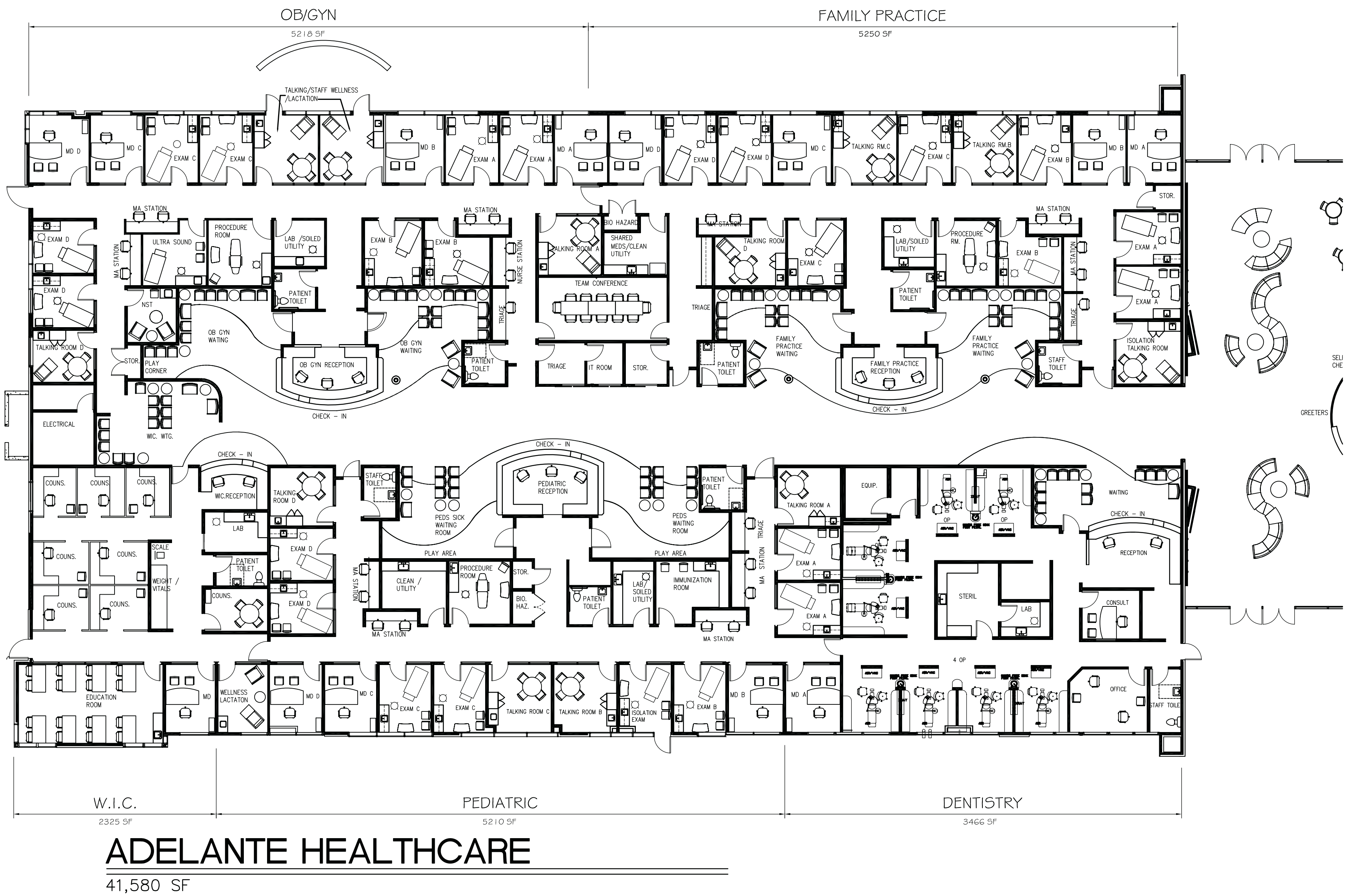


Figure 4-5. Space plan of Adelante Healthcare, Mesa, Arizona, 41,580 square feet. *(Space planning and interior architecture: Jain Malkin Inc.)*

ADELANTE HEALTHCARE

41,580 SF

Figure 4-6. Space plan community health center incorporating intuitive wayfinding. Note team collaboration center in core, 21,975 square feet, University of Minnesota Physicians Smiley's Clinic, Minneapolis. *(Courtesy of HGA Architects and Engineers; Photographer: Saari Forrai Photography)*

Figure 4-7. View of colored soffit and inset carpet cues wayfinding, University of Minnesota Physicians Smiley's Clinic, Minneapolis. *(Courtesy of HGA Architects and Engineers, Photographer: Saari Forrai Photography)*

4. Break waiting areas into small-scale units associated with individual departments to avoid the "bus station" appearance of large clinic waiting rooms (see Figures 12-3; Color Plate 9, Figure 4-9; and 4-29).
5. Locate internal medicine in a quiet area, away from pediatrics, to minimize exposure of elderly patients to communicable illnesses (see Figure 4-5).
6. Employ noise reduction strategies such as a carpet tile, high NRC acoustic tile, and by avoidance of rotundas or domed ceilings that create echoes and a cacophony of reverberating sound (Figure 4-11).
7. Model healthy lifestyle choices in artwork, clever educational exhibits, a café that serves tasty nutrient-dense foods and offers recipes and calorie counts.
8. Use LED lighting if the budget will allow (Figure 4-12).

Figure 4-8. Lobby/reception area, University of Minnesota Physicians Smiley's Clinic, Minneapolis. *(Courtesy of HGA Architects and Engineers, Photographer: Saari Forrai Photography)*

Figure 4-9. Lobby, Hennepin County Medical Center's Whittier Clinic, Minneapolis. *(Courtesy of HGA Architects and Engineers; Dana Wheelock Photography)*

9. Plan clinic layout to facilitate one-stop care (see Figures 4-5 and 4-30). Note that the facility depicted in Figure 4-30 is only one floor of this clinic.
10. Consider long-term operating costs and the implementation of sustainable energy reduction strategies.
11. Use modular furniture that can easily be reconfigured or stacked, folded, or rolled away to allow for multipurpose functions (Figures 4-12 and 4-13).
12. Examine the design from the perspective of multiple stakeholders (Figure 4-14).
13. Use robust color! Paint is cheap and color is the least expensive way to create an uplifting environment (see Color Plate 7, Figure 4-3; Figure 4-15; and Color Plate 9, Figures 4-16 and 4-27).

Space Planning Considerations

1. Locate high-volume departments close to lobby (see Figure 4-5).
2. Aggregate women and children's services together (see Figure 4-5).
3. Locate dental operatories with outdoor views (see Figures 4-5 and 4-17).
4. Cluster exam rooms into pods with decentralized medical assistant workstations and provider offices (see Figures 4-5 and 4-29).
5. Intersperse "talking rooms" with exam rooms for more informal discussions with patients and families when disrobing is not required (see Figures 1-1, 3-8, 3-46a and b, 3-47, 4-19, and 4-20).

Figure 4-10. Floor plan, first floor, La Maestra Community Health Center, San Diego, California. *(Courtesy of Richard Yen & Associates, Architects and Planners)*

Figure 4-11. Patient care concourse with skylights and department subwaiting areas, Adelante Healthcare, Mesa, Arizona. *(Interior architecture: Jain Malkin Inc.; Cawley Architects; Dustin Revella Photography)*

Figure 4-12. Community conference center, Adelante Healthcare, Mesa, Arizona. *(Interior Architecture: Jain Malkin Inc.; Cawley Architects; Dustin Revella Photography)*

6. Create multidisciplinary collaboration spaces close to exam rooms (see Figures 3-15, 3-16, 3-17, 4-2, Color Plate 8, Figures 4-6, 4-21 and 4-29).

7. Create exam rooms large enough to include one or two family members and more than one care team member or provider (see Figures 3-2, 3-9, and 4-22) and provide visually screened location for interpreter if required (see Figure 3-8).

8. Design exam rooms to minimize the power differential between patient and provider by enabling them to sit together maintaining good eye contact with both being able to look at the monitor (see Figures 3-8, 3-9, 3-14, and 3-22).

9. Design for flexibility—being able to expand or contract a department easily due to a continuous interior corridor running through all departments. Staff can "seamlessly" move back and forth throughout clinical spaces (see Figures 4-5 and 4-30).

10. Provide a second separate entrance into the building other than through the main lobby. It is common in pediatric practices to have an exam room with an exterior door for patients who may be contagious (see Figures 3-101 and 4-5).

Enhancing the Patient Experience
With increasing emphasis on creating an optimized patient experience, there is now a specific medical home survey tool that can be provided to patients to assess their experience based on a single visit to a provider's office. It is called the CAHPS PCMH (Consumer Assessment of

Figure 4-13. Conference/training room at Grace Hill Neighborhood Health Center—Water Tower, St. Louis, Missouri. *(Architecture and Interior Design by Arcturis; Photographer: Sam Fentress)*

Figure 4-14. Interactive art in pediatric waiting area, Adelante Healthcare, Mesa, Arizona. *(Artist: Kristine Kollasch; Photo: Dustin Revella)*

Healthcare Providers and Systems) survey and it covers these areas:

- Access
- Information
- Communication
- Coordination of care
- Comprehensiveness
- Self-management support and shared decisionmaking

Figure 4-15. Colorful ceiling soffits add whimsy to pediatric waiting area, Adelante Healthcare, Mesa, Arizona. *(Interior architecture: Jain Malkin Inc.; Dustin Revella Photography)*

Figure 4-16. Greeter desk at Adelante Healthcare, Mesa, Arizona. *(Interior architecture: Jain Malkin Inc.; Dustin Revella Photography)*

Figure 4-17. Community health center dental suite, South of Market Health Center, San Francisco, California. *(Interior Architecture/Interior Design: Polytech Associates Inc.; Photography: pmstructure photography)*

Figure 4-18. Core waiting area of Clinica Family Health Services/Peoples Clinic, Boulder, Colorado. *(Courtesy of Boulder Associates; Photographed by Boulder Associates Staff)*

Figure 4-19. Talking room care suite, Adelante Healthcare, Mesa, Arizona. *(Design: Jain Malkin Inc.; Cawley Architects; Dustin Revella Photography)*

An excellent checklist of physical design implications that affect the patient experience can be found on the CHD Clinic Design site in the white paper, *Improving the Patient Experience: Best Practices for Safety-Net Clinic Redesign*.

Seismic Change: New Priorities Drive Total Restructuring

This is a volatile time in U.S. healthcare, not unlike seismic changes in the Earth's crust. It will likely be five years before we know whether the patient-centered medical home model will yield the best results for the least cost. On the surface, it seems very promising because of its holistic approach that deviates considerably from the current model of episodic care. There is a physician shortage and it is anybody's guess whether the huge number of individuals who will now be covered will actually have access to care. The good news is that the ACA has made more money available to community health centers and there is great motivation among payers and healthcare provider organizations alike to take a hard look at eliminating waste and focusing on effective care. Community health centers are already shining examples of success in chronic disease management and in collaborative team care, making good use of physician extenders and multidisciplinary decisionmaking. In addition, the best of these function as a place of celebration (Figures 4-23a and b), a true community center for immigrant populations and the many disenfranchised and underserved who need access to care; because it is essential to have good health in order to be productive. Although community health centers are at the other end of the spectrum from the concierge care/direct care model, they are two approaches to the current healthcare crisis, both involving very dedicated practitioners committed to providing excellent care.

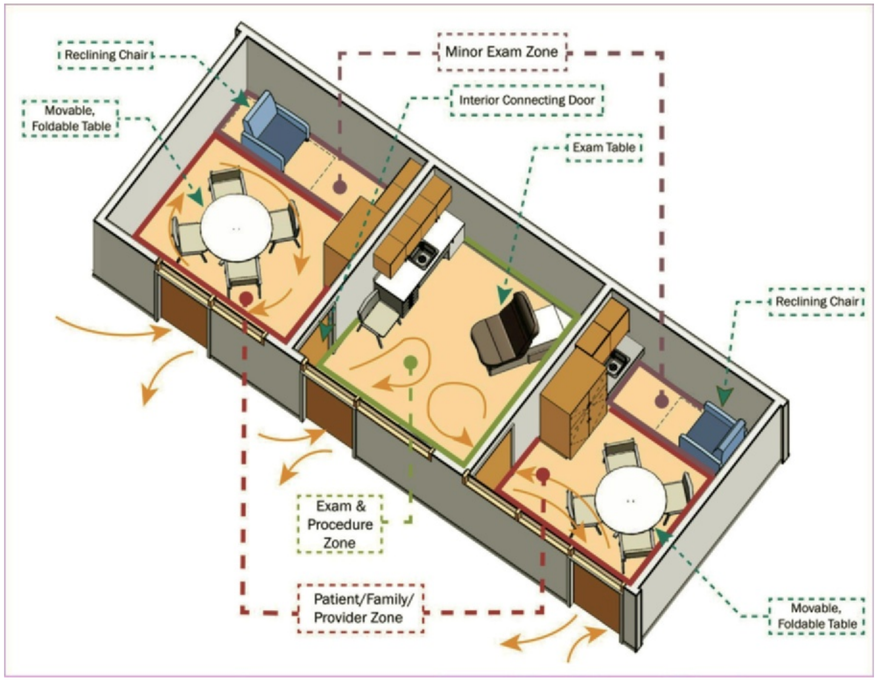


Figure 4-20. Axonometric rendering of care suite concept, Adelante Healthcare, Mesa, Arizona. *(Design: Jain Malkin Inc.; Rendering courtesy of Deborah Wingler)*

Figure 4-21. Team collaboration center at Grace Hill Neighborhood Health Center—Water Tower, St. Louis, Missouri. *(Architecture and Interior Design by Arcturis; Photographer: Sam Fentress)*

Figure 4-22. Examination room at University of Minnesota Physicians Smiley's Clinic. *(Courtesy of HGA Architects and Engineers; Photographer: Saari Forrai Photography)*

Figure 4-23a. Lobby reception, La Maestra Community Health Center, San Diego, California. *(Photo courtesy of Richard Yen & Associates, Architects and Planners)*

Figure 4-23b. Pediatric play area, La Maestra Community Health Center, San Diego, California. *(Photo courtesy of Richard Yen & Associates, Architects and Planners)*

RESOURCES

National Association of Community Health Centers (nachc.com)

California HealthCare Foundation (chcf.org)

The Center for Health Design (healthdesign.org/clinic design)

Patient-Centered Primary Care Collaborative (pcpcc .net/what-we-do). See downloadable guide under "Publications": *Benefits of Implementing the Medical Home*.

Agency for Healthcare Research and Quality (ahrq .gov/research/primarix.htm)

National Academy for State Health Policy (nashp.org/ med-home-map)

Transformed.com

Benefits of Implementing the Primary Care Patient-Centered Medical Home: A Review of Cost and Quality Results 2012 (www.pcpcc.net/guide/ benefits-implementing-pcmh)

The American Academy of Private Physicians (AAPP.org)

Primary Care, Everywhere: *Connecting the Dots Across the Emerging Health Landscape*, November 2011, by Jane Sarasohn-Kahn (chcf.org)

The Building Blocks of High-Performing Care: Lessons from the Field, April 2012, by R. Willard and T. Bodenheimer, California HealthCare Foundation (chcf.org)

EXEMPLARY PROJECTS

La Maestra Community Health Centers

La Maestra, with several locations in San Diego county and the central, largest facility in City Heights (36,440 square feet), is an example of a community health center that is truly "home" to many low-income, culturally diverse individuals, many from Mexico and other Latin American countries. Their mission includes the goal of guiding people on a path of self-sufficiency and this includes finding transitional housing, job training and placement, acculturation classes, English as a Second Language classes, nutrition and cooking classes, access to a food pantry, and finding safe, affordable housing. The vibrancy of these programs is expressed in the exterior architecture of the building (see Color Plate 7, Figure 4-4) and the colorful interior spaces (see Figures 4-23a and b) with many rounded walls and circular forms (Figure 4-10). A micro-credit loan program is available with 300 participants currently and several of the recipients run the onsite flower and gift shop or provide janitorial services. An Arts and Culture committee brings in artists to show their work and occasionally commissions them to create something. One such artist creates multicultural stories about food and then does art celebrating healthy food from various cultural traditions. A video/slide show available to visitors depicts these stories. All of this supports the main focus of healthcare, which includes optometry, prenatal and ultrasound, substance abuse, telemedicine visits, and also domestic violence and human trafficking. This project is LEED Gold certified.

Smiley's Clinic

University of Minnesota Physicians Smiley's Clinic (22,000 square feet) serves a culturally diverse population that includes non-English-speaking Hmong and Somali families. The wayfinding system is utterly direct and simple (see Color Plate 8 and Figures 4-6 and 4-7) and, at the same time, aesthetically appealing. Three interdisciplinary teams of physicians, residents, and nurses are organized into three pods associated with the colors of orange, green, and purple, making it possible for anyone to find their way around even with few language skills. Soffits and carpet carry the identifying accent color.

The large triangular team collaboration area has three colored "points," and each has a three-physician team

assigned to it. This space is central to all of the nurses' stations allowing for high levels of interaction between residents, physicians, and nursing staff. Exam rooms have a bench large enough for several family members (or for a bariatric patient) and a curtain that screens a portion of the room at the entry where an interpreter or family member may sit without infringing upon the patient's privacy (see Figure 4-22). High ceilings with suspended decorative panels and skylights create a contemporary upbeat environment.

The reception desk at the clinic entry has an exuberant use of color and features sliding glass panels to provide privacy for staff without compromising visibility. The 24-foot-high ceilings with skylights and the expanses of windows create an appealing openness. Stretched fabric panels suspended from the ceiling have subtle colors achieved by focused accent lights fitted with colored gel lenses (see Figure 4-8).

Whittier Clinic

Hennepin County Medical Center's (HCMC) Whittier Clinic gets high marks for rehabilitating a brownfield site into a pedestrian-friendly neighborhood clinic and garnering LEED Silver certification. The exterior of the building is contemporary and lively with a mix of materials that includes metal and brick with staggered window placement and multiple canopies reiterating details of adjacent buildings. Small colored glass windows with programmable LED lights in the four HCMC branding colors provide a light show at night for local residents. The 60,000-square-foot clinic is further enhanced by several pocket parks and gardens with low-maintenance native plants. Designed by the same architect as Smiley's Clinic, the sensitivity to wayfinding challenges of culturally diverse individuals who speak little or no English was addressed with color and large-scale graphics. Each clinic entry is assigned a bold color that is reinforced by a large-scale graphic image and these images are represented, as a group, in the lobby (see Figure 4-9). Patients are issued color-coded cards with graphics to help them move to their destinations.

The community had a great deal of input in the design of the facility, working with the architect and HCMC representatives. This resulted in, among other things, the provision of community meeting rooms that are placed in a corner of the building with visual access to the sidewalk. The community hoped to reenergize an underdeveloped "gritty" section of Nicollet Avenue known as "Eat Street" due to the many cafés offering multi-ethnic cuisines. Local leaders hope the clinic will encourage further economic growth in this neighborhood. This is why the architects put so much emphasis on the exterior being colorful and friendly with good pedestrian access. A new transit stop encourages public transportation.

Clinic services include urgent care, lab, pharmacy, diagnostic imaging, occupational and physical therapy, family medicine (48 exam rooms) and a physician residency training program. The two-story lobby has suspended glass graphic panels (see Figure 4-9) and the clinic space has high ceilings with clerestory windows and suspended metal grid panels (see Figure 4-2). Exam rooms are clustered around the large collaborative team space providing excellent visibility of all exam rooms.

Grace Hill Neighborhood Health Center—Water Tower

Grace Hill is an 18,500-square-foot clinic with views of the historic water tower and the Gateway Arch from its North St. Louis location. It offers family medicine including podiatry, radiology, social services, dental, lab, WIC (federally funded nutrition program for women and infants), and community outreach. This is a Federally Qualified Health Center (FQHC) located in a medically underserved area of an economically challenged neighborhood. Working with a very limited budget, the architects and designers created a contemporary, upbeat space full of natural light, lively accent colors (see Figures 4-1 and 4-24), high-quality light fixtures, and even a terrazzo floor in the entry and connector spine. The entry and connector spine have high ceilings and an attractive community message board welcomes visitors (Figure 4-24). Exam rooms (Figure 4-25)

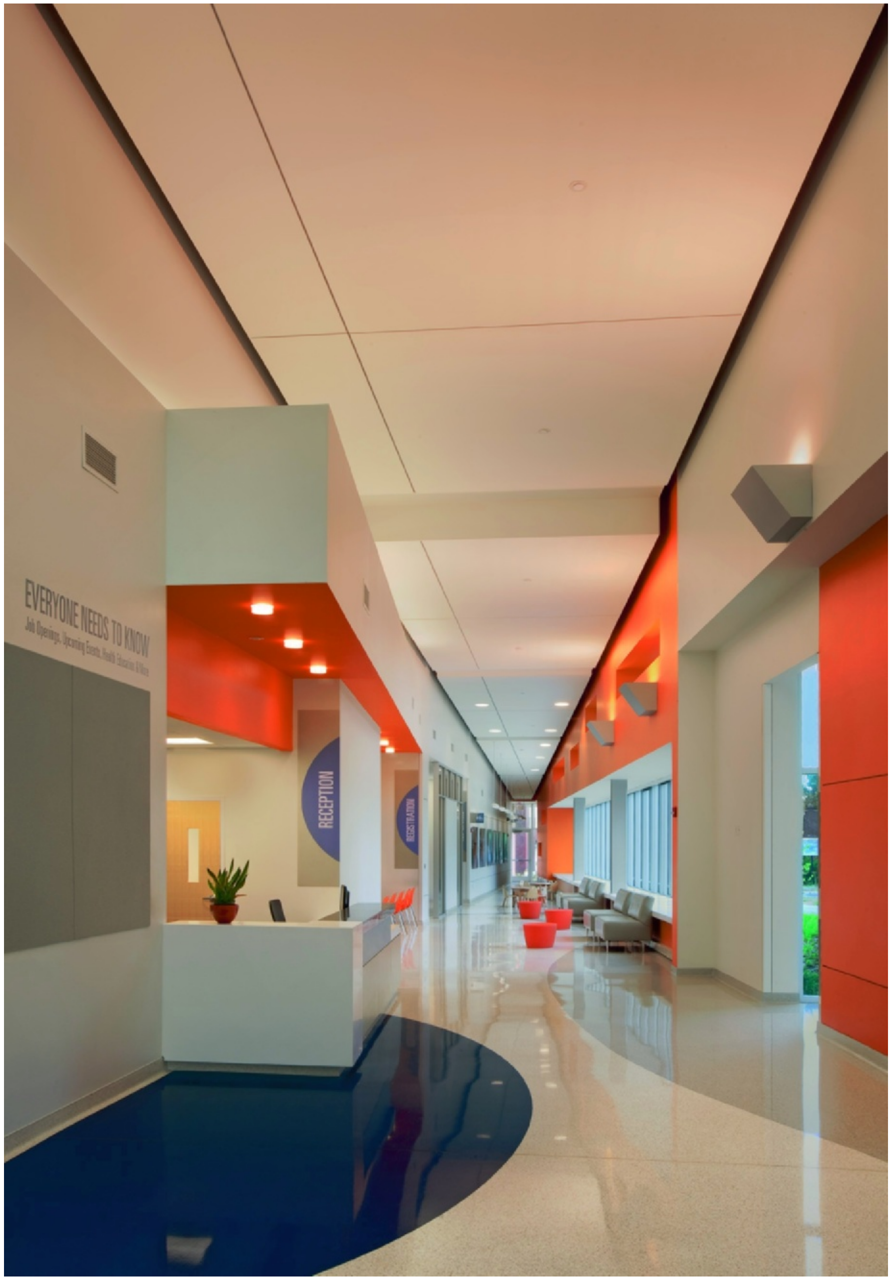


Figure 4-24. Entry Lobby community health center uses vibrant colors to enliven architecture. Grace Hill Neighborhood Health Center—Water Tower, St. Louis, Missouri. *(Architecture and Interior Design by Arcturis; Photographer: Sam Fentress)*

Figure 4-25. Examination room with monitor on wall-mounted rail. Note perforated basket light fixture that reduces glare. Grace Hill Neighborhood Health Center—Water Tower, St. Louis, Missouri. *(Architecture and Interior Design by Arcturis; Photographer: Sam Fentress)*

have monitors and a keyboard on a 56-inch adjustable extension arm to enable the patient to see it from the exam table. The clinic has electronic health records.

Community activity rooms are used for adult education classes and community events (see Figure 4-13). Throughout the clinic black and white photos taken by patients are used as artwork (see Figure 4-1). This is a great way to create a culturally appropriate art program with limited funds.

A large team collaboration space has exam rooms on both sides and good exposure to natural light (see Figure 4-21).

Adelante Healthcare

Adelante Healthcare is a multisite FQHC with facilities throughout the greater Phoenix area. The most recent (opened in 2012) is in Mesa, Arizona, a 47,000-square-foot freestanding building, new construction, with LEED Certified Gold for core and shell and LEED Certified Platinum for the interior. Transportation to the health center is facilitated by the new light rail line abutting the property. The clinic is Joint Commission–accredited as a patient-centered medical home. Adelante Mesa is a Center for Health Design Pebble research partner. The dynamic CEO had a clear vision of imperatives:

- Visibility and transparency—“we have no secrets”
- Natural light everywhere
- Quiet
- Ease of wayfinding with little signage
- Flexibility: clinic internal corridors connect, enabling departments to easily expand or contract according to daily volumes
- All exam rooms same-handed
- Aggregate women’s and children’s services
- No nurse stations: nurses need to be in exam rooms with patients
- Locate internal medicine in a quiet area, away from children with viruses and contagious diseases
- Provide amenities that support family presence
- Design exam rooms to enhance patient-provider interaction
- Private practice–type waiting areas—no bus station ganged seating

The health center offers family medicine, pediatrics, internal medicine, OB-GYN, WIC nutrition, dental, lab, café, pharmacy, and a multipurpose community room (see Figure 4-12). A collaborative program with a nearby vocational school provides internship opportunities for students in the health center and Adelante provides student health services.

The design theme of the lobby is water, an ode to the geologic events that shaped the surrounding desert canyons eons ago. It is expressed in “wave” shapes and forms, finish materials, glass mosaic tile at the welcome desk, the curvilinear form of the seating, and the color palette. Patients are greeted at a welcome desk in the lobby from which they are directed to their destinations (see Color Plate 10, Figure 4-16). All department reception areas are visible from the main circulation spine (see Figures 4-5 and 4-11), which makes wayfinding easy. Each department soffit has a different accent color, making it easy to give directions. The lobby has 24-foot-high ceilings and clerestory windows (see Color Plate 9, Figure 4-27).

The color palette for the facility beyond the lobby reflects desert colors of sage, buff, and adobe. The circulation spine has carpet tile as do the internal clinic corridors, but exam rooms have wood-look resilient flooring. A unique feature of the clinic is the use of talking rooms, based on the idea that (especially in general internal medicine) many individuals need not undress. A room with a table and chairs and no diagnostic instruments enables patients to relax more and it enhances the interaction with the provider. It gives patients the message that they do not have to define their problem medically in order to be helped. These multipurpose rooms have a closet for storage of

Figure 4-26a. Crawl-through caterpillar delights young children at Adelante Healthcare, Mesa, Arizona. *(Photo: Jain Malkin)*

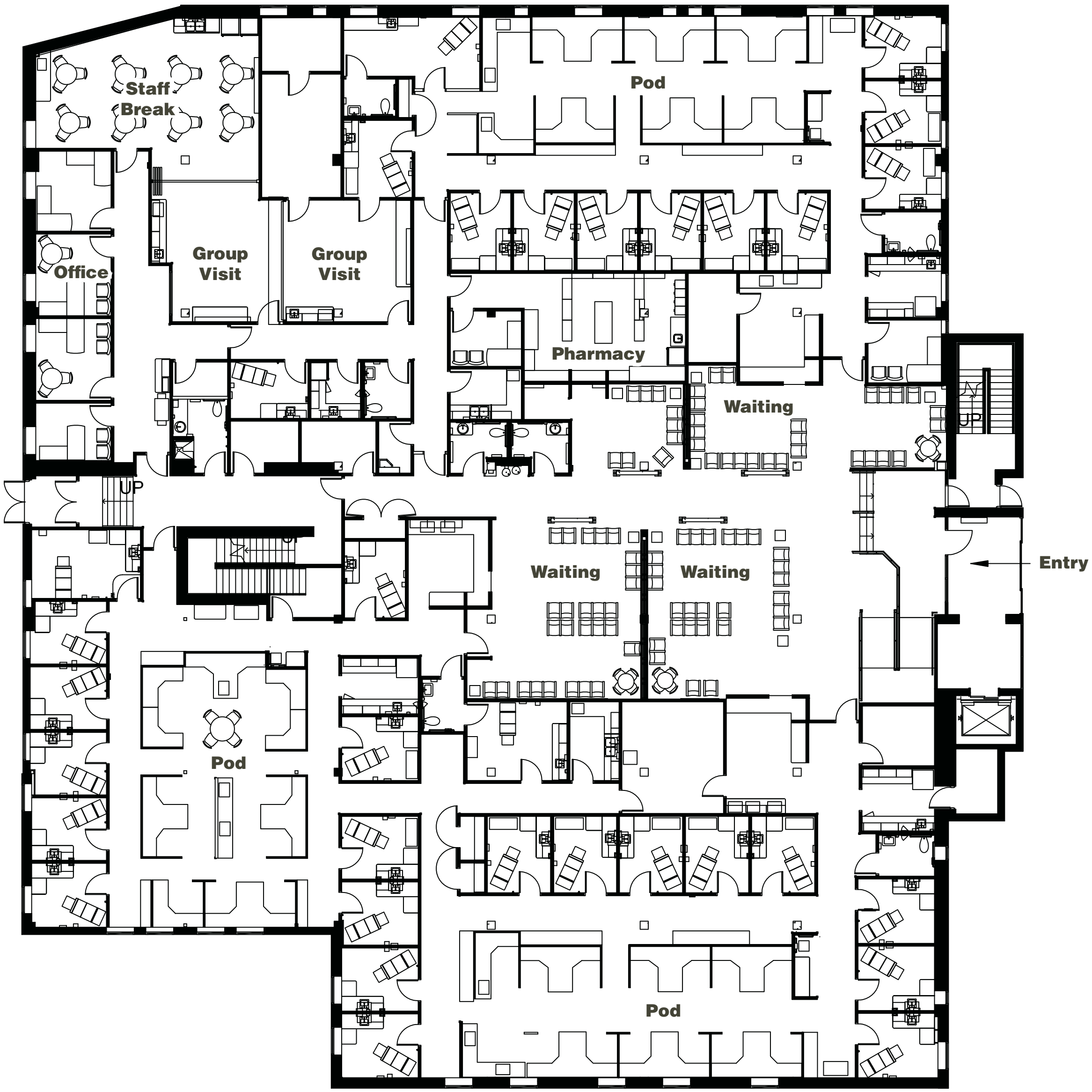
Figure 4-26b. "Exploration Interactive" art installation includes numerous textures, colors, words, mazes, and push buttons that activate backlit panels for exploration on many cognitive levels. Adelante Healthcare, Mesa, Arizona. *(Artist: Kristine Kolasch; Photo: By Artist.)*

Figure 4-27. Reception/lobby with clerestory windows and exterior view, Adelante Healthcare, Mesa, Arizona. *(Design: Jain Malkin Inc.; Cawley Architects; Dustin Revella Photography)*

Figure 4-28. Pediatric talking room for consultation with parents. A detailed pictorial mural is a positive distraction for children and enables providers to observe and assess developmental deficits. Adelante Healthcare, Mesa, Arizona. *(Artist: Kristine Kollasch; Dustin Revella Photography)*

a folding therapy table that can be used for osteopathic adjustments or for massage (see Figure 4-20). In internal medicine there are two talking rooms with an exam room in-between but in family practice and pediatrics, separate talking rooms are interspersed with exam rooms (see Figure 4-5). In pediatric talking rooms, a detailed pictorial mural is a positive distraction for children, and it also enables providers to observe and assess developmental problems (Figure 4-28). The reader is referred to a discussion of talking rooms in the section titled Primary Care in Chapter 3. There is ongoing research at Mayo Clinic and also at Adelante looking at enhanced throughput by not tying up an exam room with a patient who may be there to discuss lab tests or any number of issues that do not require an exam table. Figures 3-46a and b show the Adelante exam room with connecting door to a talking room. If, during the discussion, it is determined an exam table is required, it is immediately adjacent. The staff work as a team in a pod of rooms and therefore know when a room is available without a signal system. The mobile table in Figure 3-46a can be moved anywhere in the room to facilitate a discussion between the provider and patient.

Another research project, done in concert with the Center for Health Design, is the use of a large TV monitor in exam rooms (Figure 4-31) as a positive diversion to relax patients and also for entertainment and education.



PEOPLE'S CLINIC - COMMUNITY HEALTH CENTER
21,120 SF

Figure 4-29. Space plan for community health center, 21,120 square feet. Clinica Family Health Services/Peoples Clinic, Boulder, Colorado. *(Courtesy of Boulder Associates, Photographed by Boulder Associates staff)*

Second Floor Plan
Community Health Center of Central Wyoming | 101870.00

Figure 4-30. Space plan Community Health Center of Central Wyoming, 25,000 square feet. *(Courtesy of Boulder Associates)*

Figure 4-31. Interactive monitor in examination room is a positive diversion for patients with options for views of nature, entertainment, and education. Adelante Healthcare, Mesa, Arizona. *(Photo: Jain Malkin)*

Patients are able to choose whether they prefer nature images alone or with music, educational videos about a specific health topic, or entertainment. A device installed on the TV records their choices and how long they watched. The study will look at their selections and try to match them to outcomes with respect to measures of stress reduction.

In the women and children's waiting areas, a number of pieces of educational and interactive art pieces have been developed to engage children (see Figures 4-14, 4-26a and b, and 4-33).

Every community health center has to post, in a visible location near the entry or in the lobby, notices of patients' rights and other documents. These can occupy a great deal of room and they often have to be in more than one language and are required to be a minimum font size. Placing them between two pieces of Plexiglas (after they have been printed in a uniform way with borders that match) is an attractive solution (Figure 4-32).

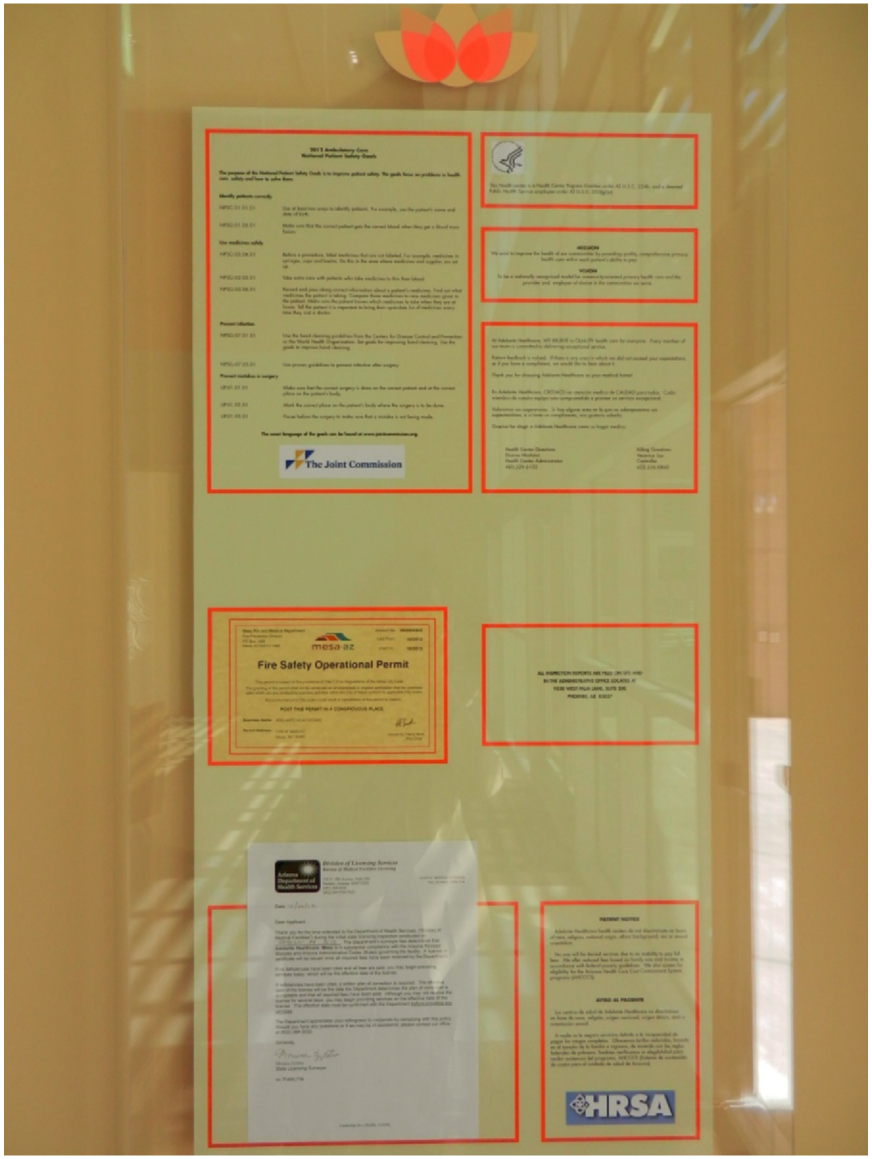


Figure 4-32. Patients' rights notices are visible upon entry to Adelante Healthcare, Mesa, Arizona. *(Photo: Jain Malkin)*

Figure 4-33. Interactive educational wall art keeps children entertained at Adelante Healthcare, Mesa Arizona. *(Source: i.d.e.a. Museum; Photo: Jain Malkin)*

Clinica Family Health Services/People's Clinic

Clinica Family Health in Boulder, Colorado is a Level 3 NCQA patient-centered medical home provider. It is an FQHC and also accredited by The Joint Commission. This 21,120-square-foot remodel follows a pod-based clinical practice concept resulting in three color-coded team office pods. Patients are assigned to a dedicated pod to ensure continuity of care and each of these has its own reception and waiting area to create a "clinic within a clinic" feel.

Within each pod a central provider "bullpen," ringed by exam rooms, provides easy visual coordination of patients and improved staff communication (see Figure 4-29). In addition, group visit rooms provide a means of leveraging peer empathy and support for patients coping with pregnancy, diabetes, smoking cessation, and a number of chronic disorders. Services offered are family practice, behavioral health, pharmacy, and family planning. The waiting area has an interesting ceiling and a wood-look resilient floor (see Figure 4-18).

SUMMARY

The look and feel of community health centers around the nation is as varied as the communities they serve. As seen in this chapter, many achieve an upbeat design aesthetic that belies the low budget for design and construction. Some have even garnered LEED certification. For many years community health centers were drab affairs that seemed a visual representation of the day-to-day grind of dedicated care providers serving people who have so little and deserve so much more. Isn't it great to see the change—facilities with such good planning and accommodation for care teams to collaborate and for all of this to occur in facilities that are aesthetically beautiful and colorful? This conveys to patients and staff alike that they are valued.

CHAPTER 5

Medicine: Specialized Suites

The American Board of Medical Specialties recognizes, as of this writing, 24 medical specialties and over 100 subspecialties. The specialties are Allergy and Immunology, Anesthesiology, Colon and Rectal Surgery, Dermatology, Family Medicine, Internal Medicine, Neurological Surgery, Nuclear Medicine, Obstetrics and Gynecology, Ophthalmology, Orthopedic Surgery, Otolaryngology, Pathology, Pediatrics, Physical Medicine and Rehabilitation, Plastic Surgery, Preventive Medicine, Psychiatry and Neurology, Radiology, Surgery, Thoracic Surgery, Urology, Emergency Medicine, and Medical Genetics.

Subspecialties under Internal Medicine are Cardiovascular Disease, Endocrinology, Diabetes and Metabolism, Gastroenterology, Hematology, Infectious Disease, Medical Oncology, Nephrology, Pulmonary Disease, Rheumatology, Adolescent Medicine, Clinical Cardiac Electrophysiology, Critical Care Medicine, Geriatric Medicine, and Sports Medicine. Subspecialties under Pediatrics are Pediatric Cardiology, Pediatric Gastroenterology, Pediatric Endocrinology, Pediatric Hematology-Oncology Neonatal-Perinatal Medicine, Nephrology, Pediatric Critical Care Medicine, Pediatric Emergency Medicine, Pediatric Infectious Diseases, Pediatric Rheumatology, Sports Medicine, Sleep Medicine, Medical Toxicology, and Adolescent Medicine. There are a few other subspecialties under Psychiatry and Neurology, such as Child and Adolescent Psychiatry, Pain Medicine, and Sleep Medicine.

Although Family Medicine, Pediatrics, and Internal Medicine are primary medical practices, they are also listed as specialties by the American Board of Medical Specialties, since physicians in these specialties must take and pass specialty boards that certify their competence in their respective fields. Those in these three “specialties,” then, are primary-practice physicians, whereas many of the other specialties listed above tend to be referral specialties—patients are referred by their primary care physicians.

This chapter will discuss the requirements of the medical specialties the designer or architect is most likely to encounter in a medical office building. It is assumed that the reader will have read Chapter 3, which is the foundation for Chapter 5.

As a general comment, the same economic pressures and regulatory issues that have affected primary care physicians have impacted specialty care except for a few specialties like reproductive medicine/IVF, dermatology (especially practices focused on cosmetic procedures), and plastic surgery, which are for the most part paid out of pocket by the patient. In recent years, physicians have wanted to do as many tests as possible in their offices to capture the additional revenue. Today, in many parts of the United States, reimbursement is so low that the more procedures one does, the more one loses. Medicare is the largest payer in the United States, and what it will or will not cover and the amount it pays influences other payers as well as the types of procedures physicians are willing to do in their offices. If it’s not reimbursed, the patient may be referred to the local hospital for the procedure. This is especially true if the investment in equipment is large and the regulatory documentation for the procedure is burdensome; if the reimbursement is low, physicians are likely to refer patients elsewhere.

SURGICAL SPECIALTIES

To avoid redundancy, certain issues common to all surgical specialties with respect to minor surgery rooms and office-based outpatient surgery suites will be discussed here, rather than under each specialty heading. However, the

Plastic Surgery section has the most complete discussion of office-based surgery (OBS) suites in terms of layout and design issues. The three levels of surgery discussed below are designated by the American College of Surgeons (ACS) as Classes A, B, or C (www.fasc.org) and Levels I, II, or III in the State of Kentucky "model" document on the ACS website (www.facs.org/ahp/kyOBSguide12.03.pdf). The wording is different in each of these documents but similar in content. The document from the state of Kentucky is referenced here because it provides explanatory background that may be interesting to some readers and it came up numerous times in the author's research on this topic. States will vary in their approaches to regulating OBS and the design professional needs to be familiar with the jurisdiction in which they are working. A physician's authority to perform procedures in an office is established by that practitioner's license to practice his or her profession, and it is expected that this will be carried out according to current standards of care but documentation of those standards may or may not exist in a specific state. When a practitioner seeks Medicare certification or accreditation by one of three national agencies, it imposes a level of patient safety and regulation. This will be discussed in detail under the Plastic Surgery specialty. The reader is also referred to the well-established *Guidelines for Design and Construction of Health Care Facilities* (2010), published by the Facility Guidelines Institute, Section 3.8: "Specific Requirements for Office Surgical Facilities."

Office Surgery/ACS Class A

Physicians with specialties in OB-GYN, otolaryngology (ENT), ophthalmology, dermatology, plastic surgery, general surgery, urology, and occasionally, orthopedic surgery, will have a minor surgery or special procedures room where they may use local or topical anesthetics not involving drug-induced alteration of consciousness and this requires no special accommodation other than generally accepted standards of care, resuscitation equipment (in some jurisdictions), and staff trained to respond to patient safety emergencies. Chances of complications are remote.

Office Surgery/ACS Class B

Level II procedures may require the use of minimal to moderate intravenous or intramuscular sedation making postoperative monitoring necessary. Endoscopy procedures, for example, are often done with conscious sedation, which involves intravenous (IV) sedatives like Valium® often combined with an agent that acts like an amnesiac so that the memory of pain is erased. When conscious sedation is administered, monitoring equipment and a resuscitation cart are required. Urologists now infrequently use this type of sedation when performing cystoscopies, as many physicians are reluctant to assume the liability and risks of using conscious sedation in their offices unless they do many procedures that require it and have properly trained staff to monitor patients. As an option, a surgeon may contract with an anesthesia service to assist in a procedure. An anesthesiologist or nurse anesthetist with a portable anesthesia machine will come to the surgeon's office as scheduled.

The American College of Surgeons defines Class B as "provides for minor or major surgical procedures in conjunction with oral, parenteral, or intravenous sedation or under analgesic or dissociative drugs."

Office Surgery/ACS Class C

Procedures requiring deep sedation, general anesthesia, or major nerve block and in which the known complications have the potential to be serious and/or life-threatening, and for which support of vital bodily functions is necessary.

Office-Based Surgery

The American College of Surgeons defines office-based surgery (OBS) as "any surgical facility organized in or for the surgeon's office for the purpose of providing invasive surgical care to patients with the expectation that they will be recovered sufficiently to be discharged within a reasonable amount of time" (www.facs.org).

Plastic surgeons are the most likely physicians to have an office-based surgery center within their suites, followed by dermatologists and, occasionally, otolaryngologists. Pain management specialists, such as physiatrists and anesthesiologists, do interventional procedures that are considered office-based surgery, and gastroenterologists perform a number of endoscopic procedures, usually in an endoscopy center designed to office-based surgery center standards. As statutes and codes vary widely from state to state, the following comments reflect national trends driven by the Centers for Medicare and Medicaid Services (CMS) for facility certification or the Accreditation Association for Ambulatory Health Care (AAAHC) accreditation. See also Chapters 8 and 14 for more in-depth discussion of regulations and codes.

As a prelude, it should be noted that physicians setting up office-based surgery suites have historically had considerable flexibility in the layout of these facilities, generally trying to fit two pounds of program into a one-pound container. Operating room sizes, space around each recovery bed, and ancillary rooms (clean and soiled utilities, scrub area, staff and patient dressing areas) have been left largely to the discretion of the physician, sometimes resulting in "funky" layouts. One may find a "prep room" in which clean and soiled utilities are accommodated side by side, rather than in separate rooms. Minimum-width corridors and clearances may also have been compromised. Unless physicians seek Medicare certification in order to be able to bill a fee for the use of the facility (in addition to the surgeon's fees), they may be able to avert close scrutiny on these issues, although professional societies such as the American Society of Plastic and Reconstructive Surgeons have spoken out boldly about the risks to patients in facilities that have not been designed to meet minimum standards required by accreditation agencies (Iverson 2002)[1]. As of this writing, 27 states have regulations and standards for office-based surgery settings (Mowles 2012)[2] often incorporating guidelines developed by the American College of Surgeons (ASC) (www.facs.org/commerce/guidelines.html). [A "free" copy of the document *Guidelines for Optimal Ambulatory Surgical Care and Office-based Surgery*, Third edition, 2000, may be accessed from the website of the American Urological Association (www.auanet.org/resources/office-based-surgery/office-based-surgery.cfm).] For the past decade, surgery performed in office-based settings has attracted the attention of state legislators and regulators throughout the nation. Individual professional societies, however, may not always embrace the notion of what they view as overly burdensome requirements, as evidenced by this letter from the American Society of Dermatologic Surgery Association to a policy analyst at the Oregon Medical Board on the occasion of Oregon's move toward mandatory accreditation for minimally invasive outpatient surgery (Flynn 2013).[3]

The Joint Commission stepped up to the plate with its Office-Based Surgery (OBS) Standards, approved 2001, intended for physicians and dentists performing operative and invasive procedures in an office setting. To be eligible for accreditation under the OBS standards, a provider must meet all of the following criteria:

- The practice comprises four or fewer licensed surgeons performing operative or invasive procedures.
- The organization or practice must be surgeon-owned or operated such as a professional services corporation, private physician practice, or small group practice.
- Invasive surgical services are provided to patients and local anesthesia, minimal sedation, conscious sedation,

[1] Ronald E. Iverson et al., "Patient Safety in Office-Based Surgery Facilities: 1. Procedures in the Office-Based Surgery Setting," American Society of Plastic and Reconstructive Surgeons, Vol.110 (5) April 2002: 1337–1342.

[2] Amy Mowles, "Accreditation for Office Based Surgery vs. Ambulatory Surgery Centers: Frequently Asked Questions" published online in Becker's ASC Review, November 13, 2012 (beckersasc.com/news-analysis/accreditation-for-office-based-surgery-vs-ambulatory-surgery-centers-frequently-asked-questions.html), retrieved August 13, 2013.

[3] Timothy Flynn, Letter January 7, 2013 regarding Oregon's move toward mandatory accreditation for minimally invasive outpatient surgery, American Society for Dermatologic Surgery (asdsa.net/uploadedfiles/ASDSA/office-based_surgery/ASDSA-ORrulecomment2013.pdf), retrieved July 20, 2013.

or general anesthesia is administered. Laser eye surgery and dermatological procedures using topical anesthesia qualify.

- OBS practices that render four or more patients incapable of self-preservation at the same time are required to meet the provisions of the Life Safety Code, NFPA 101, of the National Fire Protection Association (NFPA).

Office-based surgery suites often fall into a "gray area" in terms of codes. For example, the Uniform Building Code (UBC) classifies them as a "B," or office occupancy, if fewer than five individuals are incapable of self-preservation, which limits the enterprise to two ORs and three recovery beds or one OR and four recovery beds. (NFPA 101 limits it to four persons or fewer.) The local department of public health will, in many jurisdictions, send an inspector to review life safety issues, and this individual may demand accommodations that go beyond what is stipulated in the local building code and in NFPA 101® Life Safety® Code.

An example might be that the surgery portion of the suite be separate from the physician's office practice with a dedicated entry and reception office. This seems unwarranted in a one-physician practice in which the doctor can only be in one place or the other. However, from the standpoint of patient safety, in theory, nothing would preclude the physician from allowing an "outside" physician to see patients while he or she is performing surgery, and the front office staff might be distracted when called upon to assist in an emergency to evacuate a patient. Nevertheless, this results in the need for additional staff and additional space, which might exceed the physician's budget.

A good place for a design professional to start is to reference the *Guidelines for Design and Construction of Health Care Facilities* (2010), Section 3.8, for requirements for office surgical facilities.

Physicians will want to be accredited by one of a number of possible agencies that vary, in terms of physical design considerations, from flexible to rigorous. See the Plastic Surgery section for more detail.

To reflect the range of options the architect or designer may encounter, the suite plans in this book demonstrate both types of office-based surgery suites—those that meet physicians' functional needs but may be somewhat idiosyncratic in layout, and those meeting more rigorous standards, which is where things are headed.

OBSTETRICS AND GYNECOLOGY

This is a high-volume practice, so patient flow must be carefully analyzed. Obstetrical patients usually make monthly visits, which entail weighing and a brief examination. Gynecology patients require a more lengthy pelvic examination. This type of practice requires a large staff, as each physician needs one or two nurses; often, two physicians share three nurses or aides in addition to the front office staff. It is customary for a female nurse to be present during pelvic examinations, necessitating more staff per doctor than required with many other medical specialties. Figure 5-1 shows the relationship of rooms.

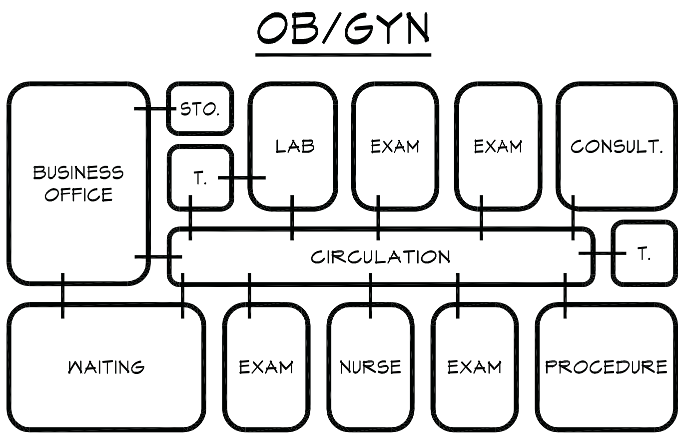


Figure 5-1. Schematic diagram of OB/GYN suite.

Nurse Practitioner

A trend in this field is the use of nurse practitioners and midwives to perform routine patient examinations. A registered nurse (R.N.) with additional training in OB-GYN can be certified to work in this capacity (refer to Chapter 3 for more detail). This frees physicians from routine pelvic examinations and Pap smears on healthy patients, allowing them to concentrate on diagnosis of disease. Offices using nurse practitioners will need larger nurse stations or perhaps a small private office for them (Figure 5-2).

Patient Flow

There probably would not be more than three doctors working in an office at one time, even if it were a four- or five-person practice, since one or two doctors may be delivering babies, making hospital rounds, or taking the day off. There should be three to four exam rooms per physician. The patient flow is from waiting room to weighing area, to toilet (urine specimen), to exam room. A good space plan will channel patients to each area by the most direct route with no backtracking or unnecessary steps. If possible, the nurse station/sterilization/lab areas should be located toward the front of the suite (centralized) so that the staff can cover for each other, and duplication of personnel is avoided.

Waiting Room

The waiting room of an OB-GYN suite should be large and comfortable. Unexpected deliveries frequently make the doctor late and necessitate a long wait for patients. The patient is apt to be more forgiving if her wait is in a well-designed room with good lighting, current magazines, comfortable seating, and interesting artwork on the walls. A play area for children would be a practical addition to the waiting room, since many patients are young mothers who are apt to bring their children with them.

Table 5-1.
Analysis of Program
Obstetrics and Gynecology

No. of Physicians		1		2
Exam Rooms	3@	10 × 12 = 360	7 @	10 × 12 = 720
Exam/Ultrasound		10 × 12 = 120	2 @	10 × 12 = 240
Consultation Room/Private office		10 × 12 = 120	2 @	10 × 12 = 240
Nurse Station[a]		10 × 10 = 100	2 @	10 × 10 = 200
Laboratory		—		8 × 10 = 80
Toilets	2@	8 × 8 = 128	3 @	8 × 8 = 192
Minor Surgery		12 × 14 = 168		12 × 14 = 168
Equipment or Soiled Utility		60 SF		60 SF
Staff Lounge		10 × 12 = 120		12 × 12 = 144
Storage		6 × 8 = 48		6 × 8 = 48
Nurse Practitioner		—		8 × 10 = 80
Business Office[b]		16 × 18 = 228		16 × 18 = 228
Office Manager				8 × 10 = 80
Surgery Scheduling		8 × 10 = 80		8 × 10 = 80
Waiting Room		14 × 20 = 280		20 × 25 = 500
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20
Biohazard		4 × 4 = 16		4 × 4 = 16
Subtotal		1,848 SF		3,096 SF
20% Circulation		369		619
Total		2,217 SF		3715 SF

[a]Combined with lab.
[b]Includes reception, appointments, bookkeeping, and insurance/collections.

Note: The nurse practitioner counts as another provider.

Exam Rooms

Exam rooms may have painted walls or vinyl wallcovering, perhaps a wood-look vinyl floor, and a dressing area where patients may disrobe in privacy and hang underwear out of sight. Upon dressing, they may check makeup and hair in a mirror before leaving the exam room. This dressing area can be a 3 × 3–foot corner of a room with a ceiling-mounted cubicle drape and a chair or built-in bench. Or, it can be a hinged space-saver panel

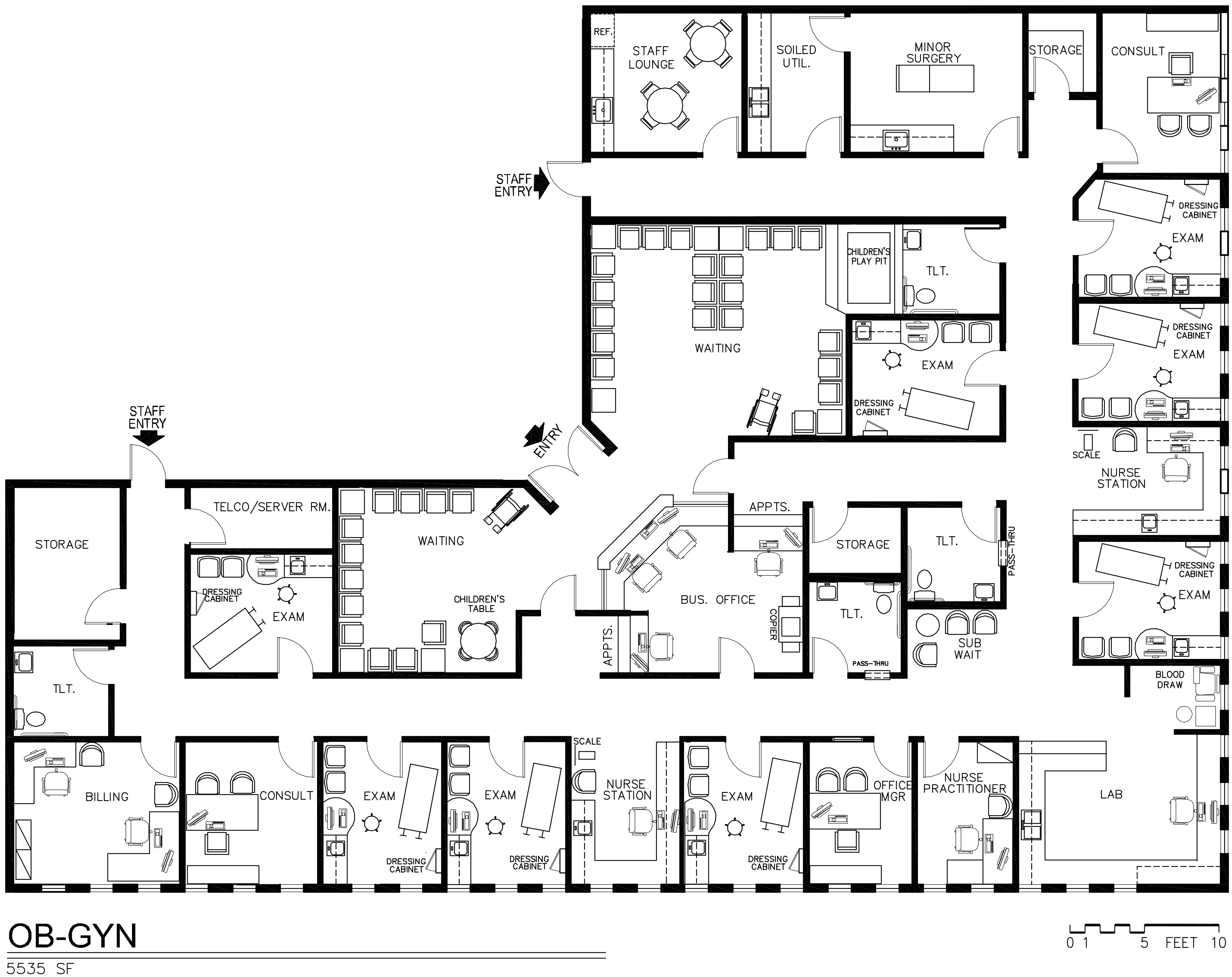


Figure 5-2. Space plan for OB/GYN suite, 5,535 square feet. *(Design: Jain Malkin Inc.)*

that opens perpendicular to the wall (see Figure 3-51). Remember that the door to the exam room must open to shield the patient.

The size of an OB-GYN exam room may be 8 × 12 feet but this width is tight, especially if the casework has an area for a monitor and a place for the patient and physician to sit side by side to view the monitor. A room 10 × 12 feet is desirable and allows the physician to remain in the room while the patient dresses behind a curtain in order to chart and write a prescription as depicted in Figure 5-3. Allow space for a printer in the nurse station to print the prescription and other notes to be handed to the patient upon exit.

The orientation of the room should allow the physician to be on the patient's right side although most of the activity occurs at the end of the table. In Figure 5-4 because two exam rooms share a bathroom, the orientation is mirror-image due to having achieved a higher goal of immediate access to a bathroom.

The position of the sink cabinet is particularly important in an OB-GYN exam room because many items are dropped into it during the procedure. Not much countertop space is needed except for a sit-down workstation to be able to enter data. The physician should be able to examine the patient with the right hand and reach for instruments from the cabinet or Mayo stand with the left hand (see Figure 5-3). The sink should be positioned close to the end of the exam table. The type of exam table used here is a pelvic table with stirrups. Such tables often have a built-in speculum warmer. Alternatively, one drawer of the sink cabinet may have an electrical outlet at the rear for warming instruments. However, the increasing use of disposable specula will soon make this a nonissue. Three electrical outlets are required: One must be located near the foot of the table for the examination lamp used for pelvic exams; one should be located above the sink countertop; and the third should be located on the long wall, near the head of the table. There is no need for wall-mounted diagnostic instruments in this medical specialty.

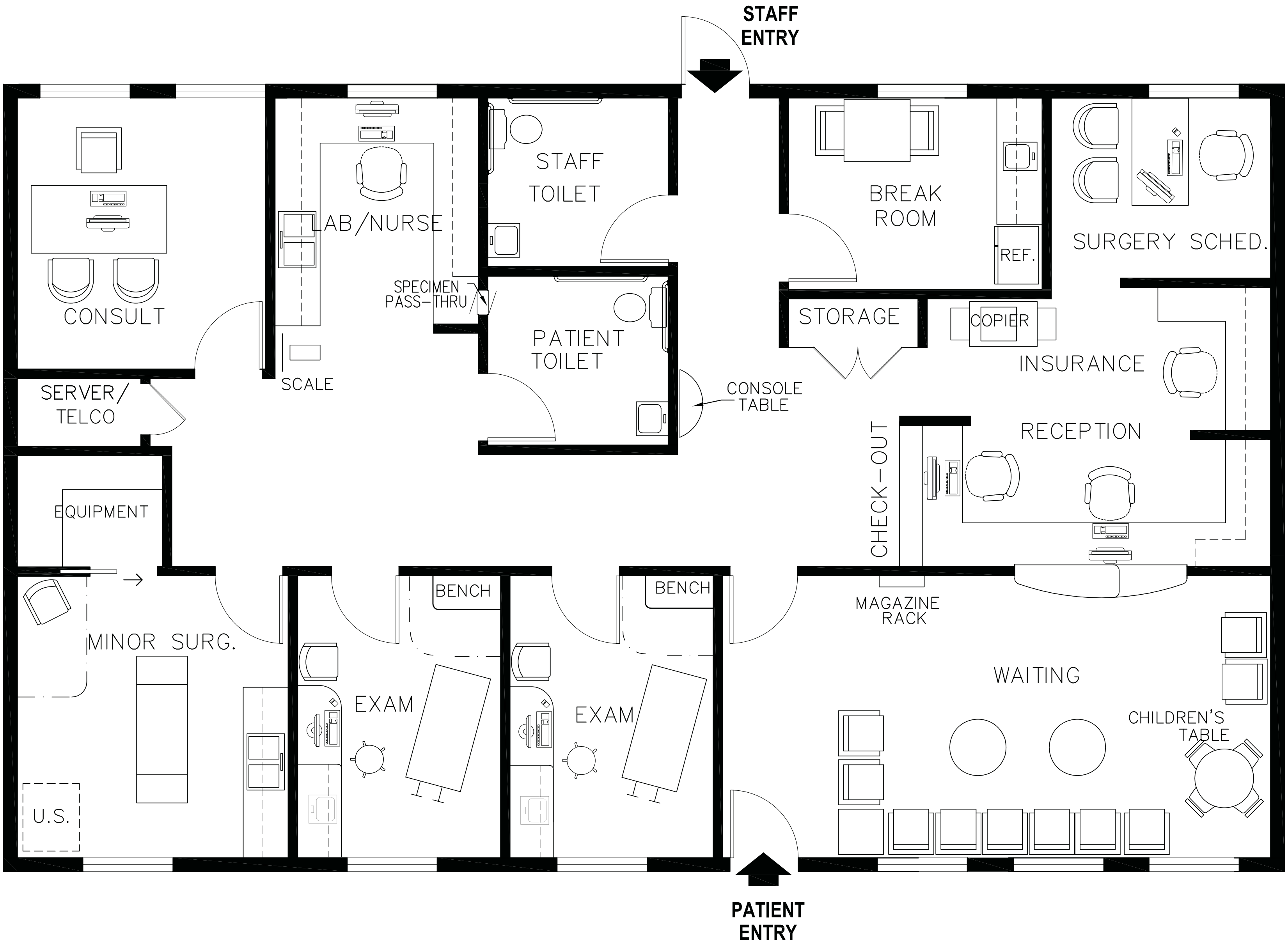
It is pleasant to have windows in an OB-GYN exam room. The wait is frequently long and being able to look outside makes the wait a little more pleasant. Vertical blinds or mesh shades serve exam rooms well since they permit light and view to enter the room while protecting the occupant's privacy.

Minor Surgery/Special Procedures

OB-GYN suites will have a minor surgery room where a variety of procedures are performed (see Figures 5-2 and 5-3). See also Figure 3-5, although it is not specifically set up for OB-GYN, the accompanying text addresses it. The plan in Figure 5-3 shows a procedure room with an equipment storage room opening off of it. The sink should be a large one with foot pedal control that can be used as a scrub sink. Special procedure rooms such as this always have a sink in them; however, it should be noted that operating rooms such as may be found in plastic surgery or dermatology suites would not have a sink, as regulatory agencies would view this as a breach of infection control. Sinks and drains are considered a potential source of pathogens.

Types of Procedures

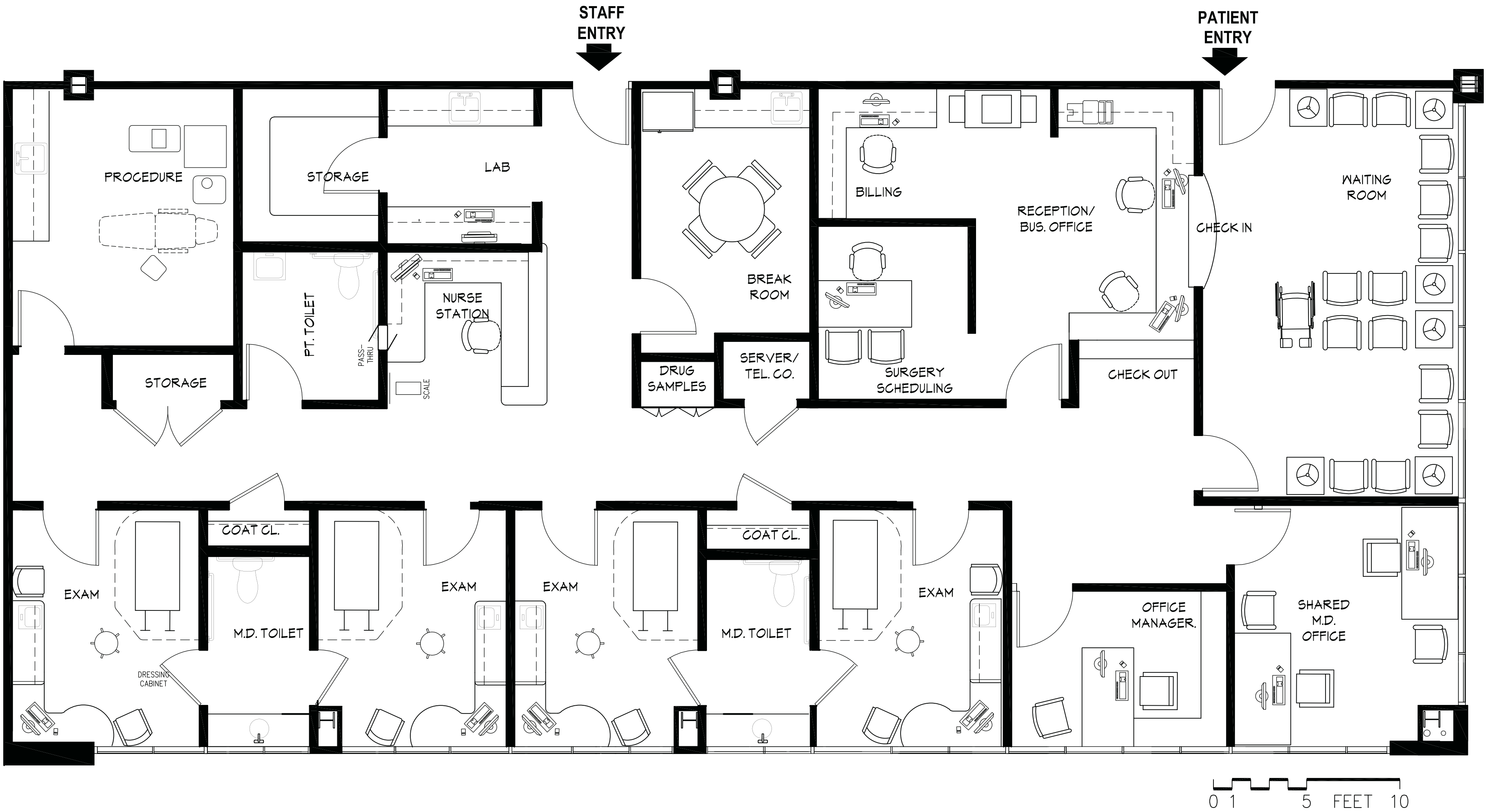
The kinds of procedures that may be performed in this room include (if the gynecologist has a subspecialty in urology) cystoscopies, hysteroscopies (examination of the uterus with a fiber-optic scope), D&Cs, colposcopies (examination of the cervix with magnification), and LEEP (loop electrosurgical excision procedure), which replaces core biopsies. The colposcope (Figure 5-5a) and all other equipment are portable. A version of this equipment is available with video and direct upload to an EHR. The LEEP equipment generates smoke, requiring a smoke evacuation machine (Figure 5-5b) that can be stored in the equipment room. Colposcopy and LEEP can also be performed in a standard exam room. Sedation is not required, which negates the need for a recovery area. Suction (may be central or portable) is required in this room, but other medical gases are not. The room may have a video monitor associated with the colposcope or other fiber-optic scopes, in which case glare on the screen from windows or light fixtures may be a problem. The video



OB-GYN

1900 SF

Figure 5-3. Space plan of OB/GYN suite, 1,900 square feet. *(Design: Jain Malkin Inc.)*



UROGYNECOLOGY

2660 SF

Figure 5-4. Space plan urogynecology suite, 2,660 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-5a. Colposcope is used for examining the cervix with magnification. This example is manufactured by Leisegang Optik™. *(Images provided by Cooper Surgical)*

Figure 5-5b. Laser smoke evacuation machine, a product of Laservac 750™. *(Photograph courtesy of Walker Filtration Group)*

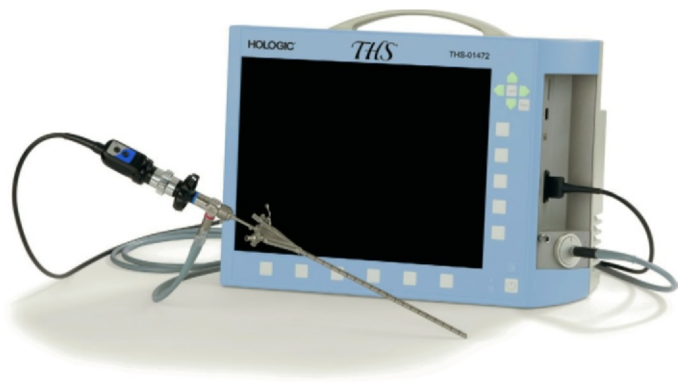


Figure 5-6. THS® tower-free hysteroscope system used to examine the uterus with a fiber-optic scope. *(Courtesy of Hologic Inc.)*

monitor enables the patient to view the procedure and, with a printer, an image can be captured as a still photo for future reference. With a telemedicine connection, video images can be viewed at remote locations. Lighting in this room should be able to be dimmed if video monitors are used. The Hologic *THS®* hysteroscopy system (Figure 5-6) also uses a fiber-optic scope.

Note that fiber-optic scopes need to be disinfected after use. A specific cleaning process is followed. In many practices this will be done manually, first washing the scopes in a sink and later soaking them in a strong chemical solution in tubs that sit on the counter. Refer to Chapter 3, Endoscopy, and to Urology in this chapter for further discussion.

Room Size

The size of the room may vary from 12 × 14 feet to 14 × 16 feet, depending on the number of assistants who must be in the room and the amount of medical equipment. Usually, an adjustable-height standard procedure table, as in Figure 3-61 would be used, however, a gynecologist with a specialty in urology—a urogynecologist—would use a urodynamics procedure chair in this room.

Ultrasound

A common piece of equipment in an OB-GYN office is an ultrasound machine, which is used to observe the developing fetus and also to image growths such as fibroids and cysts. It requires a trained sonographer. The room should be located close to a bathroom, as women are usually asked to drink a large quantity of water prior to the procedure and, immediately after, will need to void. Although this equipment is portable, it is large (Figures 5-7 and 5-8) and awkward to move from room to room. It is usually placed in a large (10 × 12–foot) exam room that can also be used for standard examinations (Figures 5-9 and 5-10). Small ultrasound units are becoming increasingly popular and can be tucked into a corner of a small exam room or, in the case of the SonoSite (see Figure 3-84) can be carried from room to room. Smaller machines may not offer the detail provided by the larger machines but that is a clinical decision. Ultrasound rooms need dimmable lighting. Two guest chairs should be provided for family members who want to "experience" the heartbeat of the fetus. An ultrasound room should have lighting that can be dimmed.

Figure 5-7. Ultrasound machine, Acuson SC2000. *(Copyright © Siemens Healthcare 2013)*

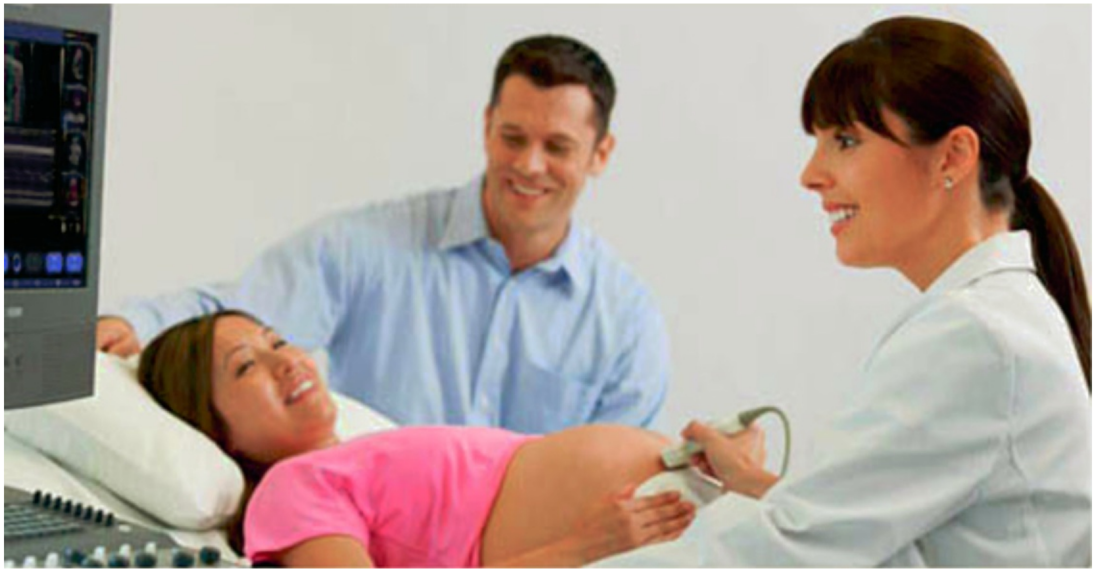


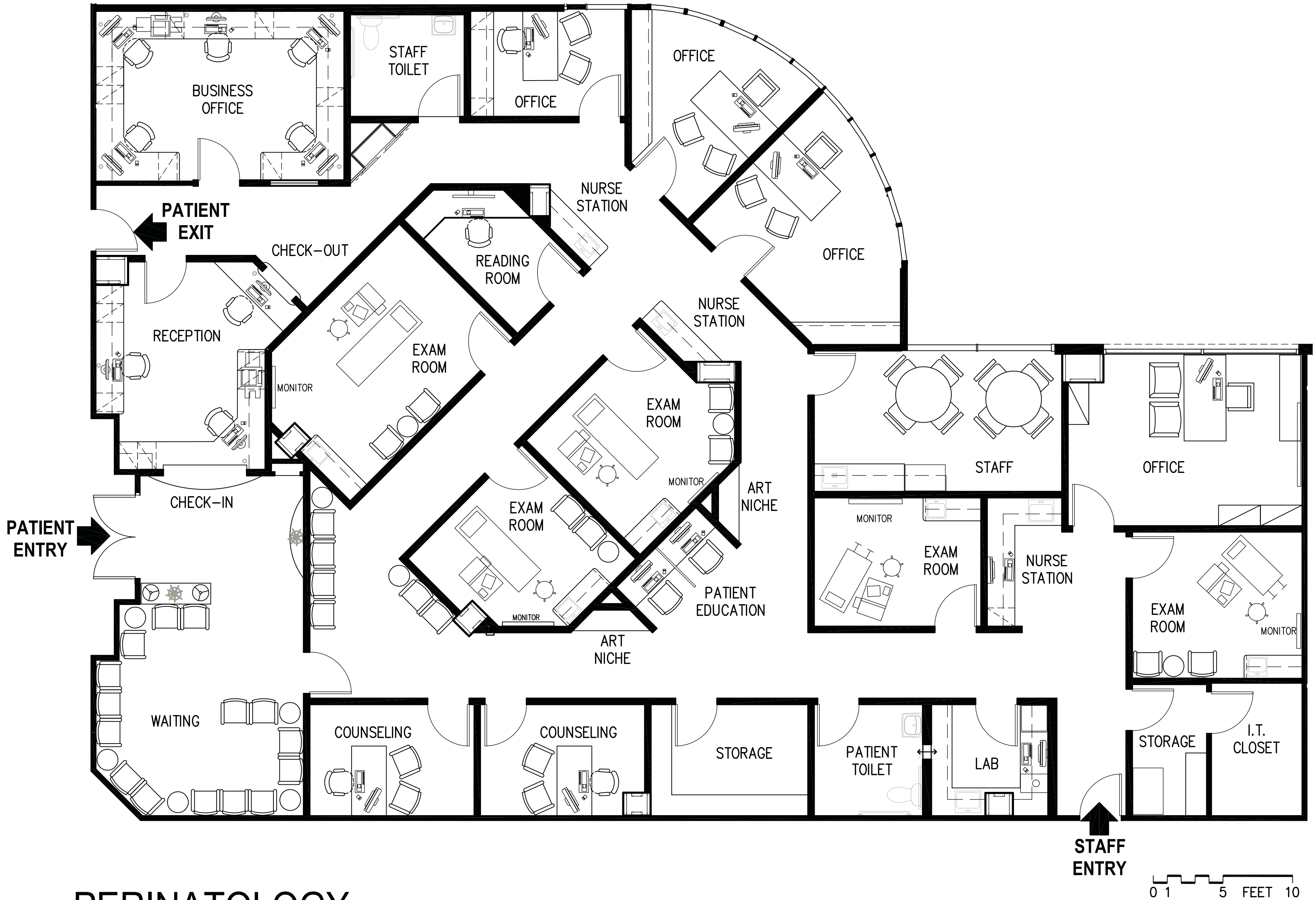
Figure 5-8. Fetal monitoring with ultrasound. *(Copyright © Siemens Healthcare 2013)*

OB/GYN and Office-Based Surgery Center

The office in Figure 5-10 functions as a primary care provider to women with a focus on OB/GYN. The practitioners are OB/GYN physicians whose goal is to provide total care to their patients, many of whom are executives and others associated with the film industry due to the office's proximity to the film studios. An accredited, licensed office-based surgery center is made available to other physicians in the MOB and also serves this medical practice. Each exam room has a large ultrasound machine.

Patient Education

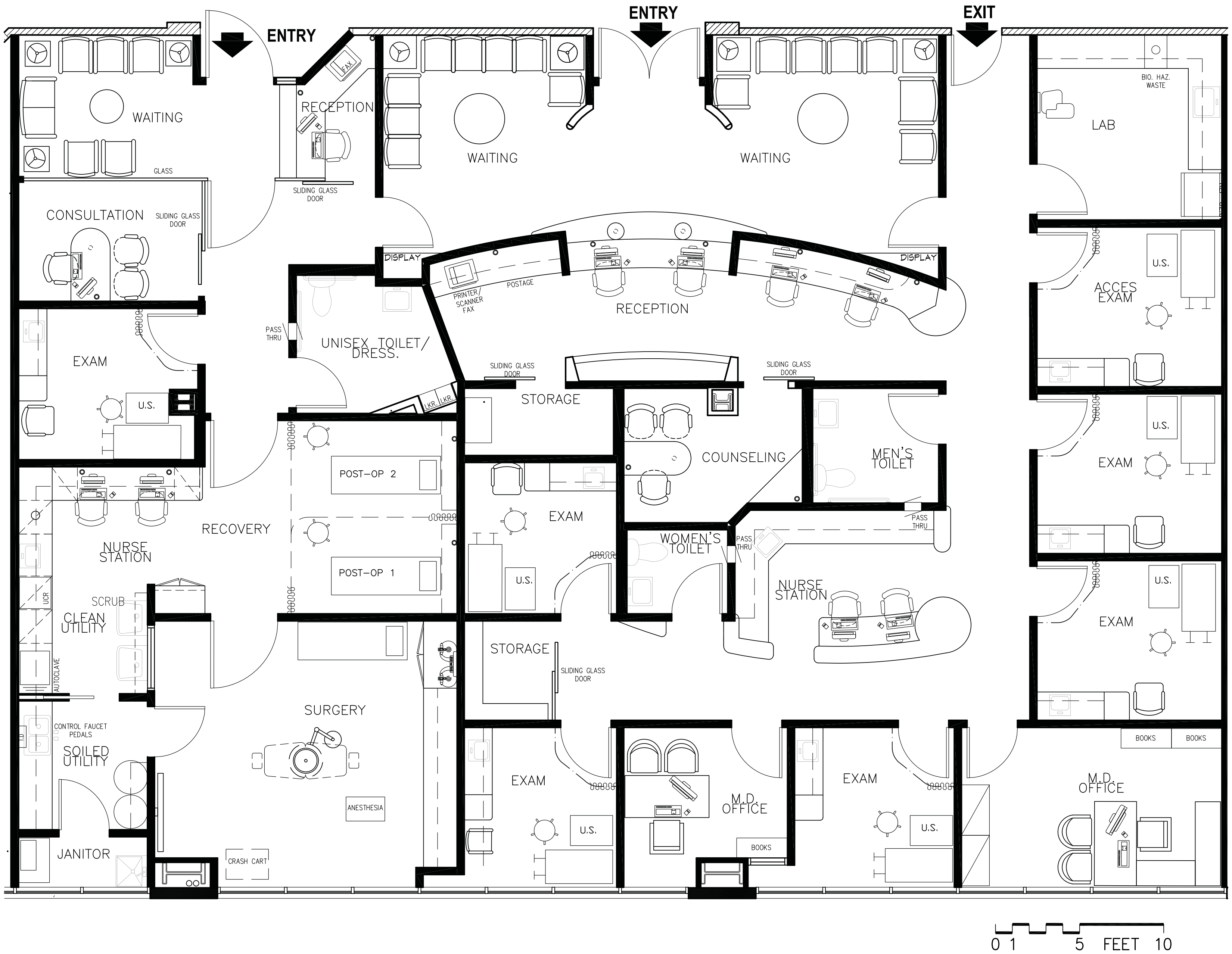
Many printed educational pamphlets are distributed, so suitable storage racks should be provided in the waiting room or in the corridor near the nurse station. (Despite the availability of online reference material and educational websites, printed brochures still exist.)



PERINATOLOGY

4070 SF

Figure 5-9. Space plan for perinatology suite, 4,070 square feet. *(Design: Jain Malkin Inc.)*



OFFICE-BASED SURGERY / OB-GYN

3488 SF

Figure 5-10. Space plan for office-based surgery and OB-GYN, 3,488 square feet. *(Design: Jain Malkin Inc.)*

Disposal of Infectious Waste

A large amount of trash is generated in this practice. A disposable gown, sheet, and exam table paper must be discarded after each patient, as well as paper hand towels and other disposable items. Each exam room should have a large trash receptacle, which may be built into the cabinet or freestanding.

It should be noted that many cities, as well as OSHA, have regulations for dealing with infectious waste. These used to apply only to hospitals, but with the presence of HIV and other "super" viruses, medical offices are also required to separate their trash (refer to Chapter 3, OSHA Issues). Provision has to be made in the examination room for two receptacles. Paper from the exam table, paper towels, and wrappings from disposables could go into one container, and items coming into contact with patients' body fluids would be disposed of in a "red-bagged" infectious waste receptacle. (These bags must be labeled to indicate they contain infectious waste.) See Figure 3-53b for an attractive container.

Specimen Toilets

Since each patient must empty her bladder before an examination, an OB-GYN suite needs a minimum of two toilet rooms. If it is possible to locate the toilet rooms near the nurse station or lab (see Figures 5-3 and 5-4), a specimen pass-through in the wall can eliminate the need for the patient to carry the urine specimen to the nurse station. Toilet rooms need a hook for hanging a handbag and coat, a shelf for sanitary napkins and tampons, and a receptacle for sanitary napkin disposal. It would be a nice touch to use a decorative vinyl wallcovering and/or attractive ceramic tile in the bathrooms along with a piece of art.

Laboratory

The laboratory should be at least 10 × 12 feet and must include a sit-down space for a microscope and a countertop space for centrifuge and an autoclave. Space should be allotted for an undercounter refrigerator. If the physicians elect to do a good deal of lab work in the suite, include a blood draw area and adequate countertop space for an automated clinical analyzer. The reader is referred to Chapter 3 for a discussion of CLIA regulations and an explanation of why physicians do little lab work in their suites these days.

Urogynecology

Gynecologists with a subspecialty in urology are called urogynecologists (see Figure 5-4). This is also referred to as *women's pelvic floor medicine*. Although in many respects their offices are similar to OB-GYN offices, there are some differences in the types of tests and procedures performed. Women with overactive bladders may receive cystoscopic injections of Botox in the bladder. This requires a sink and countertop for preparing the injection. Other procedures include endoscopic urethral injections for incontinence. Urodynamic studies require a minor procedure room with immediate access to a toilet. These are bladder function studies that require a catheter in the bladder and rectum and a portable flow meter nearby. A specialized, motorized urodynamics chair is used in this room. Another method of treating urge incontinence involves posterior tibial nerve stimulation using an acupuncture needle near the ankle. This 30-minute treatment can be done in a recliner chair, but one may not want to tie up a room devoted to this alone, in which case an exam table can be used. The room designated for this needs to be near the urodynamics procedure room because typically the same nurse does it. Some practices are bringing in a physical therapist to treat pelvic floor disorders. Treatment can be performed in a small room with a physical therapy–type flat table; no sink is required. In this practice an ultrasound machine may be moved from room to room, which means it needs to be stored in a closet with a lockable door. In this specific practice, patients change clothes behind the drape. After the procedure, the physician charts at the desk while the patient dresses, and then they sit together and chat.

An office for surgery scheduling is required in this suite. It should provide a private place for patients to schedule and discuss surgeries.

Perinatology

Obstetricians may have a subspecialty in maternal fetal medicine focusing on the care of the fetus and complicated high-risk pregnancies. Large exam rooms are required as each will have a large ultrasound machine placed at the patient's right side and a large 55- or 60-inch flat screen monitor mounted on the wall in a location and height where the patient and family can see it, which is typically on the patient's left side (see Figure 5-9). It is not mounted in front of the patient because it is hard for patients to see over their bellies, especially with multiple fetuses. Images from the ultrasound exam are shown on the monitor and also accessible from the physicians' reading room, usually viewed on a large screen. If something abnormal is detected, he or she will come into the exam room to discuss it with the patient or the consultation may occur in a private office. Offices for genetic counseling need to be provided. Tests for Down Syndrome and other risk factors are evaluated. Patients and families may experience considerable stress both prior to and after the examination, whether in anticipation of how things are going or perhaps after finding out that something is amiss, the worst of these being the news of a miscarriage. The office design should incorporate a number of positive distractions and stress-reduction features, have a soothing color palette, and comfortable seating. Remember that ultrasound rooms need to have dimmable lights—in this case, that means all exam rooms.

Interior Design

Physicians in this specialty often like a well-designed consultation room, although it is rare for patients to be escorted to this room at the end of an examination because it slows down patient flow. Therefore, this room functions as a private office for a physician. The room may be designed along the lines of a residential library or den, with a wood floor and Oriental rug, bookshelves, fabric wallcovering, elegant upholstery fabrics, and a unique desk. Window treatment, likewise, may be more like one would find in a residence rather than in a medical office.

The waiting room, as well as the rest of the suite, ought to be designed to appeal to women. This may take the form of sunny colors and a garden theme with floral upholstery fabrics, or it may be elegant and sophisticated (see Color Plate 10, Figure 5-11). If a physician's leanings are traditional, the style could be formal with wood moldings, Chippendale chairs with petit point upholstery, fabric wallcoverings, and Oriental rugs on a wood floor. Or, the physician's style might be less formal—country French. The options are many. This specialty allows the designer a great amount of freedom; obstetricians and gynecologists usually like to present a well-decorated office to their patients. Whatever the design style, chairs should not be so soft or so low that it is difficult for pregnant women to disengage themselves.

In summary, the patients here—due to the nature of the specialty—are generally happy, and this upbeat mood should be enhanced by the interior design. All rooms except exam rooms, laboratory, minor surgery, and toilets may be carpeted.

BREAST CENTERS

Historically, mammography screening has been available to women in diagnostic imaging (radiology) centers and, occasionally, in the offices of large OB-GYN practices. In recent years, however, more comprehensive breast care services have been provided in specialized facilities that offer women more psychosocial support and a full range of services, should they be diagnosed as symptomatic. Even when mammography is part of a diagnostic imaging suite, the goal is usually to separate it from the other imaging modalities, creating a separate entrance and identity (see Figures 6-14 and 6-16).

Figure 5-11. Waiting room, ophthalmology office. *(Photo courtesy of Ann Asher, Inc., Los Angeles, California; Photographer: Ron Solomon Photography)*

Depending on the anticipated volume of procedures and the potential as a feeder to oncology services, the breast center may be totally independent of diagnostic imaging, having its own ultrasound, mammography, and stereotactic rooms, as well as reading areas. The proliferation of well-designed, high-profile breast centers in recent years is a reflection of the increased awareness of the benefits of early detection as well as a response to reaching out to women who make most of the healthcare decisions for their families.

The breast care center in Figure 5-12, Carol Ann Read, is located on the first floor of a hospital with direct access by elevator to a surgery center; the one in Figure 5-13 is also under a hospital's license but located in a medical office building with direct access to an ambulatory surgical center. The facility in Figure 5-14 is also under a hospital's license and is located in an MOB. All of these facilities have outstanding design features in addition to being highly functional in terms of space planning and critical adjacencies.

Psychological Context

The possibility of breast cancer strikes such a chord of fear and terror in many women that the anticipation of having a mammogram fills them with dread. (This, despite the fact that more women die of heart disease every year than breast cancer.) Understanding this context of fear of the unknown, and perhaps the subconscious fear of the possibility of losing a breast if a lesion or tumor is discovered, causes some women to arrive at the facility in an anxious state of mind. Therefore, a design that is calming and soothing will be appreciated. Research shows that connecting people to nature with a view of a garden, or a water element like a large fountain, and natural light has immediate physiological benefits in terms of reducing stress. Even a simulated view of nature as in large-scale photographs and back-lit photo images is effective. Providing options and choice also reduces stress. Patients who visit the Scripps Breast Care Center (Figure 5-15) have a choice of five options to fill their time while waiting for the procedure. After gowning, they may sip tea from a china tea service and read magazines, watch a video on breast self-exam, visit the resource library to select a book or video or go online to research women's health topics (Figure 5-16), tour the corridors to see the many works of art and contemporary crafts, or visit the positive appearance center to select a gift. Positive diversions, according to research, also reduce stress. These include aquariums, fountains, soothing music, interactive works of art, or anything that distracts one from worry and fear.

Psychological Support

One of the advantages of screening at a breast center, as opposed to having a mammogram at a diagnostic imaging facility, is the psychosocial support that is often available to women who prove to be symptomatic. In the typical scenario, a woman who learns she has a suspicious growth has to wait an agonizing week or two to book an appointment with a primary care physician who will likely refer the patient for further diagnostic studies. That interval of time can be torturous, whereas, in a breast center, psychosocial support is immediately available through a patient navigator, counselors, and nurses. Further diagnostic tests can be conducted at the same site with care coordinated by a concerned and familiar team of individuals. A connection to the breast center can be maintained even after surgery and other types of therapy, by virtue of counseling and educational programs as well as support groups.

Scope of Services

Screening and Diagnosis

- Screening and diagnostic mammography
- Mammography with tomosynthesis
- Clinical breast examination
- Ultrasound and ultrasound-guided biopsy
- Stereotactic-guided core biopsy

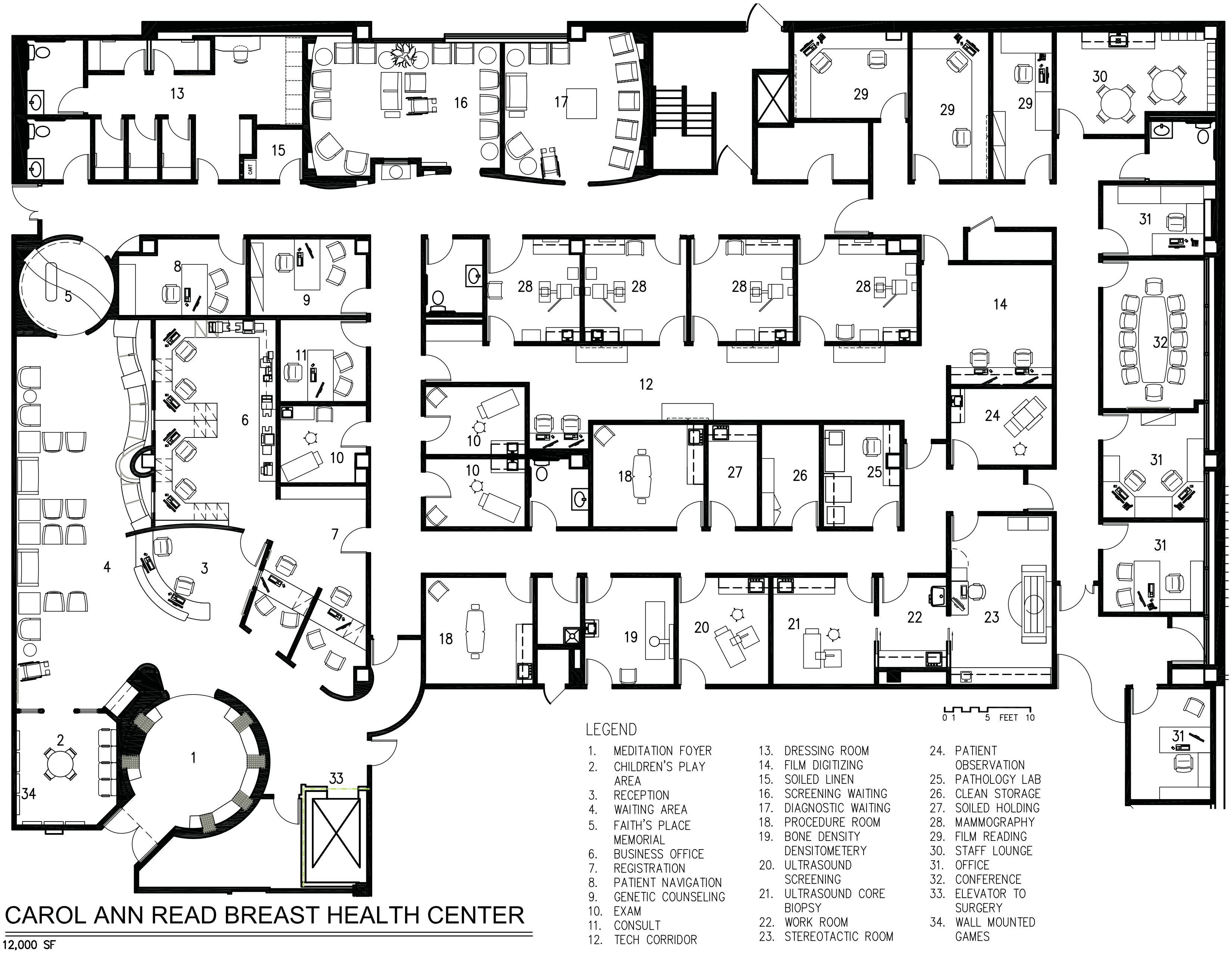


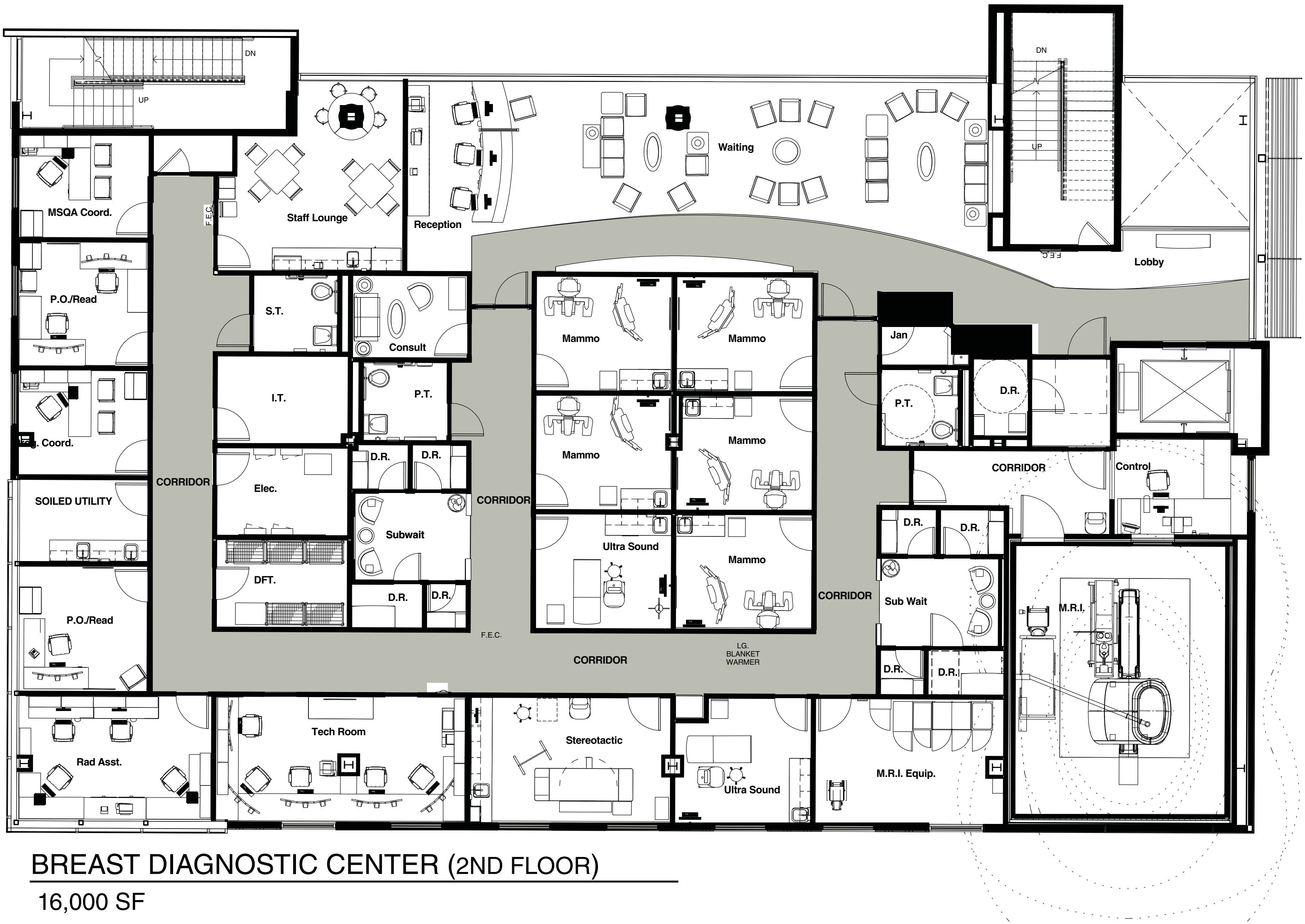
Figure 5-12. Space plan, Carol Ann Read Breast Health Center, 12,000 square feet. *(Design: Jain Malkin Inc.)*

1 RECEPTION
2 RESOURCE LIBRARY
3 ROTUNDA
4 SCHEDULING
5 WORKROOM
6 POSITIVE APPEARANCE CENTE
7 EAST OF THE SUN LOUNGE
8 WEST OF THE MOON LOUNGE
9 DRESSING ROOMS
10 RESTROOM
11 ULTRASOUND
12 PATIENT EDUCATION/EXAM
13 MAMMOGRAPHY ROOM
14 MEDICAL DIRECTOR
15 ADMINISTRATOR
16 NURSES' OFFICE
17 STEREOTACTIC
18 ULTRASOUND
19 WORKROOM
20 SOILED LINEN
21 TRANSCRIPTION
22 TECH WORK CORRIDOR
23 CONFERENCE ROOM
24 READING ROOM
25 RADIOLOGISTS' OFFICE
26 STAFF LOUNGE
27 BSGI
28 VOLUNTEER COORDINATOR/ GIFT SHOP

SCRIPPS POLSTER BREAST CARE CENTER

9600 SF

Figure 5-13. Space plan, Scripps Polster Breast Care Center, 9,600 square feet. *(Design: Jain Malkin Inc.)*



BREAST DIAGNOSTIC CENTER (2ND FLOOR)

16,000 SF

Figure 5-14. Space plan of 49 Wells Breast Diagnostic Center, 8,000 square feet, Palo Alto Medical Foundation, a Sutter Health Affiliate. *(Architecture and Interior Design: Hawley Peterson Snyder)*

Figure 5-15. Waiting room with concierge desk, Scripps Polster Breast Care Center, La Jolla, California. *(Interior Architecture and Design: Jain Malkin Inc.; Photographer: Glenn Cormier)*

Figure 5-16. Ethel Rosenthal Resource Library, Scripps Polster Breast Care Center, La Jolla, California. *(Interior Architecture and Design: Jain Malkin Inc.; Photographer: Glenn Cormier)*

- Stereotactic-guided Mammotome™ biopsy
- Needle localization biopsy
- Breast Specific Gamma Imaging (BSGI)
- ABUS Automated Breast Ultrasound

Education and Outreach

- Education in breast self-examination and breast health
- Positive appearance center with wigs, scarves, hats, and prostheses
- Resource library with Internet access and guidance

Wellness Programs

- Healthy lifestyle programs
- Nutrition counseling
- Complementary therapy resources

Professional and Support Services

- Peer survivor program ("buddy" matching)
- Support groups
- Genetic risk assessment and counseling
- Patient and family education
- Multidisciplinary pretreatment planning conferences
- Second-opinion consultation services
- Lymphedema/rehab services

Space-Planning Considerations

The space planner may wish to consider these space-planning features:

- Lay out procedure rooms with separate entries for tech and patient: techs enter rooms from a tech work corridor that includes workstations, view box, and access to darkroom (see Figures 5-12 and 5-13).

- Instead of a conventional reception window, consider using a concierge desk, staffed by a volunteer, in the main lobby to greet and check-in patients (see Figure 5-15).
- If possible, provide a connection to a surgery center. This provides the greatest privacy and convenience for women who have had a needle localization and now have to proceed to surgery for biopsy (see Figures 5-12 and 5-13).
- Separate "screening" mammography patients from "symptomatic" in gowned waiting (see Figures 5-12 and 5-13).
- Provide a separate and identifiable entry when part of a larger clinic setting (see Figures 6-14 and 6-16).
- Provide acoustically and visually isolated (from patients) staff area with lounge, conference room, restrooms, film reading, and offices for radiologists and medical director (see Figures 5-12, 5-13, and 5-14).
- Provide a resource library alongside the waiting area (see Figures 5-13 and 5-16).

Interior Design Amenities

- Consider wall sconces and other indirect lighting in procedure rooms as well as exam/patient education rooms.
- Consider a painting for the floor under the stereotactic table (protected by a piece of Lexan®), where patient is lying on stomach, looking down (Figure 5-27).
- Furnish the lobby or waiting room like a living room with a variety of seating, interesting ceilings, lighting, and artwork (See Color Plate 12, Figure 5-20; and Color Plate 13, Figures 5-21 and 5-22).
- An intimate, serene inner sanctum was created in a challenging below-grade space with low ceilings and no windows, by building banquette seating around the perimeter, complemented by careful detailing, attention to lighting, and a few surprises such as the opening in the ceiling (Figure 5-17).
- Provide elegant, private dressing rooms (see Figures 5-14, 5-18, and 6-20a).
- A considerable amount of literature is dispensed, which requires racks to keep it sorted and neat.
- Gowned waiting can be designed as a living room with an inset area rug and an opening on one or two sides to provide a view of something interesting. The suite plan in Figure 5-13 provides two 18-foot-diameter gowned waiting rooms, one for screening mammography patients and the other for symptomatic patients. It opens, on one side, to a view of three large commissioned oil paintings to represent the three phases of a woman's life: the young maiden, the nurturing mother, and the wise elder. They combine symbolism such as a butterfly for metamorphosis, a lotus flower representing higher consciousness, and they also incorporate the sun and the moon, the two themes of the gowned waiting lounges. Another opening in the room exposes a view of a carved granite fountain that looks like a large boulder.
- Locate the positive appearance center near the front of the suite, as this is a retail space (Figure 5-19).
- Historically, facilities designed specifically for women have often had period-style furniture and somewhat frilly decor. The Scripps Polster Breast Care Center departs from expectations about appropriate colors for a breast center. The geranium red accent used throughout (the most auspicious color in *feng shui*) is a counterpoint to the warm gray walls and carpet.

Focus on Art to Celebrate Multicultural Diversity

The Carol Ann Read Breast Health Center, at Sutter Providence Hospital in Oakland, California, serves a culturally diverse community with many individuals of modest income (see Figure 5-12). The goal was to express, in the design, respect and appreciation for each of the cultural traditions in order to make women feel welcome and comfortable. In the waiting room, large color portraits of

Figure 5-17. Waiting room, Hoag Hospital Breast Care and Imaging Center. *(Architecture and Interior Design: Taylor & Associates Architects, Newport Beach, California; Photographer: Farshid Assassi)*

five celebrated women with their individual stories occupy a focal point wall (see Figure 5-21). The women are representative of the major cultural groups served by the Center: novelist Amy Tan; Olympic athlete Jackie Joiner Kersee; superstar architect Zaha Hadid; and Wangari Maathai, a Latina woman, an astrophysicist who is the president of a University, and the winner of a Nobel Peace Prize for planting trees in Kenya. Elsewhere in the clinic is a series of color photographs donated by celebrated photographer Paola Gianturco documenting the contributions of women in Third World countries who work in textiles, often supporting the entire community by their efforts. Each photo carries descriptive text.

A large light well over the reception desk delivers natural light to an otherwise windowless environment (see Figure 5-22). An artist was commissioned to create a metal sculpture of "falling leaves" originating from the light well and extending out into the waiting area.

Elsewhere, wall niches display hand-blown glass and other hand-made crafts. Another artist donated a series of large macro photos of flowers. One of the emotional touchstones for this facility is the memorial for Faith Fanchur, a beloved Bay Area TV personality who lost her battle with breast cancer. Her friends formed the "Friends of Faith" foundation and donated funds to have a permanent memorial to honor her (see Color Plate 12, Figure 5-23). Along with her photo and biography, two quotes by Mother Teresa and Maya Angelou capture her personality.

At the juncture of two interior corridors leading to mammography rooms, a "Zen garden" flanked by torchiere lights was created. Behind the translucent panel with horizontal stalks of bamboo is the gowned waiting area (see Color Plate 12, Figure 5-24).

Explanation of Treatment Modalities

Mammography

An X-ray is taken of the breast, which is compressed between two horizontal plates. The control screen that protects the tech is usually integrated into the equipment (Figures 5-25 and 5-26). The room often has a sink cabinet and may have a desk for the tech. There are no restrictions about finishes in this room with carpet and wallcovering having become standard, although a wood-look sheet vinyl may be more practical and easier to keep clean and fresh. Some mammography rooms have nice interior design features incorporating crown moulding, wall sconces, and unique works of art.

Stereotactic

In this room, the patient lies on her stomach on a special table with an opening through which the breast protrudes. To accommodate staff, the table is high (Figure 5-27). The breast is compressed on a panel while two stereotactic X-rays (taken from two different angles) are taken. The precise location of the suspicious lesion is analyzed by a computer based on the X-rays. Following this, a device that will direct a probe and needle into the breast is positioned by the computer at the proper angle. The target area is deadened with a local anesthetic. The needle has a notched opening on the tip that cuts a small amount of breast tissue while a vacuum pulls the tissue into the probe. A machine equipped with a device called the *Mammotome®*, manufactured by Devicor Medical Products, Inc., enables the nurse to obtain several tissue samples within a full circle with only one needle insertion, as opposed to several when doing core-needle biopsy. The stereotactic room can also be used for needle localizations prior to surgical biopsies. Typically, the needle is placed and a paper cup is put over it to protect it while the patient dresses and drives to an ambulatory surgical center for the biopsy. This is inconvenient and most likely adds to the patient's anxiety. If direct access to a surgery center is possible, as in Figures 5-12 and 5-13, it is optimal.

There are numerous pieces of equipment that must be accommodated in this room, including a console for the tech, a two-step stool with a tall support rail for the patient, and various specific storage requirements. A full wall of cabinets is necessary. The room must be large enough for all of this.

The success of the biopsy can be confirmed on the spot with the *Faxitron® CoreVision* (Figure 5-28), which eliminates delays waiting for the pathologist's verification of core samples. Images can be viewed on a monitor and also be sent to multiple destinations.

Figure 5-18. Subwaiting/changing area of 49 Wells Breast Diagnostic Center, Palo Alto Medical Foundation, a Sutter Health Affiliate. *(Architecture and Interior Design: Hawley Peterson Snyder; Photographs by David Wakely)*

Ultrasound

Used as an adjunct to mammography and physical examination, ultrasound helps physicians decide if a biopsy is necessary for suspicious breast lesions by providing more information about whether the "area" is a cyst or a solid mass. The aforementioned Mammotome® device is also compatible with ultrasound equipment, allowing the physician to position the probe in the exact spot where tissue acquisition is desired. Something relatively new is the Automated Breast Ultrasound (ABUS) arm, which attaches to the ultrasound unit to screen women who have dense

Figure 5-19. Positive appearance center, Texas M.D. Anderson Cancer Center. *(HKS, Inc.; Photos: Copyright © Ed LaCasse)*

breast tissue (Figure 5-29). A number of states have passed legislation directing that such patients receive a letter recommending they have a screening ultrasound which, at present, is not reimbursed. Refer to the Obstetrics and Gynecology sections for discussion of lighting and layout of ultrasound rooms.

Tomosynthesis

This is a 3D image of the breast that enables the radiologist to more effectively pinpoint the size, shape, and location of abnormalities especially in dense breast tissue. Masses, distortions, and asymmetrical densities are better visualized than in a 2D view. There is less chance

Figure 5-20. Intimate seating groupings offer privacy and comfort in settings such as breast health and diagnostic imaging. *(Courtesy of Ewing Cole; Photographer: Bernstein Associates)*

Figure 5-21. Waiting area of Carol Ann Read Breast Health Center. *(Design: Jain Malkin Inc.; Ratcliff Architects; Photographer: Copyright © 2008 Douglas A. Salin)*

Figure 5-22. Reception desk with light well overhead and custom mobile art, Carol Ann Read Breast Health Center. *(Design: Jain Malkin Inc.; Ratcliff Architects; Photo courtesy of Linda E. Grant, Alta Bates Summit Foundation)*

for a tumor to hide under overlapping tissue. The Hologic® Dimensions unit is state-of-the-art (Figure 5-26); it does both 2D and 3D imaging.

Breast-Specific Gamma Imaging

This machine requires the injection of a nuclear isotope in the arm. If there is a cancerous lesion in the breast it will show up as a hotspot (Figure 5-30). Unlike mammography, breast-specific gamma imaging (BSGI) is not affected by tissue density. It is a molecular imaging procedure to evaluate metabolic activity of breast lesions through uptake of the intravenously administered radioactive tracer. Cancer cells absorb more of the tracing agent due to their higher metabolic activity and increased blood supply which causes cancerous lesions to light up. This is useful for screening high-risk women and those who are hard to evaluate due to breast implants, dense tissue, or scar tissue.

Tech Areas

Patients should not overhear staff conversations to ensure patient confidentiality. Since film illuminators are no longer in use with digital mammography there is no possibility of walking by a view box with another patient's films mounted on it. An ideal layout is one that provides a private tech corridor, as in Figures 5-12 and

Figure 5-23. Faith Fanchur memorial rotunda, Carol Ann Read Breast Health Center. *(Design: Jain Malkin Inc.; Photographer: Copyright © 2008 Douglas A. Salin)*

Figure 5-24. "Zen" garden is a visual landmark in circulation core, Carol Ann Read Breast Health Center. *(Design: Jain Malkin Inc.; Photographer: Copyright © 2008 Douglas A. Salin)*

Figure 5-25. Mammography room. *(Courtesy of Boulder Associates; Photographed by Boulder Associates Staff)*

Figure 5-26. Dimensions® 2D Full Field Digital Mammography and 3D Breast Tomosynthesis System. *(Courtesy of Hologic Inc.)*

Figure 5-27. Stereotactic room with table raised as it would be during the procedure. *(Photo: Jain Malkin)*

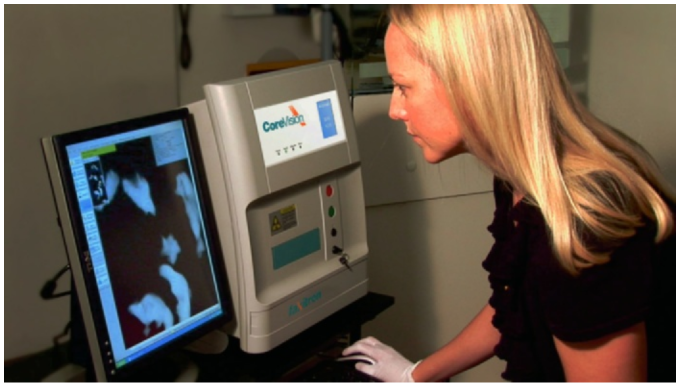


Figure 5-28. CoreVision specimen radiograph system used during a procedure to confirm a successful biopsy. *(Courtesy Faxitron® Bioptic, LLC)*

5-13, for staff entry into all procedure rooms as well as access to the radiologists' reading room. Placed conveniently outside each procedure room are stand-up-height countertop work areas, which used to enable techs to check films. *Remember that the techs in a breast center are all women, which means casework, countertops, and mounting heights for anything on the wall must be appropriate for the average 5-foot-4-inch-tall woman*. Things that are too high is a common complaint not discovered until they move in and it's too late to make changes.

The radiologist will sit at a viewing console looking at several monitors (Figure 5-31). They may have a portable film viewer for patients who arrive with old films that need

Figure 5-29. Somo V Platinum automated breast ultrasound. *(U-Systems, a GE Healthcare Company)*

Figure 5-30. Breast-specific gamma imaging machine. *(Photo: Jain Malkin)*

to be compared. It is important to control distractions. Ergonomics are important to reduce fatigue and repetitive motion disorders. The viewing console in Figure 6-22 easily transitions from sit-down or stand-up height and has many ergonomic adjustments. A good ergonomic chair with a headrest is ideal and with arms that can be adjusted in height. The walls of the room should be fairly dark in color to reduce glare. Lighting should not

be overhead but, rather, indirect along the perimeter of the room and should be dimmable. The film viewing area should be in the quietest part of the suite and will be adjacent to the radiologist's office. A large conference room is common to these facilities as there are numerous staff conferences regarding treatment planning and case presentations.

Donor Opportunities

Breast care centers are valued by hospital foundations because they are highly visible and attractive to donors (see Figure 5-32). If the facility has a high-profile design that distinguishes it, the amount of money that can be raised to name individual rooms, the lobby, the positive appearance center, and the facility itself is astonishing. A high-profile center may cost $150 to $175 per square foot in 2013 to construct (tenant improvement cost), but can attract $10 to $30 million in underwriting, depending on the geographic location, the foundation's outreach and skill, the prestige of the physicians associated with it, and the unique design properties of the facility.

Figure 5-31. Mammoreport operational workstation. *(Copyright © Siemens Healthcare 2013)*

REPRODUCTIVE ENHANCEMENT (ASSISTED REPRODUCTIVE TECHNOLOGIES)

Overview

Who would not be smitten by the emotional context that surrounds this ultra-high-technology specialty? The hopes and dreams of so many to have a family are linked to a successful outcome and the fact that it all happens within the walls of this facility—life is created here—makes this almost a sacred space. Couples, singles, both heterosexual and homosexual, and occasionally individuals who travel from remote parts of the world find their way to the portals of the most celebrated and clinically successful specialists in reproductive enhancement. This is a field that has been much in the news in recent years with articles celebrating the astonishing technological accomplishments, which are, at times, flanked by controversy surrounding multiple births, surrogates who later decide to keep the baby themselves, frozen eggs that have been stolen and sold without the donors' knowledge, and eggs that have been carelessly handled and transplanted into the wrong person. Registries have sprung up on the Internet offering, at exorbitant prices, "designer" eggs and sperm of individuals who exemplify an aesthetic ideal, have very high SAT scores, or are gifted musicians, athletes, or high achievers at Ivy League schools. Despite this backlash, the need to pass on one's genes and to procreate is among the most primal of nature's urges and, as this specialty continues to

Figure 5-32. Reception desk design acknowledges major donor. *(Courtesy of HKS; Photographer: Blake Marvin/HKS, Inc.)*

mature, the Brave New World queasiness will no doubt subside. These procedures are a touchstone for moral, ethical, and spiritual conflict as society attempts to grapple with what 25 years ago would have been considered science fiction.

Access to Information

The Internet is a tremendous source of information on infertility treatments with a surprising number of websites on assisted reproductive technologies that read more like medical textbooks. This means that patients may arrive at the physician's office with a highly sophisticated understanding of all of the techniques, success rates of each, and sheaves of journal articles.

Psychological Considerations

One could say that everything associated with these procedures creates stress. In the words of Elizabeth Barrett Browning, ". . . let me count the ways," starting with what brings individuals to seek this sort of help—years of yearning and trying to conceive. Couples deal with guilt, blame, worry, and hope, living by ovulation cycles and the optimum day to "do it," and what started out as pleasurable sex has become fraught with anxiety, akin to a project or a job. The pressure is tremendous. And women, at some point, feel their biological clock running out of time.

Once one enters reproductive therapy, there are no guarantees or magic bullets. One enters the world of critical timetables, cycles, and many steps in a process that are dependent on each other. Failure at any stage may mean abandoning the process and starting over. Consider the highs and lows of waiting for news about results of blood tests, sperm motility, viability of the eggs, and whether fertilization has taken place. Add to this the hormonal changes resulting from fertility drugs that can cause strong emotions and unpredictable outbursts. Trying to conceive is a stressful process and infertility treatment an ongoing enterprise. With all the magic associated with a successful outcome, the day-to-day reality of the ordeal can be physiologically and psychologically grueling. To help individuals and couples manage these emotions, counseling sessions teach coping skills, stress management, and relaxation techniques. The financial impact of infertility treatment is substantial. Individuals who have tried unsuccessfully for several

years to conceive may have mortgaged their homes, borrowed from friends and family, or sold their automobile to be able to continue with the treatment. This compounds the emotional stress.

Designing for Comfort

Designing to meet patients' psychological needs in this specialty leads one to think of comfort in every conceivable manner. One would avoid sharp angles, geometric forms that create visual tension, high levels of illumination, hard, shiny, surfaces, materials that are cold to the touch, and seating that is lined up like soldiers against the wall. Granted that design and color are always, to a certain degree, subjective, and what constitutes comfort may be open to interpretation. Nevertheless, one should strive to create a serene environment, with a variety of seating, including some oversized chairs that metaphorically form a cocoon around a person. Employ a soothing color palette leaning toward warm, rather than cool, colors (see Color Plate 11, Figure 5-20). Wood can be used on the face of the reception desk and elsewhere to add warmth (see Figure 10-5). Walls and ceilings may have curved forms, and lighting should be varied, avoiding entirely 2 × 4–foot lay-in fluorescent luminaires. High levels of illumination and glare can create tension.

Artwork used in the waiting room must be selected carefully. One must avoid anything that might hit a nerve such as photos of parents and children, although there are places in the office where this can be quite successful as relevant art, but not in the waiting room. Art that is whimsical can be appealing. In one facility, an artist was commissioned to create a series of gouache and pastel pieces reminiscent of Cirque du Soleil characters. These are placed along one wall; on the opposite wall are actual Cirque du Soleil sculptures and other whimsical works of art. Be mindful that art images should not represent what appears to be overweight female forms because women undergoing hormone therapy for infertility experience water retention, they feel bloated, and their ovaries may actually triple in size.

Procedures and Terminology

A few years ago, this field was often referred to as IVF, or in vitro fertilization, but, as the field has become more technologically advanced and an expanded number of services are offered, assisted reproductive technologies (ART) is the preferred term.

Assisted reproductive technologies include the following:

- Infertility diagnosis prescreening
- Artificial insemination—large numbers of washed motile sperm are placed into the female reproductive tract, often the uterus
- Intrauterine insemination (IUI)—sperm are placed directly into the uterus
- Hormonal therapy to induce ovulation
- Reproductive laser surgery to treat endometriosis and other uterine or tubal problems that can affect fertility
- Ovulation induction with artificial insemination
- Gamete intrafallopian transfer (GIFT)—eggs and sperm are injected directly into the woman's fallopian tubes via laparoscopy
- Zygote intrafallopian transfer (ZIFT)—a zygote (newly fertilized egg) is inserted directly into the woman's fallopian tubes
- Intracytoplasmic sperm injection (ICSI)—using micromanipulation technology, a single sperm is injected into the center of the cytoplasm of the egg to achieve fertilization
- Testicular epididymal sperm aspiration (TESA)—sperm are retrieved using an open testicular biopsy technique
- In vitro fertilization (IVF)—eggs are retrieved from the ovary and fertilized by the man's sperm in the lab; several days later, a number of fertilized embryos are transferred into the uterus; the remaining embryos can be cryopreserved for use in subsequent cycles

- Assisted hatching—micromanipulation of the embryo to increase implantation success
- Egg donation—women whose ovaries have been removed, or do not function normally, can receive donated eggs from another woman; these eggs are fertilized by the male's sperm in the lab and later implanted into the uterus
- Gestational surrogacy—transferring the embryo into another woman who carries the pregnancy to term
- Traditional surrogacy—artificially inseminating a woman who carries a baby to term; the baby will then be raised by its genetic father and his partner
- Embryo cryopreservation—freezing and storage of embryos in liquid nitrogen
- Hysteroscopy with tubal cannulization—visual examination of the interior of the uterus to check for abnormalities
- Laparoscopy—procedures using a fiber-optic scope passed into the abdomen through a tiny incision below the navel
- Psychological services

Regulatory Issues

Although IVF is not specifically defined in the codes, the facility can be viewed as having three basic components that *are* well defined in various codes and can be relied on to guide decisions. These are the examination/medical office component, which, in most codes, is a business occupancy (assuming this is not a hospital-based facility); the clinical laboratory; and the operating room suite. One should consult the state's business and professions code, if such exists, as well as the state's department of health services. There are nationally recognized accreditation agencies such as AAAHC and AAAASF (refer to the Plastic Surgery section and Chapter 8 for a detailed discussion of these agencies) that will accredit these facilities. In addition, there is The Joint Commission, but practitioners may also wish to consider state accreditation agencies for ambulatory care. As an example, in California, it's the Institute for Medical Quality, a subsidiary of the California Medical Association. This agency is approved by the Medical Board of California to verify compliance with assembly bill AB-595, (also known as the Spiers bill). Similar bills may have been enacted in other states, but in California, as of 1996, any medical practice, from solo to small group to multiservice ambulatory centers, that administers general anesthesia must be either licensed by the Department of Health Services, obtain Medicare certification, or be accredited.

Clearly, licensing and Medicare certification are quite rigorous in terms of facility design, whereas many accreditation agencies focus more on policies and procedures such as infection control measures, patients' rights, hospital transfer agreements, quality management/quality improvement, calibration logs of equipment, documentation of periodic safety drills, testing of backup power, pharmaceutical control logs, and review of medical charts. Achieving Medicare certification will most likely mean that the surgery center portion of the suite—even if it's just one procedure room with ancillary spaces—will be isolated from the medical office, having its own entry, business office, and waiting area. This is what is demanded for office-based surgery facilities. However, it is clearly a gray area for IVF suites because the nature of what is done in the procedure room, although called surgery (egg retrieval and implantation), differs from the types of surgical procedures performed in a typical OR.

General Anesthesia Is the Trigger

If general anesthesia is used, the facility will have to be licensed or accredited. The *Guidelines for Design and Construction of Health Care Facilities* (The Facility Guidelines Institute) should be used as a guide, along with NFPA 101 Life Safety Code. Many physicians do not use general anesthesia for these procedures and, instead, use monitored anesthesia care (IV sedation with oxygen), which causes a twilight sleep and does not involve intubation. An anesthesiologist would participate during these

procedures and resuscitation equipment should be available in the procedure room.

Clinical Lab Regulatory Issues

Certification. Certification is both mandatory and voluntary for the clinical lab component of the suite, which involves blood draw, the andrology lab, and the IVF/embryology lab. Currently, some states—among them New York, California, and Florida—require clinics to be licensed as a tissue bank if human tissue is collected, processed, stored, or distributed for purposes of transplantation in either the andrology or the embryology lab. States also issue licenses for clinical laboratories and one would have to be certified by CLIA (Clinical Laboratory Improvement Act), a federal program regulated by The Centers for Medicare & Medicaid Services (CMS). The reader is referred to a discussion of CLIA in Chapters 3 and 6.

On July 21, 1999, the Department of Health and Human Services released to state officials and health authorities a model certification program developed by the Centers for Disease Control and Prevention (CDC) encouraging the adoption of this program by individual states. It contained a set of quality standards that states could use for inspecting and certifying laboratories used in fertility clinics that provide assisted reproductive technology. The FDA in 2005 created a regulatory framework for the handling of human cells and tissues. For example, before tissues can be introduced into a nonintimate partner (surrogate) that person must be tested for infectious diseases in an FDA-approved lab. The FDA sought to ensure greater continuity among states because states define infertility differently and this has an impact on healthcare insurance and what is covered without a legal obligation to do so (Kindregan and McBrien, 2010)[4]. According to these legal specialists, "Government regulation of ART in the U.S. currently constitutes an inconsistent body of law. . .a few states have attempted to regulate certain practices, but for the most part, it is largely unregulated. Medical insurance of ART services, clinic reporting requirements, religious exemptions, medical evaluation of gamete donors, and standards of practice differ greatly throughout the country. The Federal government has played only a minor role in the regulation of ART, mostly to discourage misrepresentation of success rates by providers.

Accreditation. For physicians to become members of the Society of Assisted Reproductive Technology (SART), the andrology and embryology laboratories must pass a national laboratory accreditation inspection program for reproductive laboratories developed by the College of American Pathologists (CAP) and the American Society for Reproductive Medicine (ASRM). Using a checklist, the CAP/ASRM Reproductive Laboratory Accreditation Program examines all aspects of quality assurance in the laboratory, including methodology, reagents, control media, equipment, specimen handling, procedure manuals, reports and proficiency testing, qualifications of personnel, safety, and the overall management policies that distinguish a quality laboratory. Upon successful completion of the inspection process, the laboratory will be awarded CAP accreditation. In some states, CAP accreditation satisfies the state's regulatory agency.

Reimbursement. Since most third-party payers do not reimburse for assisted reproductive technologies, achieving Medicare certification to be able to bill a facility fee becomes a moot point.

Process and Patient Flow

The initial visit starts with a comprehensive physical and gynecological exam, a review of family and social history, and a review of male-related infertility issues. This initial interview and examination may take 45 to 50 minutes. Because the reasons for infertility problems are so diverse, the number of procedures to address these problems is similarly diverse. To give some idea of what is involved, consider two of the most frequent procedures, egg retrieval and egg transfer. In addition to taking hormones,

[4] Charles Kindregan, Jr. and Maureen McBrien. Assisted Reproductive Technology: A Lawyer's Guide to Emerging Law and Science, 2nd ed., Washington, D.C.: American Bar Assn., 2010.

the woman will take a medication at home and within a specified period of time—generally 35 hours—must come to the office for the egg retrieval. This is an ultrasound-guided needle aspiration procedure that is typically done under conscious sedation. Patients are understandably very nervous prior to this procedure. Afterward, the patient is transferred on a gurney to the recovery room where she remains for approximately an hour. Eggs and embryos are kept inside an incubator while in the embryology lab except when they are removed to be inseminated, changed to a new culture medium, or prepared for transfer to the uterus. The IVF lab acts as a temporary womb to support fragile gametes (eggs and sperm) and nurtures newly formed embryos until they are transferred to the uterus; therefore, the environment has to be very carefully controlled.

Sperm Collection
The collection room, sometimes referred to euphemistically as the donor room, is where sperm are collected. This room should be furnished like a comfortable lounge, with a DVD player and large flat monitor on the wall. The pressure on a man to perform is enormous. A man may ejaculate through masturbation or with the help of a partner in the room. Although there are many steps involved, a simple explanation is that sperm are first separated from the seminal fluid through repeated washing and spinning in a centrifuge, later to be subjected to *capacitation* (alterations to the surface of the sperm head accomplished by incubating it in a specially prepared culture to increase its ability to penetrate the egg).

Micromanipulation
During the process of micromanipulation, which uses a specialized inverted microscope, sperm are introduced into the egg by the embryologist. About 16 to 20 hours after insemination, the embryologist transfers each egg to a new growth medium to enhance its development and encourage cell division if fertilization has occurred.

Embryo Transfer
Finally, an ultrasound-guided embryo transfer to the uterus is performed. It's important that the woman be as relaxed as possible during embryo transfer as many stress-related hormones such as adrenalin can cause the uterus to contract. The nurse coordinator or counselor often sits at the bedside to coach the patient in relaxation techniques, often using guided imagery. Abdominal ultrasound is used to assist in the correct placement of the embryos in the uterine cavity. Following the procedure, the patient is usually asked to lie on her back or side for one to two hours in the recovery area. The patient is then transported to a car in a wheelchair and must adhere to bed rest for three days. This is a delicate procedure and it's important that no bleeding occurs and that the embryos are not damaged.

Schedule of Visits
Patients make frequent visits, which often involve blood draw and ultrasound examinations. Patients are often asked to drink a great deal of water prior to an ultrasound examination; therefore, a bathroom should open off the examination room or immediately adjacent. The initial interview usually takes place in the physician's office or consultation room, followed by a discussion with the financial counselor. There are quite a number of sequential visits that need to be scheduled. Often, a close bond forms between the patient and the nurse coordinator who, over time, offers reassurance, support, and guidance.

Clinic Components

The program in Table 5-2 is based on an embryology lab equipped to process 300 to 600 retrievals per year. The space plans in Figures 5-33 and 5-34 represent one-physician practices, while Figure 5-35 is a three-physician practice. It should be noted that IVF procedure rooms are clean rooms, but not sterile. A number of procedures can be done in a smaller "minor" procedure room. These rooms should not have sinks as they compromise infection control.

Critical Adjacencies
Embryology/IVF Laboratory. Ideally, as exemplified by Figures 5-33, 5-35, and 5-36, the IVF lab is contiguous with

Table 5-2.
Analysis of Program
Advanced Reproductive Technology

Business/Administration		
Waiting Room		20 × 20 = 400
Reception		180
Business Office[a]		550
Conference Room		300
Staff Lounge		12 × 12 = 144
Staff Toilets	2 @	8 × 8 = 128
Storage		8 × 10 = 80
Office Manager		10 × 12 = 120
Financial Counselor		10 × 12 = 120
Donor Program Coordinator		8 × 10 = 80
Lab Director		10 × 12 = 120
OR Nurse		8 × 10 = 80
IVF Coordinator		8 × 10 = 80
Psychologist		10 × 12 = 120
Resource Library/Patient Education		10 × 12 = 120
Clinical Areas		
Exam Rooms	6 @	10 × 10 = 600
Nurse Stations	2 @	8 × 12 = 192
Blood Draw		6 × 8 = 48
Collection Room		10 × 10 = 100
Toilets	2 @	8 × 8 = 128
Consultation Rooms	3 @	12 × 12 = 432
Andrology Lab		10 × 16 = 160
Embryology Lab		720
Micromanipulation Area		
Cryopreservation Prep and Storage		
Male/Female Gowning/Lockers		
Storage Med Gases and Supplies		
Procedures/Operating Suite		
Gowned Waiting		8 × 12 = 96
OR		20 × 20 = 400
Procedure Room		14 × 16 = 224
Scrub		24
Clean Utility		8 × 10 = 80
Soiled Utility		8 × 10 = 80
Business/Administration		
Central Supply		10 × 10 = 100
Toilet/Staff Dressing	2 @	8 × 8 = 128
Recovery Areas	3 @	8 × 10 = 240
Janitor Closet		4 × 6 = 24
Storage		6 × 6 = 36
Miscellaneous[b]		80
Subtotal		6,514 SF
20% Circulation		1,302
Total		7,816 SF

[a]Includes scheduling, insurance, billing, and workroom (mail/copy).
[b]Biohazardous storage, medical gas storage, vacuum, and generator.

Note: This program supports three physicians.

the procedure rooms. If the distance to the place of egg retrieval or embryo transfer (the procedure room) exceeds 100 feet, then the use of an infant isolette or other method of maintaining temperature and pH for the eggs and embryos must be employed. Intercom communication is recommended if direct communication is not possible. The laboratory should be in a low-traffic, secured area with access limited to the embryologist and techs who work in the lab. Security is of utmost importance to maintain the sterile conditions of the space as well as to protect the specimens.

Andrology Lab. This is not a clean room (although sterile technique is used) and it need not be adjacent to the IVF lab. Semen analysis is done here as well as sperm capacitation and cryopreservation.

Media Prep Room. Various culture media are prepared in this room. It can be within the IVF lab or adjacent to it.

Collection Room. This is best located in a quiet area of the suite and should be reasonably close to the andrology lab where semen is analyzed and sperm undergo the capacitation process. In fact, in some facilities (Figure 5-34 the collection room is adjacent to the andrology lab and there may even be a pass-through between the two rooms. However, it has an interlock that prevents someone in the lab from looking into the collection room.

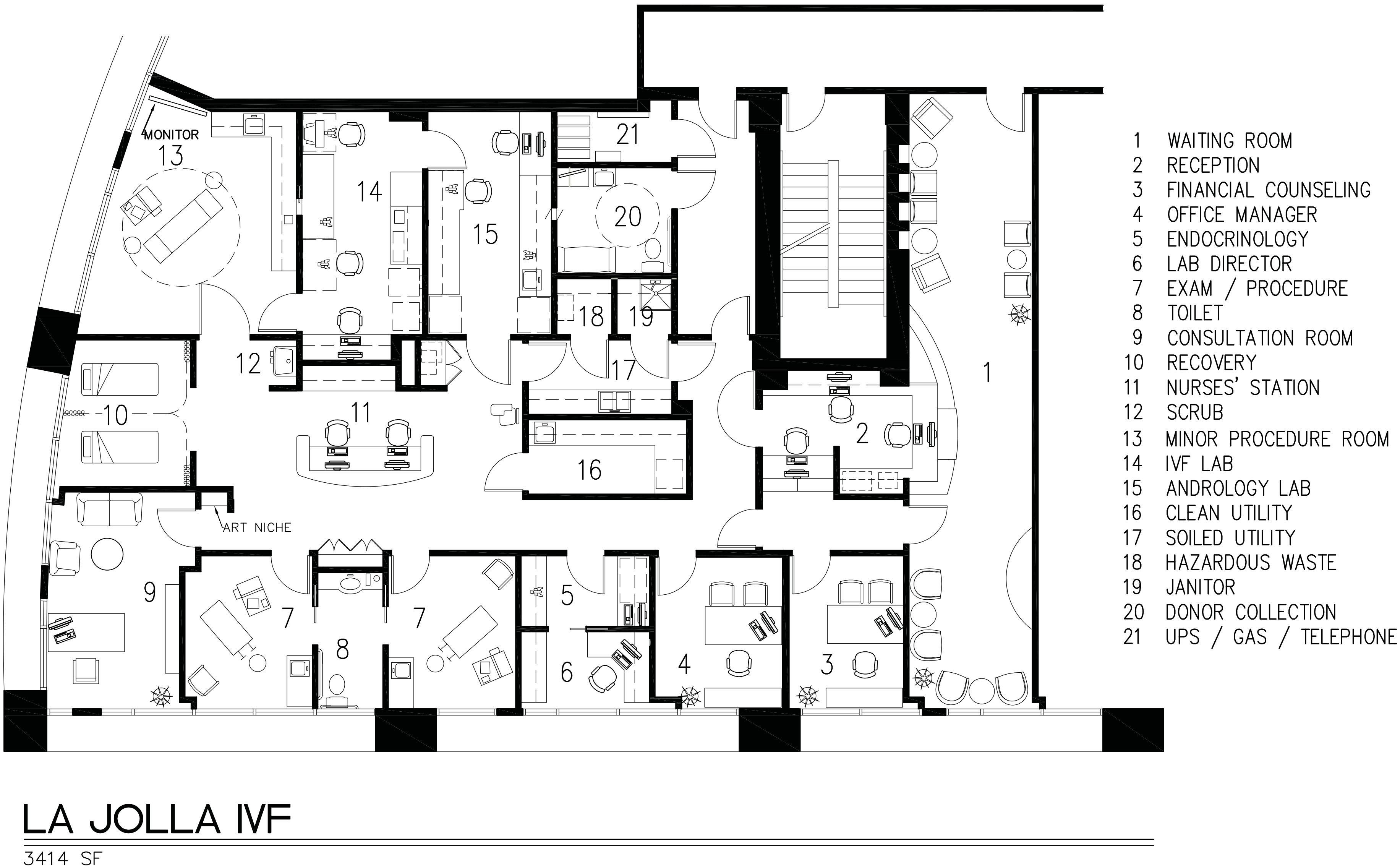
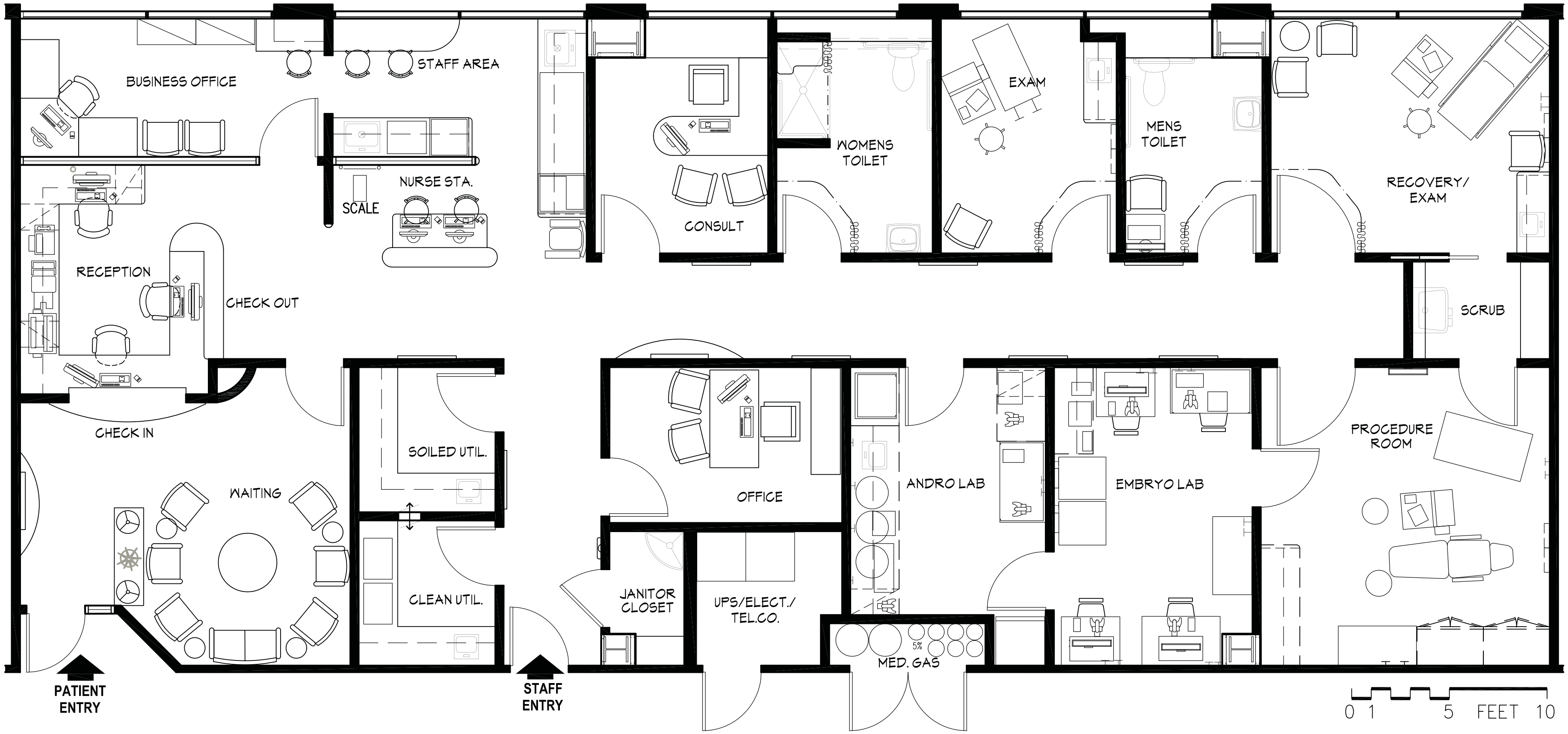


Figure 5-33. Space plan reproductive medicine, 3,414 square feet. *(Design: Jain Malkin Inc.)*



REPRODUCTIVE MEDICINE

2611 SF

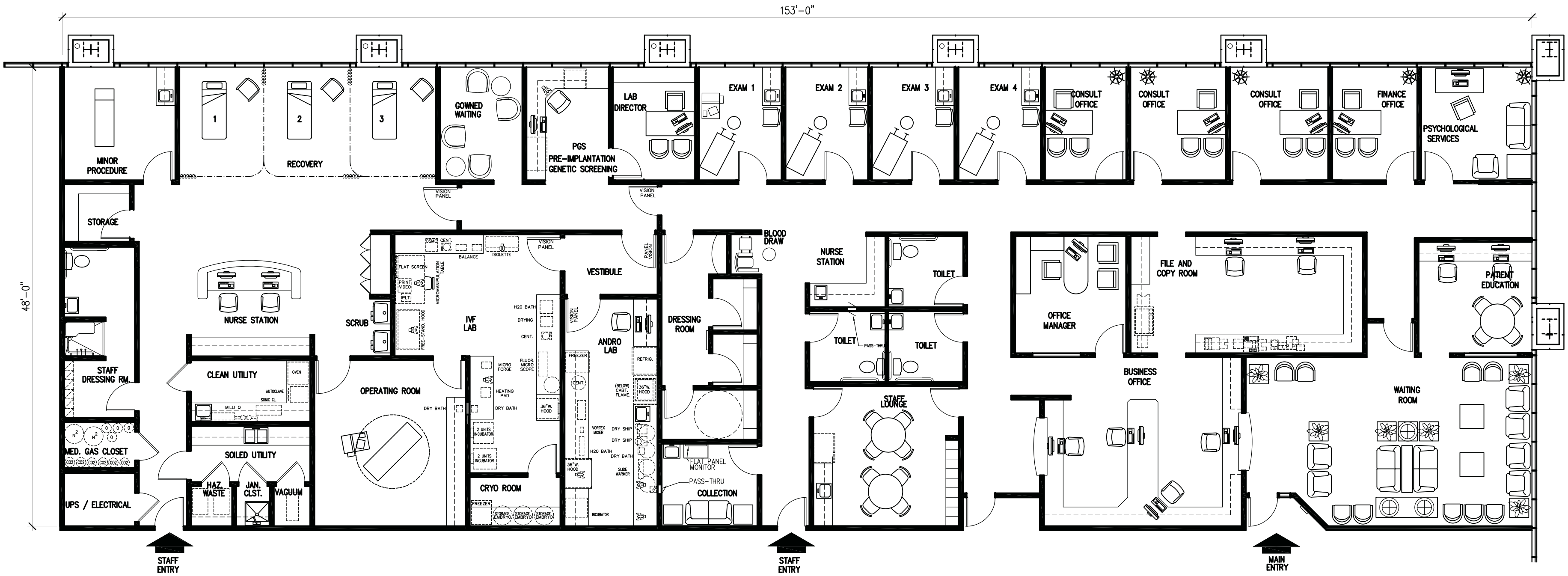
Figure 5-34. Space plan reproductive medicine, 2,611 square feet. *(Design: Jain Malkin Inc.)*

Recovery Area. This area must be close to the surgery area. In a small practice, it may be just two beds immediately outside the surgery room (see Figure 5-33).

Laboratory Equipment

Most of the equipment in the andrology and embryology laboratories is highly specialized for use in ART labs. The pieces of equipment are too numerous to be able to include photos in this chapter. Instead, following are the names of respected vendors for the larger pieces of equipment. Each has a website featuring equipment options and specifications.

Heraeus (incubators)
Forma Scientific, Inc. (incubators, cryopreservation dry shippers, laminar-flow bench workstations)



REPRODUCTIVE MEDICINE

7344 SF

Figure 5-35. Space plan reproductive medicine, 7,344 square feet. *(Design: Jain Malkin Inc.)*

MVE (liquid nitrogen freezers)

Nikon (inverted microscope) (Note: A video camera may be used with this.)

Eppendorf (micromanipulator, centrifuges)

Mid-Atlantic Diagnostics: K-System (air suspension workbench with stereo microscope built into a vertical laminar flow cabinet)

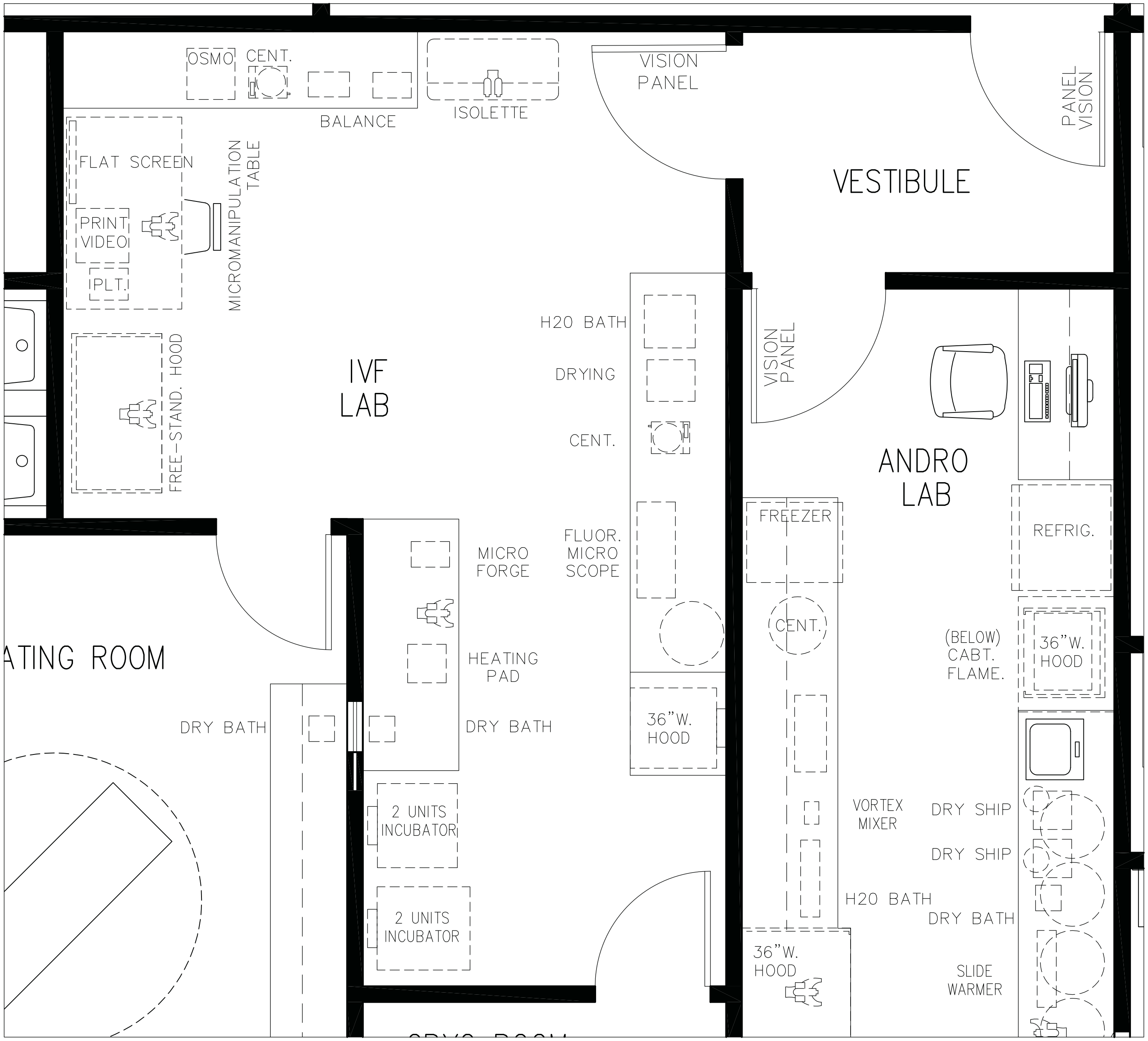
Barnstead/Thermolyne (test tube mixers, rotators, and shakers)

Thermo Forma (microcentrifuges)

Diagnostics Products Corporation (Immulite endocrine analyzer)

A list of the principal pieces of equipment follows. It should be noted that there are consultants specific to the IVF field who specify equipment and do the laboratory layout, although the embryologist will have considerable input and may, in fact, take entire responsibility for the design and equipment selection. The relationship of each piece of equipment to another affects the electrical plan, requiring careful coordination.

General Lab Equipment. Includes refrigerators and freezers; cryogenic storage tanks; specialized microscopes;



REPRODUCTIVE MEDICINE LAB

350 SF

Figure 5-36. Space plan reproductive medicine laboratory, 350 square feet. *(Design: Jain Malkin Inc.)*

air suspension tables; centrifuges; test tube mixers, shakers, and rotators.

Andrology Lab. Includes laminar-flow hood; refrigerator; centrifuges, both large and small; phase microscope with fluorescence; warming oven; water-jacketed CO_2 incubator; dry shipper tanks.

Embryology Lab. Includes laminar-flow hood; stereo microscopes; stage warmers; centrifuges, large and small; computers and printer; incubators (tabletop model, water-jacketed CO_2, and high-efficiency particulate air [HEPA]–filtered CO_2); water purification system; water-line pressure pump and tank; dry heat ovens. Note that incubators that used to be the size of an undercounter refrigerator are now the size of a toaster oven, thus saving considerable countertop area. (See Figure 5-37.)

Figure 5-37. Embryology lab. *(Photo: Jain Malkin)*

Embryology Micromanipulation Area. Includes air suspension table (to minimize vibration); inverted microscope; video camera, monitor, and recorder; stage warmer. The video camera and monitor enable the embryologist to perform the procedure at magnification on the monitor, rather than looking through the microscope. It also shows (if the OR has a large monitor) the embryo being loaded into the syringe just prior to the transfer procedure. A laser is used to aid in assisted hatching; it is attached to the micromanipulation system.

Cryopreservation Area. Includes laminar-flow hood, planar cell freezer, heat sealer, stereo dissecting microscope, and liquid nitrogen tanks.

Microscopes need to be at sit-down workstations and must be at a comfortable height for the embryologist. This can differ depending on whether that individual is short or tall, which can sometimes be accommodated by adjusting the chair height. The selection of a task chair for this position is also very important as individual comfort and ergonomic features matter.

Note that there should *not* be overhead cabinets above the balance table in the micromanipulation area, the computerized semen analyzer, the cryopreservation counters, or the autoclave area. Areas under the cryopreservation countertop should be open to accommodate liquid nitrogen storage tanks on wheels. CO_2 lines should be centrally piped to the workbenches where it is needed. If space is limited, the endocrine analyzer can be located outside the lab.

Lab Storage. If an adequate water purification system is not centrally installed, there will be a need to store quantities of ultra-pure water, which is delivered in large bottles. There are also many chemicals that need to be stored to support the lab functions.

Utility Requirements

HVAC/Air Quality Standards. Air quality is an important factor when trying to maintain process integrity. Testing reliability, results, and personal protection can be affected by airborne contamination. Air quality in laboratories is defined by Federal Standard 209E with classifications of Class 1, 10, 100, 1000, and so on. This Class number is the maximum allowable number of particles 0.5 micron and larger per cubic foot of air; the lower the number, the cleaner the air. International Standard ISO14644–1 classifications are rated as ISO Class 1, ISO Class 2, and so forth. According to both standards, Class 1 is the cleanest, ultra-pure air. ISO Class 2 correlates most closely to Federal Standard Class 100. The standard for an embryology lab is Class 100 air quality. The labs will have several laminar-flow hoods for carrying out certain procedures. The room should have a four-stage HEPA filtration system that purifies the air of the entire lab. In addition, a portable Coda® Aero Tower made specifically for IVF labs may be used to filter the air. The labs must have individual temperature, humidity, and velocity controls and there must be access to overhead ducts for periodic cleaning and changing of air filters. This room must maintain positive air pressure. Air intake must not be near any source of contamination, and air from the hoods may need to be ducted directly to the outdoors, due to the chemicals used.

Lighting. Lighting in each section of the lab should be individually dimmable. It must be an incandescent source as fluorescents generate a frequency that may affect cellular development of the embryos. Procedures in exam rooms are generally done in full light, but being able to dim the lights during ultrasound is advisable. This could also be accomplished by being able to turn off the overhead lights and have just a wall sconce remain. In large procedure rooms, a ceiling-mounted surgical light is required. Here, as well, being able to dim the lights is important during ultrasound-guided procedures. There will be a large video flat panel monitor placed so that the patient can see when the embryologist loads the syringe for the embryo transfer. Room lighting needs to be placed to avoid glare on monitors.

Electrical. Of utmost importance in the labs is an uninterrupted power source for incubators, alarm systems, and monitors. Various types of backup power systems are available. In addition, surge protection is needed for all electrical and electronic equipment.

Security and Alarm Systems. Laboratory security sometimes involves video cameras. Depending on the number of people who have access to the lab, a fingerprint or retinal identification system and/or magnetic card reader may be required. Alarm systems monitor incubators, gas and liquid nitrogen tanks, and cryotank monitors, relaying a message when equipment malfunctions. Successful results in this specialty demand precise temperature control and environmental conditions. Thermo Scientific makes the Sensaphone® telephone dialing system that interfaces with an alarm to automatically dial several sequential telephone numbers of laboratory staff if something is amiss at the lab. This device can monitor power failures, listen to the sound of smoke detectors, monitor temperature or water on the floor, humidity, and the operation of numerous pieces of laboratory equipment.

Medical Gases. There are a large number of medical gas cylinders within this suite. Even if general anesthesia is not used, there will be a need for centrally piped oxygen in the procedure rooms and the recovery room. The IVF culture area and micromanipulation area require vacuum and CO_2. The cryopreservation area requires liquid nitrogen (LN_2) and vacuum, and the media prep and andrology areas require CO_2 and vacuum.

Plumbing. Sinks must be precisely located in the laboratory areas. In addition, certain pieces of equipment may need to be connected to water and drain. As in any lab, noncorrosive piping must be used and sinks should be stainless steel. Eyewash diverters on sinks are no longer allowed. They must be plumbed separately (see Figures 6-64 and 10-10) and also be OSHA approved.

Interior Design Considerations

Embryology Laboratory. Purity of materials is of utmost importance. Off-gassing of volatile organic compounds (VOCs) from synthetic materials and contact cements used in plastic laminate casework should be reduced to

the minimum possible. At completion of construction, high-velocity air filtration and fans should be used to exhaust as much of the construction dust and off-gassing of materials as possible prior to commissioning the lab. Usually, for two weeks prior to using human specimens, mouse or hamster eggs may be used to test conditions. Walls and floors should have no seams or crevices to reduce the possibility of contamination and make cleaning easier. Sheet flooring such as linoleum (made with natural materials) can be self-coved at the base to eliminate crevices. In terms of color, labs should be fairly neutral but white creates too much glare. A beige floor and walls work well. Embryologists often prefer to work on dark-colored (charcoal) countertops because it makes it easier to see dust. The doors to laboratories must have a sign saying *Authorized Staff Only*.

Procedure Room. Physicians often prefer a medium to dark floor in these rooms to eliminate glare. Note that the door will require a sign *Proper Surgical Attire Required*.

Accommodation of Celebrities

Well-established ART practices often attract celebrities, foreign dignitaries, and even heads of state who will be ushered into the office through a private entry, bypassing the waiting room. Occasionally, to accommodate these individuals, the office is closed so that no one but staff is present during the visit.

Relevant Art

A collection of fertility dolls from various cultures is interesting and relevant. Although not recommended for the waiting room, in a corridor, a large photo wall can be attractively created with photos of parents and their babies. Physicians in this specialty receive hundreds of photos from grateful patients. These range from poorly composed snapshots taken with disposable cameras to professionally posed photos with twins or triplets wearing matching outfits with a seasonal theme. They are fetchingly adorable. Most photos will be color, which will make the overall effect quite busy. A solution is to take all of them to a professional photo lab to convert them to crisp black-and-white prints, in the desired sizes to fit the designer's selection of frames. Additionally, magazine and newspaper articles featuring the physician(s) can be attractively matted and professionally framed. The physician's diplomas should be prominently displayed in his or her consultation room (private office). Frames need not match and are more interesting if they complement each other, but don't match. Take these to a custom art framer for a polished look. Patients need to have confidence in the fertility specialist since they are investing a great deal of time, emotion, and money in this endeavor.

ONCOLOGY

Oncologists treat cancer. Patients are referred by their primary care physician or a specialist such as a urologist, gynecologist, gastroenterologist, or dermatologist, to name a few. Once a tumor or lesion has been identified, surgery is usually the first form of treatment, often followed by chemotherapy and/or radiation therapy. This discussion will focus on medical oncology, not radiation therapy. Refer to Chapter 6 for Radiation Oncology.

The oncologist manages the patient's cancer treatments, conferring from time to time with the primary care physician or specialist who referred the patient. Many medical oncologists prefer to do chemotherapy infusion in their offices rather than refer the patient to the hospital. This offers convenience for patients and a feeling of security that they are being treated under the watchful eye of their oncologist (Figure 5-38). The initial visit will typically be lengthy—perhaps an hour—and may occur in the oncologist's consultation room (private office). A large monitor for viewing digital X-rays is required. These practices may include one or two physicians, or they may consist of a large group of 10 or 12 oncologists who are the prominent group providing major cancer care at the hospital on the MOB campus. Surgeons may become well known for certain types of techniques, attracting patients

Figure 5-38. Chemotherapy infusion lounge. *(Photo: Jain Malkin)*

from considerable distances. Examples are a gynecological oncologist and a breast surgeon.

The cancer center in Figure 5-39 represents a good functional layout of rooms, maintains appropriate critical adjacencies, and also has aesthetic flair with numerous ceiling treatments, interesting lighting and design details (see Figure 5-40). Two waiting rooms are provided, one for diagnostic patients and another for infusion patients. This is a five-physician practice whereas the plan in Figure 5-41 is a two-physician practice.

Patient Flow

A course of chemo infusion may require visits once or twice a month for six months for certain regimens, or three days per week once a month, or two visits per month. The average infusion time is four hours, which means that patients get to know each other and provide encouragement and support to each other. Patients often arrive with a close friend or family member for company, necessitating a guest chair.

Patients often go to an exam room to see a doctor or nurse practitioner to reassess their situation and find out how they've been doing. Next, blood is drawn to verify that the white count is high enough to receive the next dose of chemo. Some practitioners draw blood in the exam room, while others use a blood draw chair in the lab. Still others do it in the recliner chair of the infusion bay as the IV is put in so that blood can be drawn for the CBC (complete blood count) so that the patient doesn't have to be stuck twice with a needle. A countertop CBC analyzer located in the lab provides results in 90 seconds.

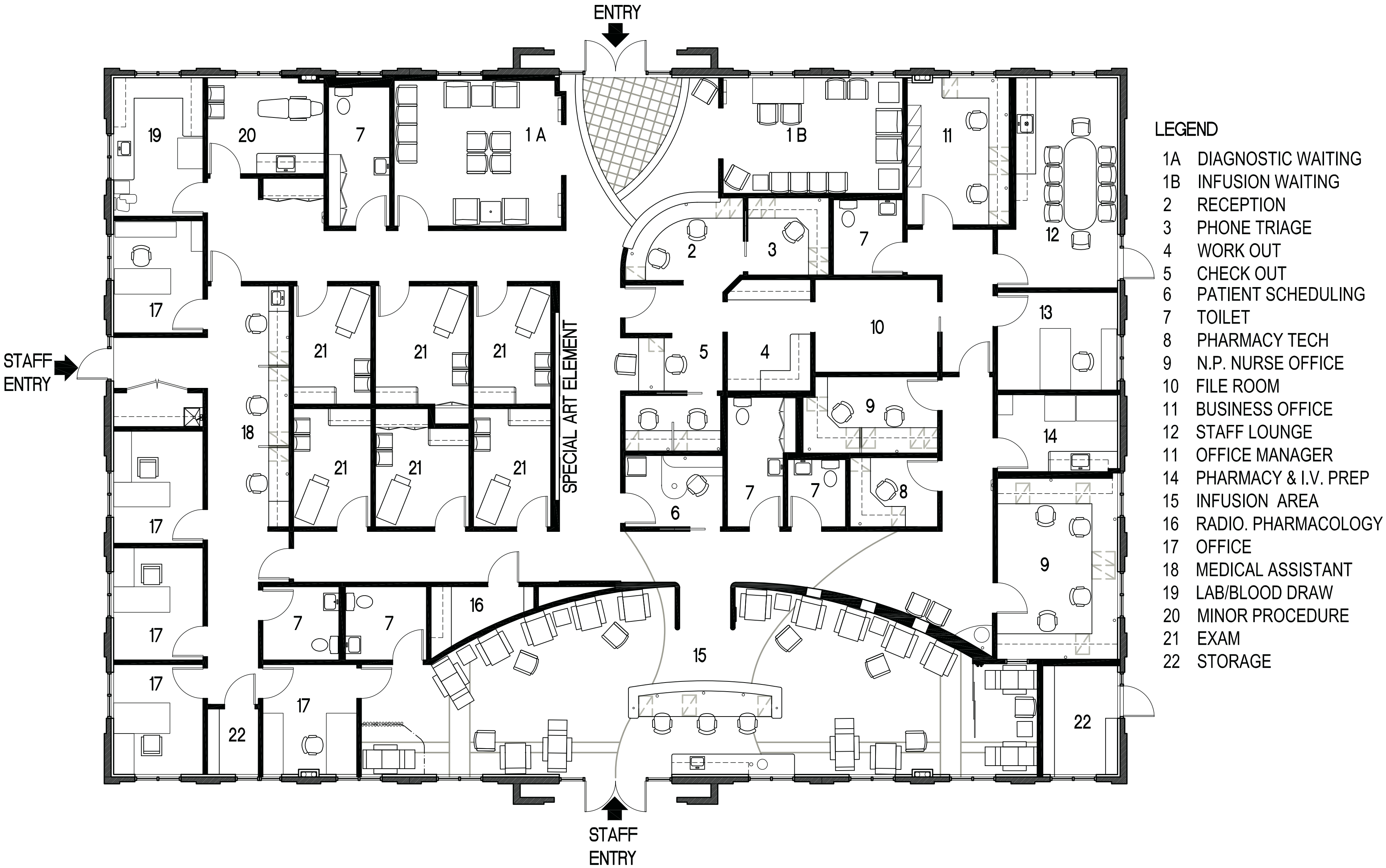
Although in most facilities it is assumed that patients will be tethered to a recliner chair and not walk around during infusion, if the patient is feeling well there is no reason why he or she cannot work a puzzle at a table or sit in a living room setting socializing with friends.

Many patients who visit oncologists do not receive chemotherapy. These patients may be on medications that need to be monitored from time to time. For example, a patient with a slow-growth prostate cancer who is on medication to reduce the growth of the tumor will require frequent PSA (prostate-specific antigen) tests to monitor progress. In this practice, there are many return visits and a great deal of rapport and camaraderie often develops between the patients and staff over the years.

Planning Considerations

Personal Space. Provide a place for personal belongings such as briefcases, books, or handbags so that they are not on the floor where the nurse might trip on them.

Nonclinical Appearance. A wood-look sheet vinyl floor adds warmth to the room. There are no restrictions on carpet (in at least a portion of the room) if a living room ambience is desired with a puzzle table and lounge chairs. The Methodist Hospital Outpatient Center (on the Texas Medical Center campus in Houston) Infusion Center exceeds all expectations for elegance and hospitality design without compromising the functional requirements for this type of facility (see Figures 5-42 and 5-43). There are 10 private infusion rooms and two group rooms accommodating four persons. The exterior corridor with lounge seating for visitors was inspired by the seaside porch of a beach house. It encourages socializing between patients and family and with other patients. An expression of the theme led to the wood slatted ceiling, "whitewashed wood" sheet flooring wall sconces, and



ONCOLOGY CENTER

6775 SF

Figure 5-39. Space plan oncology, 6,775 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-40. Chemotherapy environment is enhanced by backlit image of sky and tree tops. *(Design: Jain Malkin Inc.; Photographer: Steve McClelland Photography)*

blue-and-green-glass mosaics. Located on the twenty-first floor, views of the city are stunning.

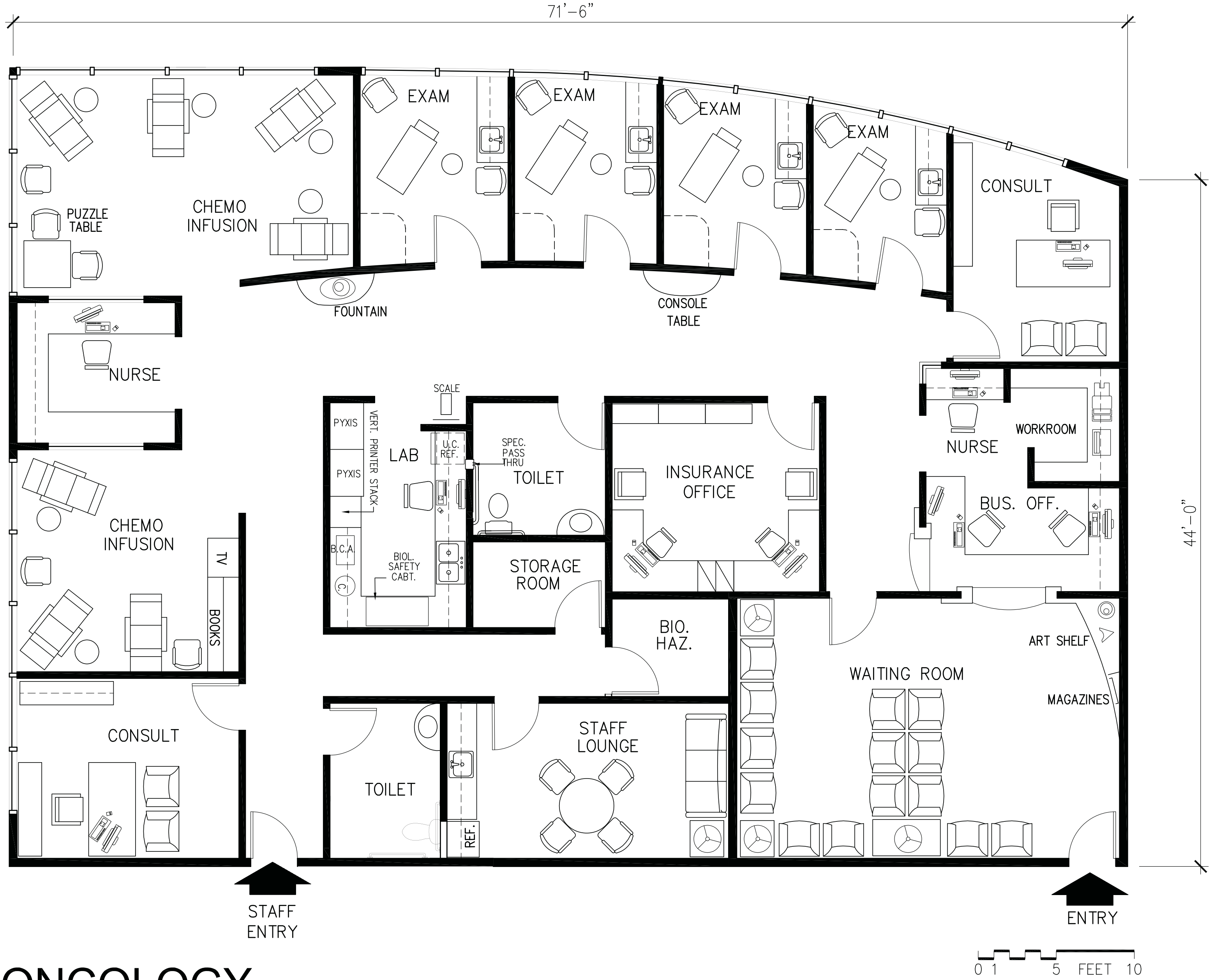
An infusion area on an upper floor sometimes conveys the feeling of being in a tree house (see Color Plate 13, Figure 5-44). In this facility, AtlantiCare in Egg Harbor, New Jersey, each patient has privacy and views, natural light, and an aesthetically beautiful environment. The ceiling and lighting design of this LEED® Gold facility are outstanding as is the overall functional layout of the clinic. For patients desiring a more social experience, there is a "buddy bay" of four chairs (Figure 5-45). Research shows that offering patients options and choices reduces stress as does connecting patients to nature.

Patient Safety. Allowing adequate space around each chair is necessary to ensure patient safety. In a "code" situation, staff must have ready access to all sides of the patient, especially the head.

Visibility. Patients typically want to know that they can be seen by the nurse and they often find it diverting to watch the activity at the nurse station. There is always the tradeoff (especially when a beautiful view is available outside the windows) of turning the chairs so that they face the view, which means that they generally no longer face the nurse station. This is not a problem if other means are employed such as cameras or individual tablet monitors that enable patients and staff to communicate easily (see Color Plate 15, Figure 5-50).

Waste Receptacles. It is hard to imagine how much waste is generated in an infusion setting unless one observes the activity for several hours. Infusions are packed in thick plastic pouches hanging on IV stands. The idea is to enable the nurse to discard the empty bag without having to walk very far to do it. The same is true for sharps containers, yet one wouldn't want to see them exposed next to the patient. The shorter the distance one has to walk to dispose of sharps or chemo bags, the less opportunity there is for exposure or needle sticks. It takes a very thoughtful designer to address these functional issues so that these items are built in and unobtrusive. In addition, there are numerous large waste carts on casters that are unattractive to look at and rarely are they well accommodated.

Hand Washing. Locate sinks in several locations to make it convenient for nurses and doctors to wash their hands. This is essential for infection control.



ONCOLOGY

3146 SF

Figure 5-41. Space plan oncology, 3,146 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-42. Chemotherapy infusion incorporates many evidence-based design features, Methodist Hospital Outpatient Center. *(Courtesy of WHR Architects; Photographer: Aker Imaging, Houston)*

Figure 5-43. Methodist Hospital Outpatient Center. *(Courtesy of WHR Architects; Photographer: Aker Imaging, Houston)*

Other Amenities. A restroom must be nearby, along with a place for self-serve beverages. Family and friends must be accommodated as many patients arrive with another individual for emotional support. Pleasant diversions such as a saltwater aquarium, an interactive work of art, a library of DVD films, and a table with a jigsaw puzzle are welcome diversions. Think about a humor corner with decor and resources all focused on laughter and mirth.

Chemotherapy Infusion

Although spaces designed for this function are sometimes nothing more than a large room with a group of recliner chairs, often placed too closely together, gregarious individuals welcome the closeness and conviviality such a setting often fosters (see Figure 5-38). According to research, however, providing options and choices reduces stress. And nowhere are choices more plentiful than in the Memorial Sloan-Kettering Brooklyn Infusion Center. It is a prototype facility that avoids waiting time; when patients arrive they are “chemo-ready.” They visit, the day before, the MSKCC’s Manhattan headquarters for blood work and screening. When they are cleared, they schedule their appointment at the Brooklyn center. The idea of sanctuary was the overarching theme, a quiet respite from hectic urban lifestyles. The central space is modeled after Manhattan’s “pocket parks” offering many

Figure 5-44. Chemotherapy suite incorporates many evidence-based design features, AtlantiCare Cancer Care Institute. *(Courtesy of Ewing Cole; Photographer: Halkin Photography)*

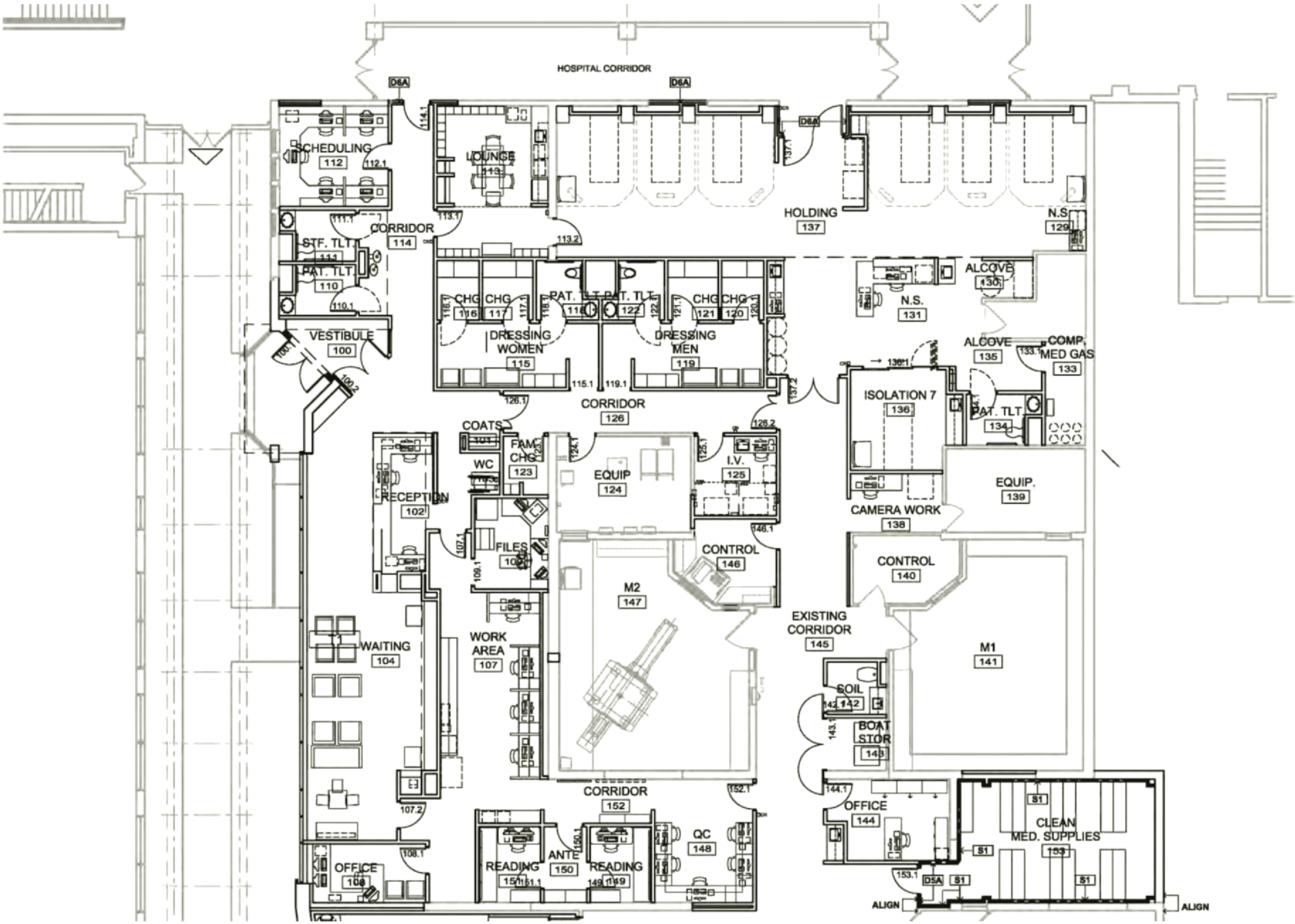


Figure 5-45. Floor plan of oncology department, AtlantiCare Cancer Care Institute. *(Courtesy of Ewing Cole; Photographer: Halkin Photography)*

options for relaxation and socialization, for mingling with patients, staff, and friends (Figure 5-46). There is a bamboo floor and plants, a fountain, a library, numerous types of seating for individual comfort, and a community table for dining or playing a game (Color Plate 14, Figure 5-47). A reading nook at the rear of the space beckons to those who prefer some moments of quiet. Special attention was paid to lighting because, once one leaves the lobby (this is a retail store front space), there is no natural light. Therefore, the ceiling and lighting design mimic natural light with coves and lighted bases of built-in furniture (see Color Plate 14, Figure 5-48).

Upon arrival, patients can check themselves in at a kiosk (see Color Plate 15, Figure 5-49). A wall design of backlit translucent panels changes color via LEDs, one of many interesting design features. Customized treatment

Figure 5-46. Infusion environment offers numerous options in which to receive treatment, Memorial Sloan-Kettering Brooklyn Infusion Center. *(Courtesy of ZGF Architects; John Bartelstone Photography)*

pods have accent walls of teal, red, and orange (see Color Plate 15, Figure 5-50). Sliding glass doors with a fritted pattern provide some privacy but still maintain visual contact. The built-in banquette provides ample space for friends and there is concealed storage for personal effects as well as clinical supplies. The infusion chairs by IOA are equipped with multimedia touch screens that enable patients to check email, watch TV, chat with doctors or friends via Skype, order lunch from a nearby restaurant, and dim the room lighting. In the author's opinion, this facility is the ultimate in what a chemotherapy environment can be: nonclinical, offering many options and choices, positive distraction, opportunities for social support, reduction of environmental stressors (glare, noise, lack of privacy), and use of technology to enable the patient to communicate in multiple ways via the touchpad at the chair. And last, but certainly not least—great design.

Figure 5-47. Infusion environment offers numerous options in which to receive treatment, Memorial Sloan-Kettering Brooklyn Infusion Center. *(Courtesy of ZGF Architects; John Bartelstone Photography)*

Nurse Station

The nurse station should be convenient to exam rooms. Registered nurses, nurse practitioners, and/or medical assistants may work out of this room. The room will require a scale and may have a *Pyxis*™ or *Omnicell*™ unit (Figure 5-51) for dispensing and charging medications (although these may be in the lab), a desk-height workstation with telephone and computer, ample storage for supplies, and a hand-wash sink. A full-height clinical refrigerator is needed if a refrigerated medication dispensing unit like Pyxis or Omnicell is not used.

Laboratory

This is the most complex room in the suite and is often poorly designed, from a functional standpoint, because of the designer's lack of understanding of the numerous pieces of equipment that must be accommodated or, as is often the case, the space available falls far short of what is required for this room. This can result in printers tucked under countertops, computer keyboards placed in awkward locations, and pieces of equipment that should be placed side by side, tethered to each other by cords running along a wall.

Typically, the R.N. who mixes the chemicals also administers them to the patient. Because chemo drugs are highly toxic, this room is kept locked so that janitorial staff do not have access to it. Many oncologists have installed controlled access machines like Pyxis that keep an inventory of drugs, help to prevent error in dispensing medication, and provide greater assurance that patients will be charged for all the meds. The Pyxis or Omnicell system automatically interacts with the billing system and charges the patient's account as drugs are dispensed and then also automatically reorders. There could be three or four drugs dispensed in one chemo preparation. Other meds like flu vaccines would be kept refrigerated at the nurse station. An eyewash device is required close to where the drugs are prepared (Figure 6-64).

Integration of Equipment. There are many pieces of equipment in the lab that need to be well coordinated.

Figure 5-48. Infusion Department. *(Courtesy of ZGF Architects; Chin Y Lai Photographer)*

Some may need to be close to a sink due to a drain line. There will be a blood chemistry analyzer like the Cell Dyn *Emerald* or the Abbott *Piccolo*. The blood count analyzer has a printer, as does the Pyxis, and there is a printer connected to the medical management software that prints labels, and another printer directly connected to a reference lab. One cannot overestimate the amount of countertop space required. There is a need for open storage for quick access to supplies (Figure 5-52) and shelves are needed for binders and manuals. A room 10 × 16 feet would be about right. There also needs to be a kneespace workstation with telephone and computer monitor. There will also be a centrifuge on the countertop as blood specimens that are sent out need to be spun down first. Generally, only blood counts are done in the office; all other lab work is sent out.

Biological Safety Cabinet. Chemotherapy infusion chemicals are mixed in a biological safety cabinet (see Figures 5-52 and 5-53), which is a unit that protects the nurse or tech. It has laminar flow and a HEPA filter and generally need not be vented to the outside although a vented option is also available. A diagram on the Thermo Scientific website illustrates the airflow for each of these options. The nurse must wear gloves, mask, gown, and safety goggles for mixing of chemicals, but only the gown and fresh gloves are worn when the chemicals are administered to the patient. The cabinet by Thermo Scientific is called Class II Type A or AB, which refers to ventilated cabinets with open fronts that use inward airflow for personnel protection, have HEPA-filtered laminar airflow for product protection, and have HEPA-filtered exhausted air for environmental protection per NSF (National Science Foundation) Standard 49. Biological safety cabinets are the primary containment devices used in laboratories to prevent the escape of aerosols. As an optional feature, the cabinet can be vented to exhaust to the outdoors. Local codes must always be consulted in these matters.

Utility Requirements. The benchtop model includes a built-in drain valve, a service valve, and one plugged penetration. The unit incorporates two separate circuit breakers and two line cords, one for the blower/motor and interior lights and one for the electrical outlet. Utility requirements must be confirmed with the vendor and appropriate to the specific model of equipment.

Patient Visibility

A nurse station is always adjacent to the chemo infusion area so that patients are constantly observed. In addition, nurses are continually circulating through the infusion area to change bags of chemicals on the IV stands as they are emptied. If the lab is contiguous with the infusion area, there is often a window through which one can observe patients. The lab should be as close to the infusion area as possible so that nurses always maintain contact with patients and chemicals do not need to be carried throughout the suite. The above is true for infusion spaces in physicians' offices, but larger facilities, usually hospital-based, may employ cameras to observe patients, which enables them to be in more private settings.

OSHA

OSHA has many requirements for biohazardous waste and protection of workers, more fully discussed in Chapter 3. Among these are an eyewash device (Figures 6-64 and 10-10) at the sink in the lab. The closet for biohazardous waste needs to be locked and should ideally be located near the service or staff entrance to the suite for easy collection by a contracted vendor.

OSHA's Office of Occupational Medicine, in a report titled "Exposure to Hazardous Drugs," describes antineoplastic drugs (cytochemotherapeutic agents) as agents capable of inhibiting tumor growth by disrupting cell division and killing actively growing cells. The potential hazards for oncology nurses who prepare the chemicals are substantial unless very strict protocols are followed. The exposure occurs by inhalation of the aerosolized drug (thought to be the primary exposure route), percutaneous (through the skin) absorption, and accidental ingestion. All surfaces of the room should be easy to clean, with few crevices or seams. A high-quality sheet vinyl with self-coved base is ideal. An additional issue is the laundering of linen or uniforms that have been contaminated with chemotherapeutic drugs or infectious agents. Universal precautions must be followed for this laundry. However, cytotoxic drugs (chemicals that are directly toxic to cells, preventing their reproduction or growth) are not necessarily rendered harmless by laundering, according to OSHA, and should be prewashed to remove as much of the drugs as possible before coming into contact with other laundry. Proper storage of contaminated linen should be provided so that housekeeping personnel do not risk exposure.

Offsite Preparation of Chemotherapy Drugs

Some oncologists do not prepare chemotherapy drugs in their offices. They are prepared offsite at the hospital pharmacy or delivered by a pharmaceutical supply vendor. In this case, there may not be a lab or the lab will be quite minimal and, in addition, patients are sent to the lab in the building for their blood tests.

Figure 5-49. Check-in kiosk with wall of backlit translucent panels that change color, Memorial Sloan-Kettering Brooklyn Infusion Center. *(Courtesy of ZGF Architects; Chin Y Lai Photographer)*

Interior Design

There are no special restrictions in terms of interior design for this specialty with the exception of what common sense would dictate for the lab and nurse station. The chemo infusion area can be carpeted (provided the correct type of hospital-type carpet is selected) although some feel carpet should not be used because drops of chemotherapy agents that spill must be cleaned up and they are hard to inactivate without using a bleach-and-water solution. With so much attention focused on ease of maintenance and infection control, a hard-surface floor would likely be more practical. Options would be a wood-look sheet vinyl, a bamboo floor, or a solution-dyed carpet that can be cleaned with bleach. Glare must be considered from the standpoint of a patient reclining in a

Figure 5-50. Optimal private chemotherapy room with every amenity and evidence-based design feature, Memorial Sloan-Kettering Brooklyn Infusion Center. *(Courtesy of ZGF Architects; John Bartelstone Photography)*

chair. The type and placement of fixture is more important than the type of lamp. Lighting that can be adjusted by the patient, or increased when the nurse needs it, would be optimal.

The oncologist's practice is composed of equal numbers of men and women; therefore, the design style, colors, and vocabulary of details should reflect the community the practice serves. Recliner chairs in the infusion room need not be covered with uncomfortable (and cold to the touch) vinyl upholstery fabric but must be able to be wiped clean of blood, IV solutions, and chemotherapy spills. Woven Crypton® provides the same benefits, yet has the ambience of a fine-woven fabric with no limitation on beautiful colors and patterns. A compromise might be a vinyl seat with Crypton® or a solution-dyed fabric on the back and side panels.

GENERAL SURGERY

This is a low-volume practice in large part dependent on referrals from primary care physicians. The suite can be small, because most of a surgeon's work is done in a hospital (Figure 5-54). Patients are examined and interviewed preoperatively and postoperatively in the office, and sutures may be removed or dressings changed.

A surgeon's office (solo practitioner) will usually contain two or three standard-sized exam rooms, a large consultation room (12 × 12 or 12 × 14 feet), a small business office, a waiting room, and a restroom. (If one exam room is larger—10 × 12 feet or 12 × 14 feet—it can be used for minor surgery.) A small nurse station, a niche in the corridor, will suffice for the sterilization of instruments and storage of dressings and supplies (Figure 5-55). An undercounter refrigerator should be built into the cabinet. Refer to Table 5-3 for space program.

The waiting room for a solo practitioner need not accommodate more than eight chairs, since patients are well scheduled and usually do not have to wait a long time. The waiting room in Color Plate 1, Figures 3-10 and 3-11, was designed for a vascular surgeon and reflects his love of contemporary art and architecture. It's a serene retreat for patients who have an abundant choice of current magazines and dozens of art books while they sip tea. Surgeons usually perform surgery in the morning and see patients in the office during the afternoon. The consultation room is larger than for many medical specialties because it may be used for consulting with patients. As with any office today the room should have a computer monitor that can be viewed by the physician and patient.

In a two-surgeon office, it is likely that schedules will be arranged so that one sees patients in the office while the other does surgery. In a three-surgeon practice, perhaps two would see patients at the same time, sharing four or five exam rooms and a minor surgery room (Figure 5-56).

In a one-physician practice, two employees can usually run the business office—answering the phone, booking appointments, handling insurance, and billing patients. A three-or four-physician practice will have an

expanded business office with more staff performing the tasks of reception, bookkeeping, insurance, and surgery scheduling.

All rooms of this suite except the minor procedure room may be carpeted. The decor should be cheerful with warm colors but, above all, it must convey a solid, conservative image due to the nature of the specialty. A patient wants to think of a surgeon as a serious person not subject to frivolities and trendy décor.

Bariatric Surgery

This is a surgical subspecialty that focuses on severely obese individuals and offers a path to weight reduction, although it is an extreme step not to be taken without careful consideration. Actually, there are quite a number of procedures that can be employed to accomplish the goal and they are explained well in great detail in a Wiki article, (www.wiki/bariatric_surgery#sleeve_gastrectomy). In essence, the size of the stomach is reduced by surgically removing all but a banana-shaped "sleeve" in a procedure called sleeve gastrectomy, or by application of a gastric band (such as the *Lap-Band®*), or by removing a section of the small intestine and rerouting it to a small stomach pouch called gastric bypass surgery. Another procedure involves a gastric balloon inserted into the stomach that is then inflated to occupy space and cause the sensation of being full. Several other procedures may be utilized.

Along with surgery, there is quite a bit of consultation on behavior modification that includes sessions with a nutritionist and a psychologist. Obesity may be a genetically based condition, but it is heavily influenced by dietary, social, psychological, and environmental factors. In some practices, a nutritionist and psychologist may be employed as staff and each would then need a private office. If they instead consult, or have a part-time staff appointment, then their schedules could be arranged to enable them to share an office as in Figure 5-57. The nature of this specialty is such that a number of pre-surgical appointments are required as well as numerous postsurgical visits, which makes it a higher-volume practice than a general surgeon's office.

Figure 5-51. Chemotherapy lab in physician's office. *(Photo: Jain Malkin)*

Figure 5-52. Chemotherapy lab in physician's office. *(Photo: Jain Malkin)*

Figure 5-53. Biological safety cabinet for preparation of chemotherapy drugs in physician's office. *(Photo: Jain Malkin)*

GENERAL SURGERY

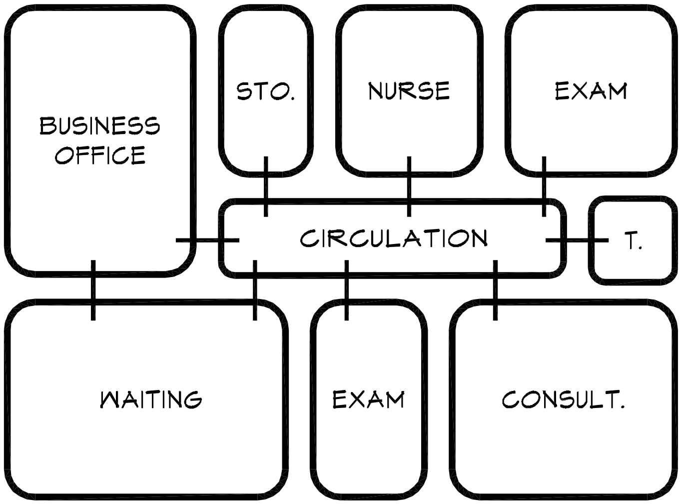


Figure 5-54. Schematic diagram general surgery.

Table 5-3.
Analysis of Program
General Surgery

No. of Physicians		1		2		3*
Exam Rooms	2 @	10 × 12 = 240	4 @	10 × 12 = 480	5 @	10 × 12 = 600
Minor Surgery		12 × 12 = 144		12 × 12 = 144		12 × 12 = 144
Waiting Room		12 × 14 = 168		14 × 16 = 224		16 × 20 = 320
Business Office[a]		16 × 16 = 256		16 × 20 = 320		16 × 24 = 384
Surgery Scheduling		10 × 12 = 120		10 × 12 = 120		10 × 12 = 120
Nurse Stations		8 × 8 = 64		8 × 8 = 64		10 × 10 = 100
Consultation Rooms		12 × 12 = 144	2 @	12 × 12 = 288	3 @	12 × 12 = 432
Toilets	2 @	8 × 8 = 128	2 @	8 × 8 = 128	2 @	8 × 8 = 128
Storage		6 × 6 = 36		6 × 8 = 48		6 × 8 = 48
Staff Lounge		8 × 10 = 80		10 × 12 = 120		10 × 12 = 120
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16		4 × 4 = 16
Subtotal		1,416 SF		1,972 SF		2,432 SF
20% Circulation		283		394		486
Total		1,699 SF		2,366 SF		2,918 SF

*Assumes only two doctors in office at one time.
[a]Includes reception, insurance, and bookkeeping.

Sensitivity to both psychological and functional issues of severely overweight individuals is important in designing an office for this specialty in order to make patients feel as comfortable as possible. Hallways need to be extra wide and doors to exam and procedure rooms should be 42 inches wide. This is functional for moving extra wide exam tables, supersized wheelchairs, and wide procedure tables into rooms. In addition, the service door into the suite should be 42 inches wide. Each nurse station will have a scale and this requires privacy. Being weighed is a sensitive issue for anyone, and especially for persons dealing with extreme overweight. Wing walls around the scale provide privacy (see Figure 5-57) and a place to locate grab bars on the sides for people to grasp.

The exam table will be a bariatric one as will the procedure table (Figure 5-58), which is a Midmark Ritter *Barrier-Free®* power table with 850-pound capacity. All furniture in this suite should be bariatric (refer to Chapter 11). A number of healthcare furniture companies offer aesthetically pleasing options that do not obviously look like "super-sized" seating. They are elegant in styling and do not stigmatize an individual. The procedure room is used for a number of postsurgical adjustments such as required by the Lap-Band®. In this surgery, the band is placed on the upper part of the stomach and an infusion port is created under the skin of the abdomen. Adjustments to it are made through that port by instilling or withdrawing saline to adjust the size.

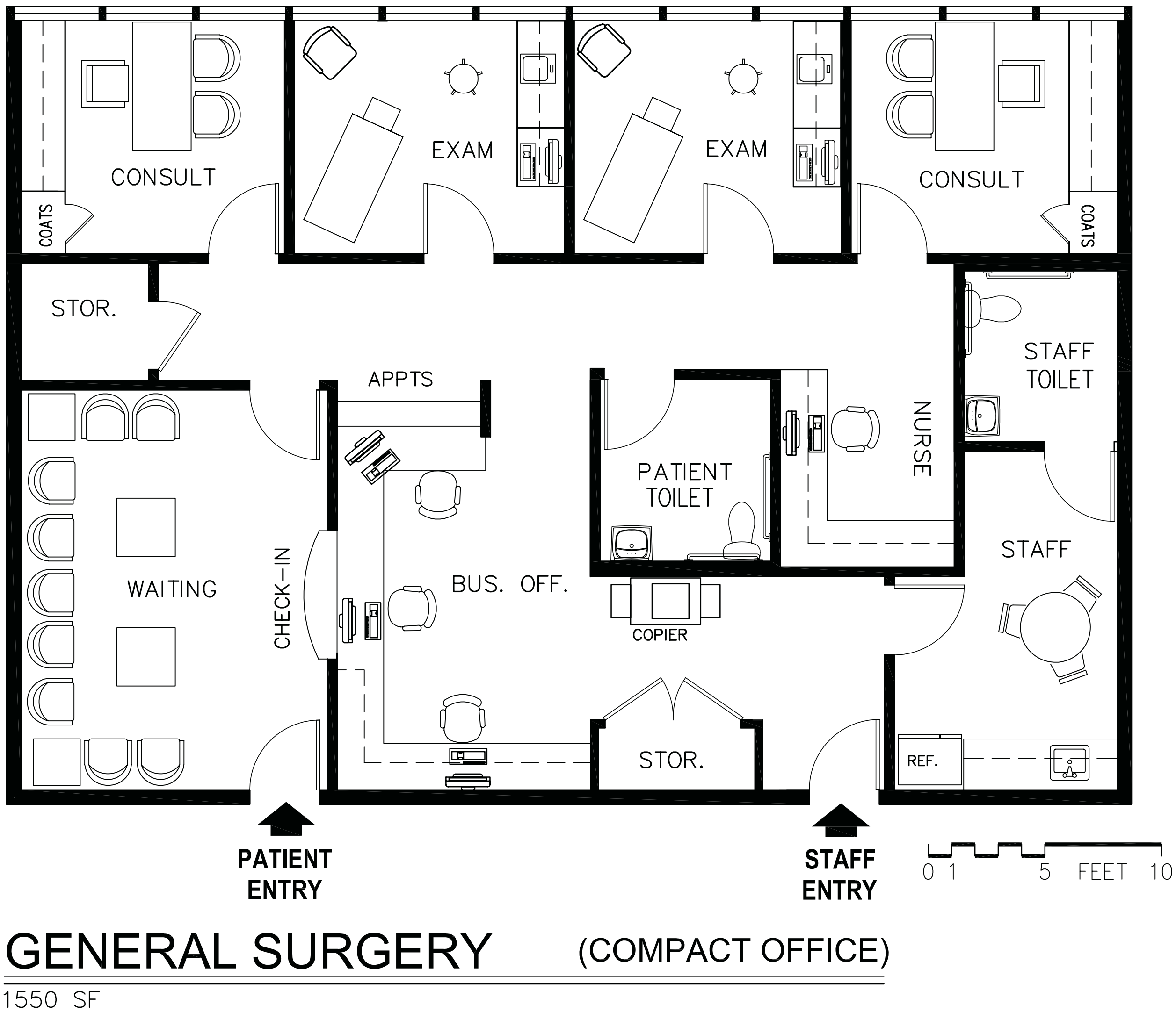
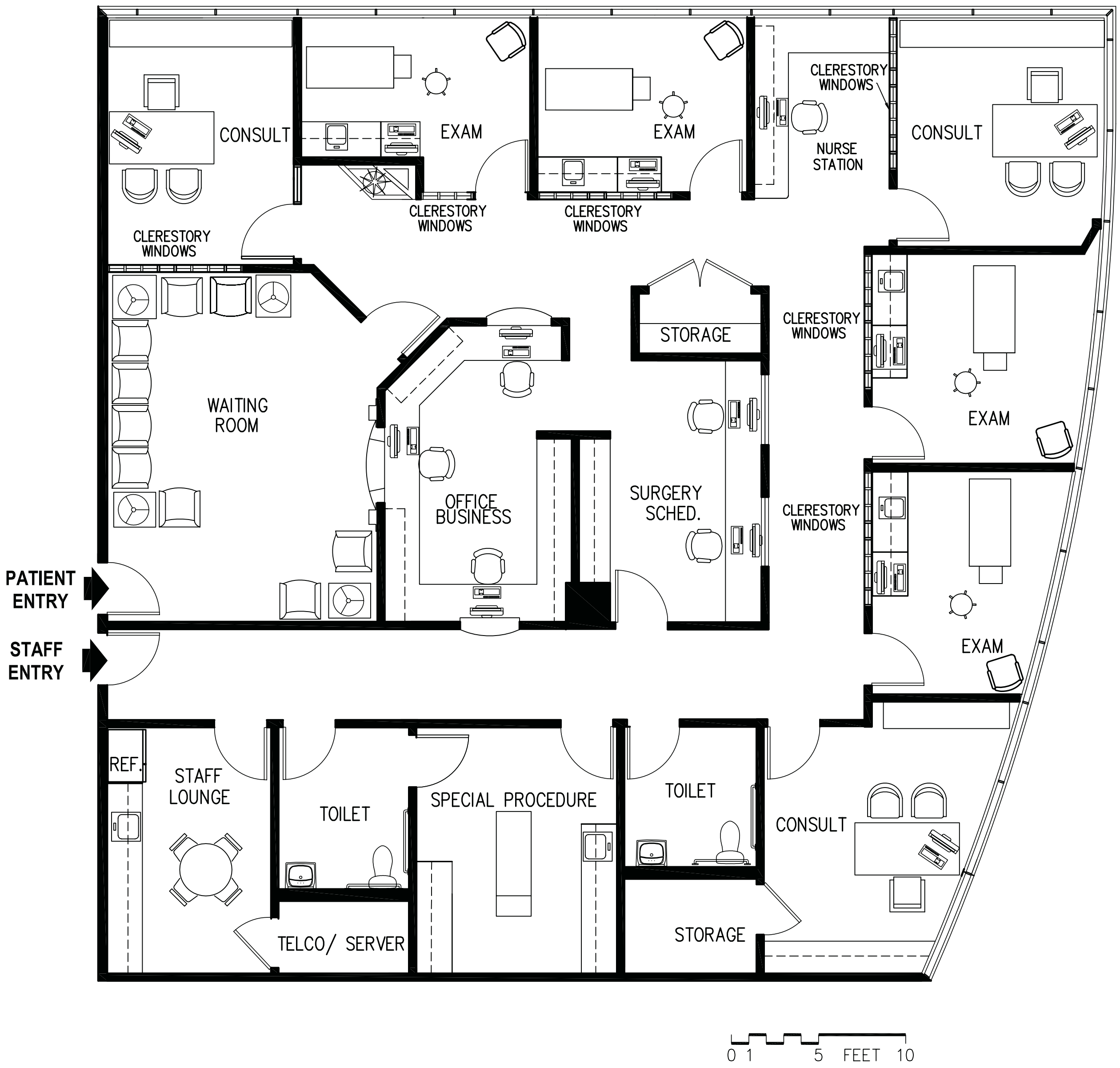


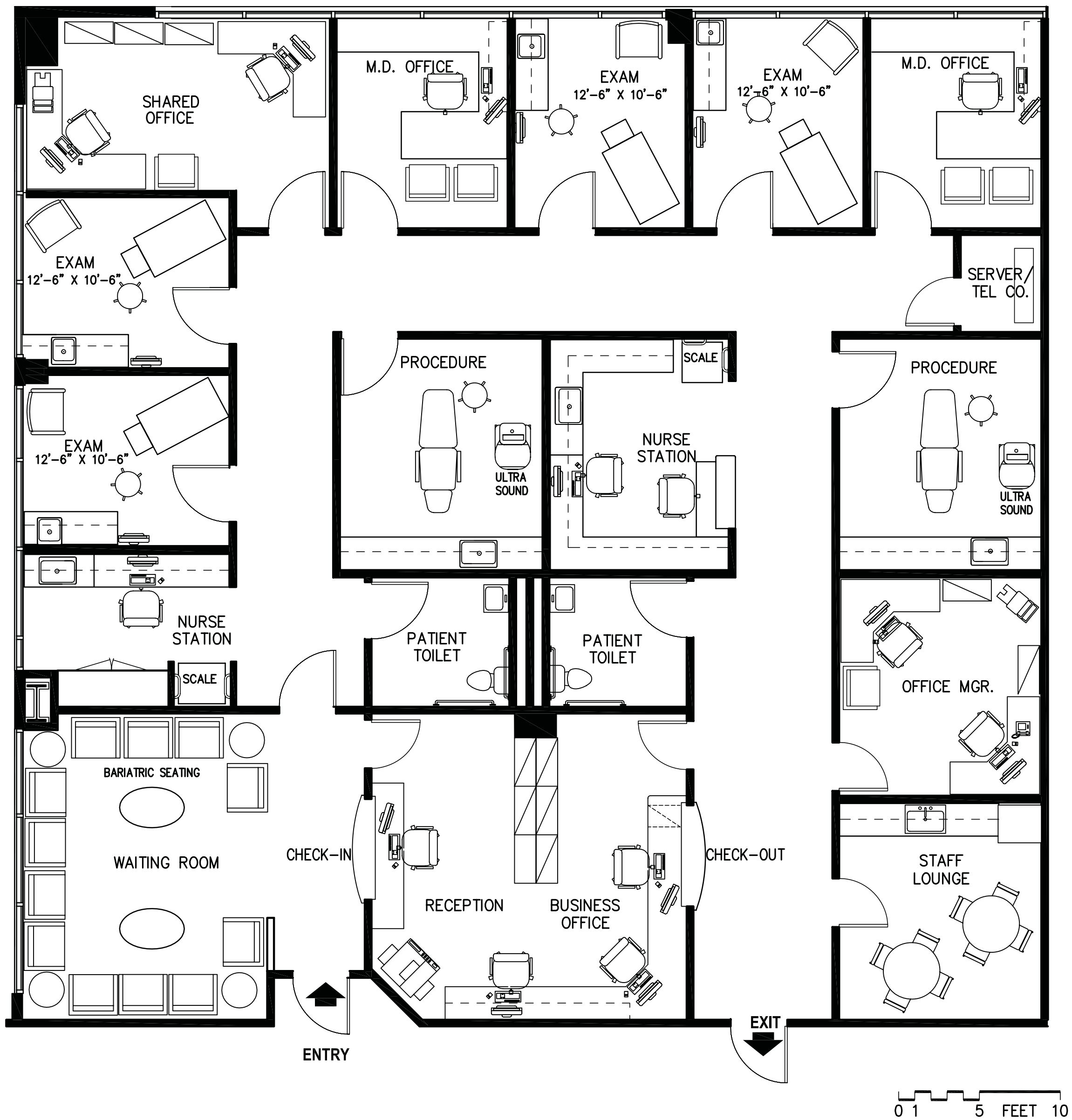
Figure 5-55. Space plan general surgery, 1,550 square feet. *(Design: Jain Malkin Inc.)*



GENERAL SURGERY

3080 SF

Figure 5-56. Space plan general surgery, 3,080 square feet. *(Design: Jain Malkin Inc.)*



BARIATRIC SURGERY

4023 SF

Figure 5-57. Space plan bariatric surgery, 4,023 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-58. Ritter 244 Barrier-Free® bariatric power treatment table. *(Courtesy of Midmark Corporation)*

Interior Design

The design of this suite should be cheerful and upbeat and display art that avoids any body distortions. Garden or landscape themes are good, still lives, florals, anything that is a "feel good" image is appropriate. Hallways, waiting room, nurse stations, and offices should be carpeted with a high-performance healthcare-type carpet but exam and procedure rooms require a hard-surface floor such as a wood-look sheet vinyl. Be aware of the static load specifications of the flooring selected because the extra-heavy exam and procedure tables may leave divots in the flooring when/if the equipment is moved.

Breast Surgery

The office for a breast surgeon may be fairly small as in Figure 5-59. It may have a stereotactic procedure room and one or two exam rooms plus an ultrasound machine.

OTOLARYNGOLOGY

An otolaryngologist treats diseases of the ears, nose, and throat and tumors of the head and neck. Some physicians develop a practice in allergy and immunology as well. This surgical specialty is more commonly known as ENT (ear, nose, and throat), and its practitioners sometimes practice facial plastic surgery. Depending upon the focus of the ENT practitioner, the suite can vary considerably in the complement of rooms (Figure 5-60).

Nasal endoscopy—due to optimal illumination and magnification—has revolutionized the diagnosis and management of patients with sinonasal disorders by helping the physician assess whether medical or surgical treatment is indicated. As with a number of the newest diagnostic instruments, a video record of the examination can be uploaded to the patient's electronic health record. In nasopharyngoscopy, a flexible tube is passed through the nose into the back of the throat while video is taken through the scope. This enables the physician to see the nasal passages, pharynx, larynx, and other structures. Patients visiting an otolaryngologist may have a very wide number of disorders ranging from pediatric birth defects of the head and neck, cancers of the tongue or throat, cleft palate, dizziness, balance problems, ear infections, or seasonal allergies.

For maximum efficiency, a solo practitioner needs three examination rooms, a waiting room that seats 10 to 12 persons, an audio test room and hearing aid dispensing area, a minor surgery room (or if facial plastic surgery is practiced, an office-based surgery suite and recovery room), a business office, consultation room, and a nurse station/lab (Figures 5-61 and 5-62). A two-physician suite would have an additional consultation room and two or three additional exam rooms (Figure 5-63). Refer to Table 5-4 for space program.

In-house X-ray has declined due to OSHA and other regulatory issues, the cost of a technician, and liability in reading films. Furthermore, the most complex problems are now diagnosed by CT scan or magnetic resonance imaging (MRI), which have become the standard of care.

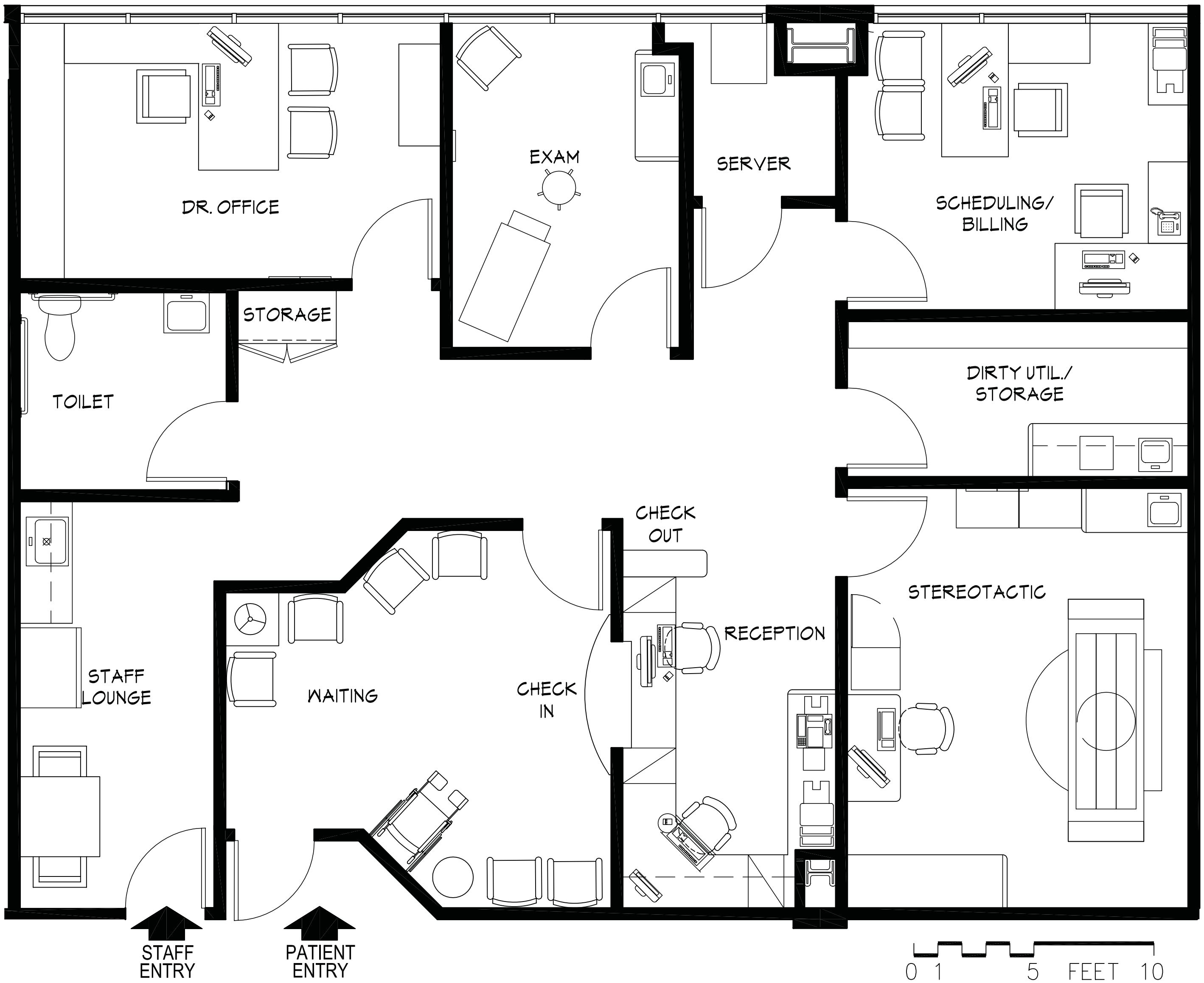
The consultation room is large (12 × 14 feet) since patients may be brought into this room to discuss fees for surgery or to discuss the feasibility of a surgical procedure. Another option is a financial consultation room such as one found in plastic surgery offices.

Exam Rooms

Examination rooms should be 10 × 10 or 10 × 12 feet with the sink cabinet located on the wall with the door on the long wall. A motorized examination chair (Figure 5-64) is located in the center of the room with the patient facing the door. The chair swivels 360 degrees. The physician works off of a cart along the wall, to the right of the patient. Most of the time, the physician is seated on a stool with casters. Each exam room needs a computer and flat screen monitor.

The unit from which the physician works is usually a specialized manufactured instrument cabinet on casters (Figure 5-65) containing a suction unit and pump, compressed air, a cautery, an electrical panel for instruments, racks for solution bottles, and a shelf and drawers for medications, cotton jars, irrigation syringes, and atomizers.

Approximately 26 inches wide by 18 inches deep by 46 inches high at the rear panel, it requires a grounded duplex outlet. Some units have Corian® tops and plastic laminate faces. (These are often referred to as SMR® carts by physicians, but the SMR division of Storz Instrument was acquired by Global Surgical Corp. in 1994.)



BREAST SURGERY

1544 SF

Figure 5-59. Space plan for breast surgery, 1,544 square feet. *(Design: Jain Malkin Inc.)*

Table 5-4.
Analysis of Program
Otolaryngology

No. of Physicians		1		2[a]
Exam Rooms	3 @	10 × 12 = 360	5 @	10 × 12 = 600
Consultation Rooms		12 × 12 = 144		12 × 14 = 168
Business Office[b]		20 × 20 = 400		20 × 20 = 400
Office Manager		—		10 × 12 = 120
Nurse Station/Lab		8 × 10 = 80		8 × 12 = 96
Waiting Room		14 × 16 = 224		14 × 20 = 280
Audio Room with Dispensing[c]		12 × 16 = 192		12 × 16 = 192
Allergy Shots		8 × 8 = 64		—
Toilets	2 @	8 × 8 = 128	2 @	8 × 8 = 128
Procedure Room		12 × 14 = 168		12 × 14 = 168
Outpatient Surgery				844 SF
Subwait		—		8 × 10 = 80
Operating Room		—		14 × 16 = 224
Scrub		—		4 × 5 = 20
Nurse Station		—		8 × 8 = 64
Toilet/Lockers				8 × 9 = 72
Soiled Utility		—		6 × 10 = 60
Clean Utility		—		8 × 10 = 80
Med Gas Storage		—		4 × 5 = 20
Janitor Closet		—		4 × 4 = 16
Equipment (air, suction, generator)		—		6 × 8 = 48
Recovery (2 beds)		—	2 @	8 × 10 = 160
Storage		8 × 8 = 64		8 × 8 = 64
Staff Lounge		10 × 10 = 100		10 × 12 = 120
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		1,960 SF		3,216 SF
20% Circulation		392		643
Total		2,352 SF		3,859 SF

[a]Two physicians share a consultation room (private office).
[b]Business office includes reception, appointments, insurance, and surgery scheduling.
[c]Audiometry testing can be contained in one room (audio booth plus dispensing) or it may be an enhanced service line requiring a suite of rooms with its own waiting area, depending upon staffing as in Figure 5-63.

Note: The one-physician suite outlined above would serve an otolaryngologist who does not do office-based surgery; the two-physician suite is designed for practitioners who do.

Sometimes the medical examination cabinet is purchased without suction and air features, in which case the designer needs to provide a vacuum system within the suite. Many physicians prefer central suction. A small room, 5 feet by 5 feet, should be provided close to the examination rooms to eliminate long-distance piping. Vacuum pumps and air compressors are noisy, so the walls of this room should be well insulated. Usually, two separate 20-ampere circuits will be required. A local vacuum contractor or a competent plumbing contractor can provide the designer with specs on the equipment and will install the plastic piping. The piping would be done after the HVAC (heating, ventilating, and air conditioning) has been completed, but before the partitions are closed up.

One exam room may be slightly larger to accommodate digital fiber-optic diagnostic equipment. This involves a monitor, an image capture device (miniature camera on tip of fiber-optic scope), and a printer. Both physician and patient can watch the procedure on video and the patient can leave with a photo. With a different probe one can examine the ear, nose, throat, and larynx. Note that fiber-optic scopes need to be carefully disinfected. This is typically performed in a lab and requires about 5 feet of countertop space for the basins used to

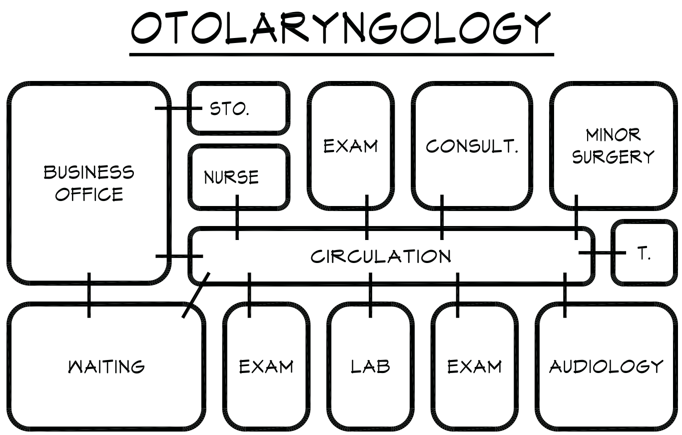
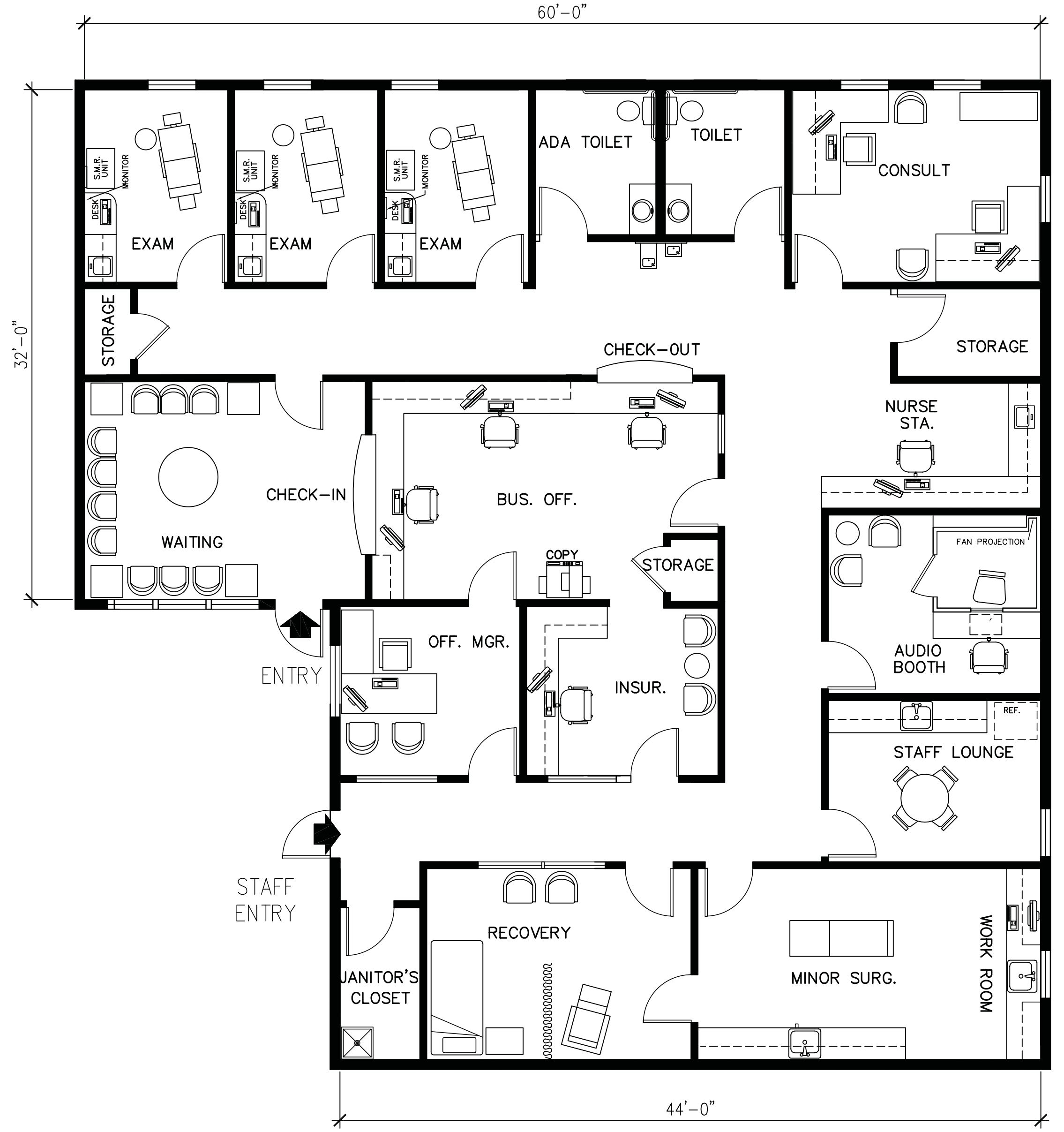


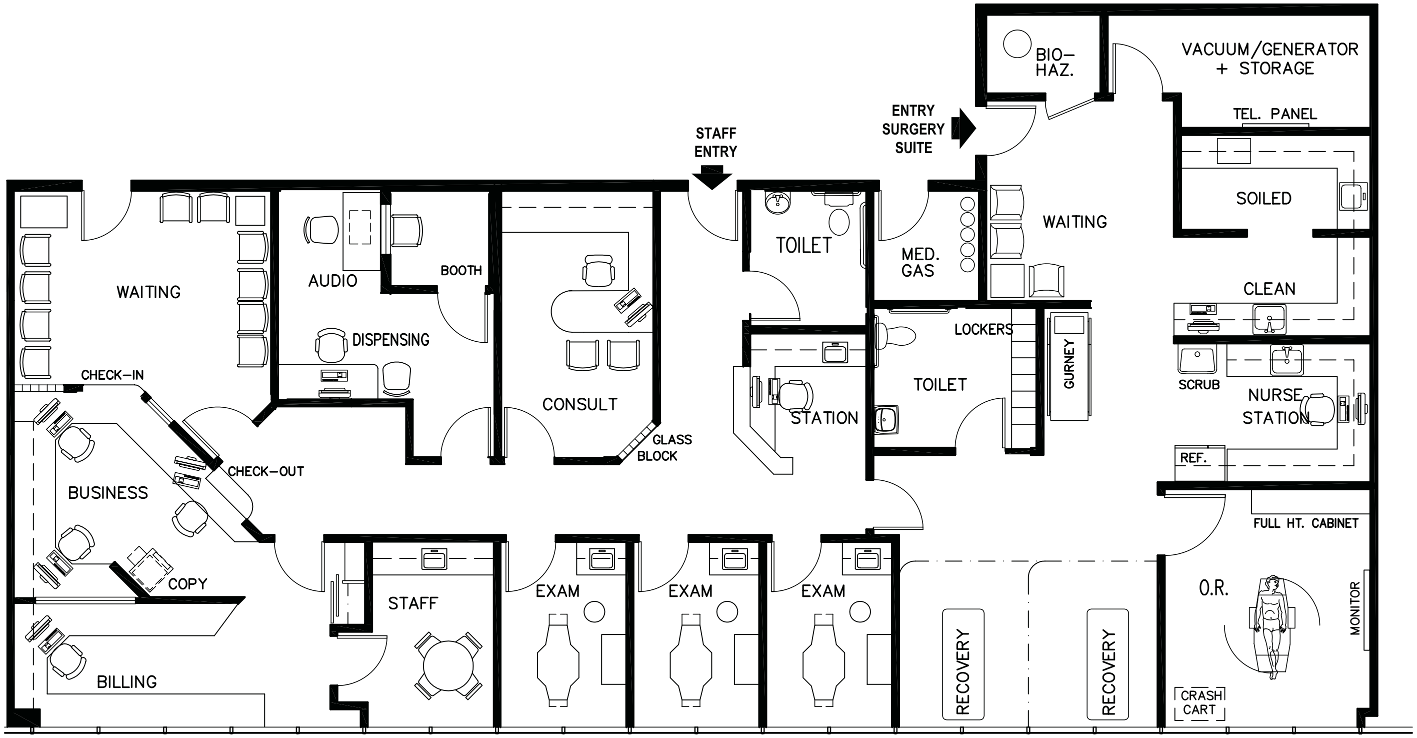
Figure 5-60. Schematic diagram of otolarynogology suite.



OTOLARYNGOLOGY

3150 SF

Figure 5-61. Space plan for otolaryngology suite, 3,150 square feet. *(Design: Jain Malkin Inc.)*



OTOLARYNGOLOGY (WITH SURGERY SUITE)

2883 SF

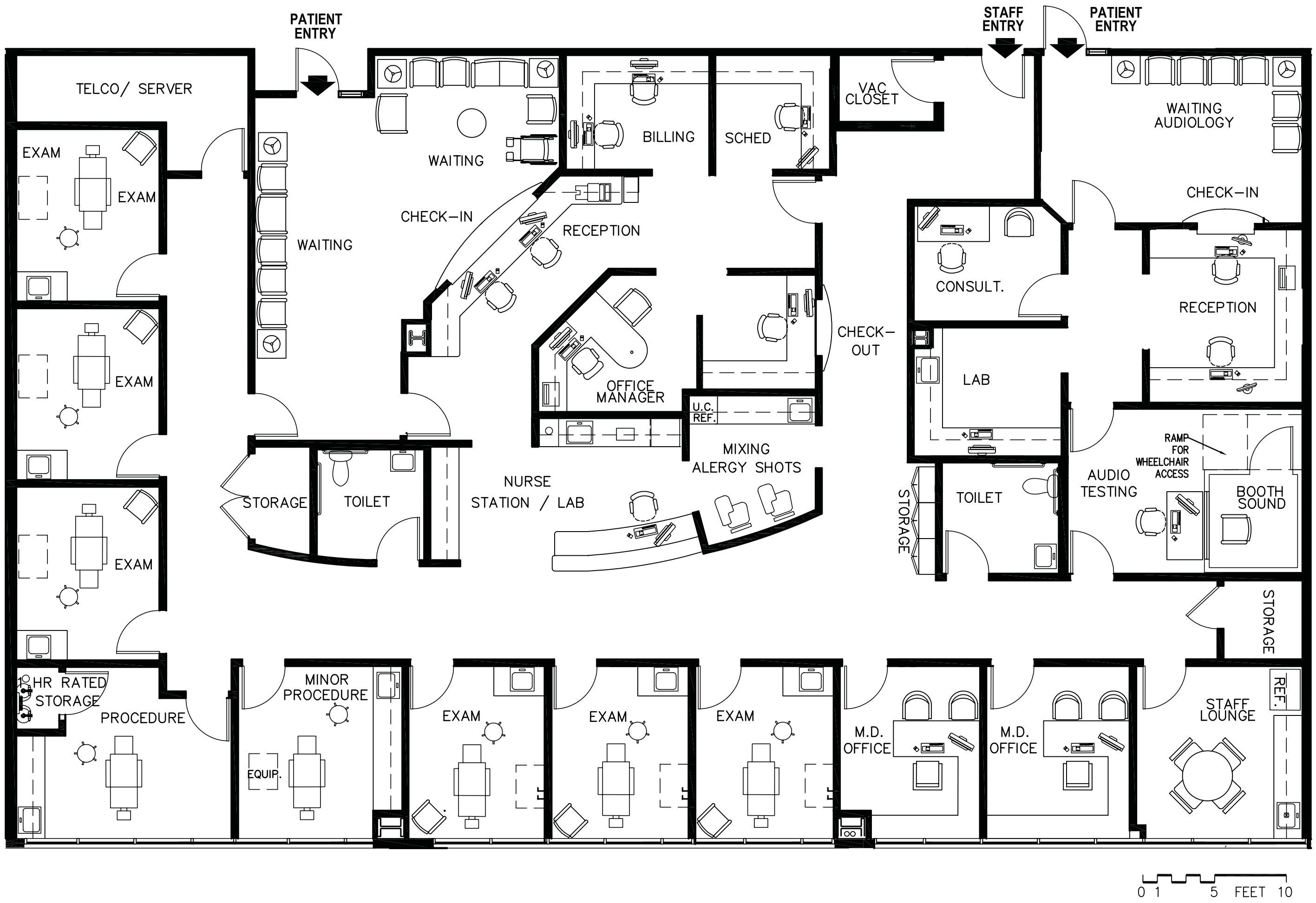
Figure 5-62. Space plan for otolaryngology suite, 2,883 square feet. *(Design: Jain Malkin Inc.)*

soak the scopes. This needs to be near a sink. They are washed first, then placed in a strong chemical solution and thereafter laid on a towel for drying. Refer to the Urology section of this chapter for more discussion on this topic.

A nice feature in exam rooms and the recovery room is a wall-mounted cosmetic mirror. A dressing area is not required in ENT exam rooms.

Office-Based Surgery

If the physician does only ENT and no facial plastic surgery, a minor surgery room (refer to Chapter 3) would be used for special procedures and for emergency care. As the practice matures, some otolaryngologists tend toward more cosmetic and reconstructive facial plastic surgery because it is more lucrative and, perhaps, more



OTOLARYNGOLOGY (EAR, NOSE AND THROAT)

4750 SF

Figure 5-63. Space plan for otolaryngology suite, 4,750 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-64. Midmark 630 Barrier-Free® power procedure table. *(Courtesy of Midmark Corporation)*

Figure 5-65. ENT cabinet. *(Photo courtesy of Global Surgical Corporation, Inc.)*

interesting than routine ENT procedures. Procedures such as nose reconstruction, facelifts, eye tucks, and face peels as well as routine tonsillectomies and sinus surgery may be performed in the office in a well-equipped outpatient surgery room with ancillary recovery room and scrub and prep areas (see Figure 5-62). Regulations have tightened on office-based surgery, requiring far more space than practitioners previously allocated.

The surgery room should contain one wall of built-in cabinets, and the sink should have a plaster trap and foot-lever control for hot, warm, and cold water. Scrub and prep can be done in the surgery room if the room is large enough and if patient volume is low. An electrical outlet is required in the floor for the motorized table. Other electrical outlets and connections for suction, compressed air, and instruments should be located by the physician, since this room allows for a variety of options with respect to work habits. The reader is referred to the Plastic Surgery section of this chapter for a detailed discussion of an office-based surgery suite, requirements for third-party payers, and accreditation issues.

Audio Testing

A basic part of an otolaryngologist's practice involves diagnosing and treating patients with a hearing loss. An audiometric test booth is used for testing hearing. It is a soundproofed booth approximately 48 × 60 inches (or may be larger) with a door at one end. The patient sits inside and listens to sounds of different frequencies through headphones. The technician or audiologist sits outside the booth, at a counter facing the patient, and looks into the booth through a window so that the patient is always in view (Figure 5-66). This countertop contains the audiometer test equipment from which sounds are transmitted to the patient in the booth (Figure 5-67). The patient's responses are digitally recorded, and a graph of hearing loss is produced for the physician to evaluate. Additional audiology test equipment includes a tympanometer (Figure 5-68) to assess middle ear conditions.

The audio booth is available as a prefabricated unit (Figure 5-69a) that breaks down into components and is assembled in the room by an installation technician. Smaller units are preassembled. The booth has a ventilation system, lighting, and a prewired medical jack panel to connect it to the testing equipment. In some jurisdictions, according to the manufacturer, the booth may need a sprinkler inside. An exhaust and electrical outlet are usually placed on the operator's window wall. Although it comes with a light, this may need to be changed to something more appealing. The audio testing room must be located in a quiet part of the suite, away from the heavy traffic of the waiting room and business office. If the prefab booth is to be handicapped accessible, which most are, the booth may be ordered with a ramp that can easily be removed when not needed to get over the 4-inch-high "ledge."

A custom audio booth can be built on the job, but rigorous construction specifications must be adhered to in order to achieve a sound transmission class of 55 to 60 decibels. Double-stud walls with several layers of sound board, insulation batting, and a solid-core door with an acoustic seal on all sides would be required.

CT Scans

The Carestream CS 9300 does point-of-care 3D imaging in the otolaryngologist's office to visualize the temporal bone and sinus structures. This provides immediate access to CT scans at 94 percent lower radiation dose than conventional CT systems. It is also more comfortable for the patient (Figure 5-69b).

Hearing Aid Dispensing

The audiologist will make a mold of the ear and fit and adjust the hearing aid when it arrives. A small lab is used for this type of activity. From time to time, patients will return to have their hearing aids fine-tuned. This can take place in the same room as the audio testing if a desk is provided for the audiologist and if there is suitable storage.

Figure 5-66. Audiometry office with window into audio booth. *(Photo courtesy of Steve Rivenson)*

Figure 5-67. Sample of an audiometer. *(Source: Welch Allyn, Inc.)*

An L- or U-shaped desk works best. The computerized equipment that tunes the hearing aid sits on the desk and the patient sits to the side of the desk facing the audiologist (see Figure 5-62).

Interior Design

There are no special requirements for interior design in this suite. If the practice tends toward facial plastic surgery, the office design should reinforce the image of the surgeon as a successful, skilled professional with refined aesthetic taste. The reader is referred to the Plastic Surgery section in this chapter for additional discussion on this topic.

Figure 5-68. Sample of a tympanometer. *(Source: Welch Allyn, Inc.)*

OPHTHALMOLOGY

This specialty is characterized by a variety of options in suite design. Therefore, the individual practitioner must make the basic decisions on preferred work habits before the designer can begin. The constant demand for specialized eye care means that the ophthalmologist may attain a capacity patient load within the first two years of practice. Thus, it is important to project at the outset what the ophthalmologist's space needs will be in two or three years. Often, young ophthalmologists setting up their first offices will try to be too economical. They set up an undersized office based on their patient projection (usually underestimated) at that moment. Then, for the remainder of their lease, they are handicapped by a small, poorly laid-out office, which greatly inhibits the growth of their practice. Figure 5-70 diagrams the relationship of rooms, and Table 5-5 lists the space program.

Patient Volume

Many ophthalmologists schedule three patients per hour for regular eye examinations, although the testing portion of the examination and updating the patient's medical history is done by a tech or medical assistant prior to the physician entering the room. Added to that are unscheduled patients—emergency and trauma—and postoperative patients, and it is not unusual for an ophthalmologist to see four or five patients an hour. Individual practice habits may differ, with some doctors spending more time informally chatting with patients than those who choose to work in a more restricted, tightly scheduled manner. The more relaxed ophthalmologist may see only two patients per hour, particularly if he or she does all the testing with little assistance from aides, but this is rare, especially with declining reimbursement and the pressures of having to see more patients. A number of technologically advanced types of diagnostic equipment have the potential to streamline the flow of patients and enable a technician to do many tests quickly, with accuracy, and to upload the data to the patient's EHR. The multimodality *EPIC® 5100* refraction

Figure 5-69a. WhisperRoom™ audio booth. *(Courtesy of WhisperRoom, Inc.)*

Figure 5-69b. Point-of-care computerized tomography (CT) imaging, Carestream CS 9300 (ENT). *(Copyright © Carestream Health, Inc. 2013)*

workstation (Figure 5-71) has an auto refractor/keratometer, auto chart projector with glare testing auto lensmeter, and a digital refractor. It can be seen in the space plan in Figure 5-72.

Required Rooms

A solo practitioner needs at least two refraction rooms, plus a third multipurpose or surgery/treatment room (see Figure 5-72). While a patient whose examination has been concluded is gathering up possessions and receiving medications and instructions from the tech or aide, the doctor has already stepped into the next refraction room and has begun to examine the next patient with no loss of time. The surgery room can be used for removing a foreign body from the eye or for other emergency visits, or the doctor may see an unscheduled patient in this room while he or she is between patients without interrupting scheduled patients in the refraction rooms (Figure 5-73). The surgery room can also be used for photography or for visual fields testing or orthoptic evaluations. Some ophthalmologists do not require a large multipurpose treatment room as they do all their procedures in the exam room, including removal of cysts, suturing lacerations, and so on. However, an ophthalmologist who does cosmetic procedures on eyelids and forehead can perform these in the office in a surgery room. These are typically done using local anesthetic.

An ophthalmologist does not need a nurse station or lab as such, but it is advisable to provide a workspace in a niche off the corridor (see Figure 5-72) for an assistant or tech. This is where phone calls can be received or made to reschedule patients, prescriptions authorized, and medications dispensed. Ophthalmologists may dispense a number of eye drops and medications, which may be stored in a rack in each examining room or at the assistant's work area.

Optical Dispensing

It is not uncommon for ophthalmologists to practice as solo practitioners with the help of an assistant or technician. An

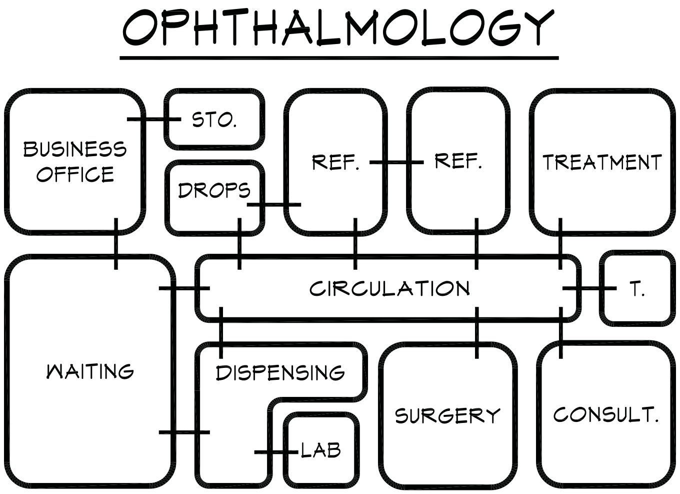


Figure 5-70. Schematic diagram of an ophthalmology suite.

optician may also be part of the practice, in which case an area approximately 10 × 24 feet is needed, divided into a lab, a contact lens area, and a fitting area (Figure 5-74). The lab has walls lined with cabinets and work counters and requires shadow-free lighting. The office in Figure 5-74 has three refraction rooms near the optical dispensing area dedicated to optometrists.

The contact lens area requires a small fitting table 2 × 4 feet with a mirrored top. The patient sits on one side and the optician on the other. The room may also have a storage cabinet and a small sink. The fitting area has a long table divided into a number of fitting stations, each with a mirror, and may have panels of eyeglass frames (*frame bars*) located on either side of the patient. The optician sits on a stool behind the table and works from drawers and cabinets to the side and behind. Attractive wall frame bars can be purchased ready made, or they may be designed and custom fabricated to hold the many eyeglass frames to be displayed.

Ophthalmologists who offer the services of an optician are called *dispensing physicians*. As a marketing strategy, it is advisable to give as much visibility as possible to the dispensing area so that waiting patients are tempted to walk over and try on the frames (see Figure 5-72).

Table 5-5.
Analysis of Program
Ophthalmology

No. of Physicians		**1**		**2**		**4[a]**
Refracting Rooms	3 @	10 × 12 = 360	6 @	10 × 12 = 720	9@	10 × 12 = 1080
Procedure Rooms		12 × 12 = 144	2 @	12 × 12 = 288	2@	12 × 12 = 288
Consultation/Private Office[b]		10 × 12 = 120	2 @	10 × 12 = 240	4@	12 × 12 = 288
Fields Room		6 × 8 = 48		6 × 8 = 48		6 × 8 = 48
Data Collection		12 × 12 = 144		12 × 12 = 144		12 × 12 = 144
Waiting Room		14 × 18 = 252		18 × 20 = 360		22 × 26 = 572
Mydriatic		Use Waiting Room		6 × 12 = 72		8 × 12 = 96
Toilets	2 @	8 × 8 = 128	2 @	8 × 8 = 128	3@	8 × 8 = 192
Business Office[c]		14 × 20 = 280		20 × 20 = 400		20 × 20 = 400
Office Manager				10 × 12 = 120		10 × 12 = 120
Tech/M.A. Station		5 × 10 = 50		5 × 10 = 50		5 × 12 = 60
Storage		4 × 6 = 24		6 × 8 = 48		6 × 8 = 48
Optician and Lab						
Contact Lens		300 SF		(Nondispensing Physician)		500 SF
Staff Lounge		10 × 10 = 100		10 × 10 = 100		12 × 12 = 144
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16		4 × 4 = 16
Subtotal		1,986 SF		2754 ft²		4016 ft²
20% Circulation		397		551		803
Total		2,383 SF		3305 ft²		4819 ft²

[a]It is likely that only three physicians would be in the office at any one time.
[b]Physicians sharing a private office, two in each 12 × 12 room.
[c]Includes reception, insurance, appointments, and surgery scheduling.

Refraction Room

The most important room is the refraction room, a multipurpose examination room with equipment and instruments grouped around the patient and the doctor sitting either in front of the patient or just to one side. Right-handed physicians may prefer to examine from the patient's right side although, if the physician wants to write notes while facing

Figure 5-71. EPIC Refraction workstation. *(Courtesy of Nidek Incorporated)*

the patient, the preference may be to locate the cabinet (with writing desk) to the left of the patient. The dimensions of this room are crucial, and both the ophthalmologist's work habits and instruments will dictate the critical distances that must be observed.

Refraction rooms have two basic sizes. Since a standard eye chart is designed for a distance of 20 feet from chart to patient's eye, refraction rooms used to be 24 feet long (20 feet for the refraction lane plus 4 feet for the examining chair and space to walk around it). However, with the aid of projectors and mirrors, the room length may be reduced to 12 or 14 feet. A 9- or 10-foot-wide by 12-foot-long room would be suitable. Today, it is rare to find refraction rooms longer than 12 feet.

To compensate for a room length of less than 24 feet, two mirrors are placed on the wall in front of the patient, and a screen is placed on the wall behind the patient (see Figure 5-73). A projector (Figure 5-75), usually wall mounted, projects the text characters onto one of the front mirrors, which, in turn, projects it back to the screen behind the patient. The second mirror, in front of the patient, reflects the image from the rear screen. The refracting lane, in this case, is the distance measured between the second mirror and the screen plus the distance between the mirror and the patient. The letters of the eye chart can be adjusted in size by the projector so that correct visual acuities can always be maintained.

There are several types of procedures performed in the refracting room, but the primary task is to determine the refractive power of the eye. To do this, the tech or physician selects various lenses from a partitioned rack (Figure 5-76), a *trial lens box* (approximate size 12½ × 20½ × 2½ inches), and places them in a holder through which the patient looks. The patient is asked to read the test letters to determine which lens is best. Sometimes a *refractor*, an instrument containing lenses, is used.

The interior of the eye, the fundus, is examined by an *ophthalmoscope*, a handheld light source, while the conjunctiva, lens, iris, and cornea (the front portions of the eye) are examined with a *slit lamp*, an illuminated microscope, which may be mounted on the shelf of the instrument stand

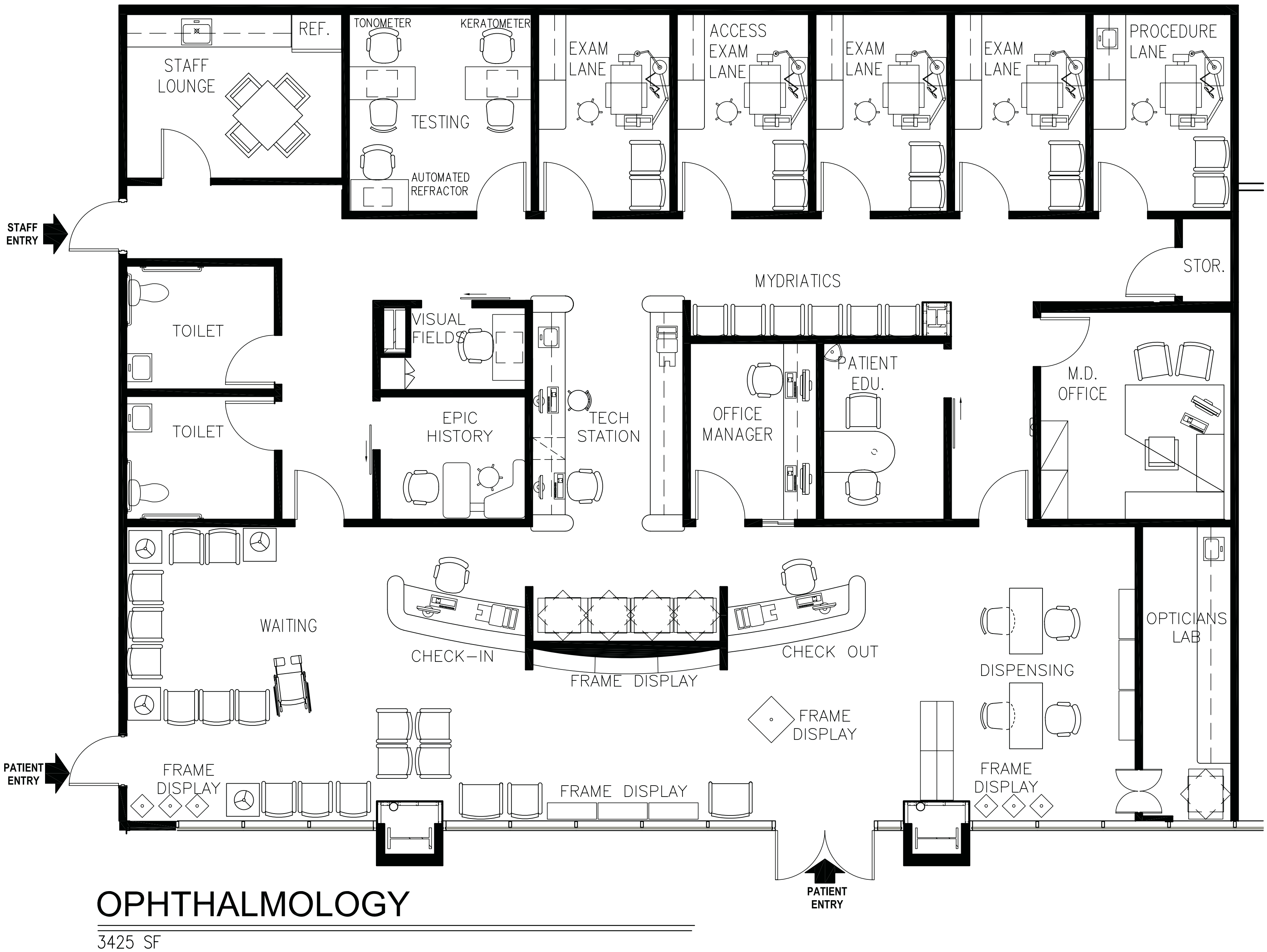


Figure 5-72. Space plan of ophthalmology suite, 3,425 square feet. *(Design: Jain Malkin Inc.)*

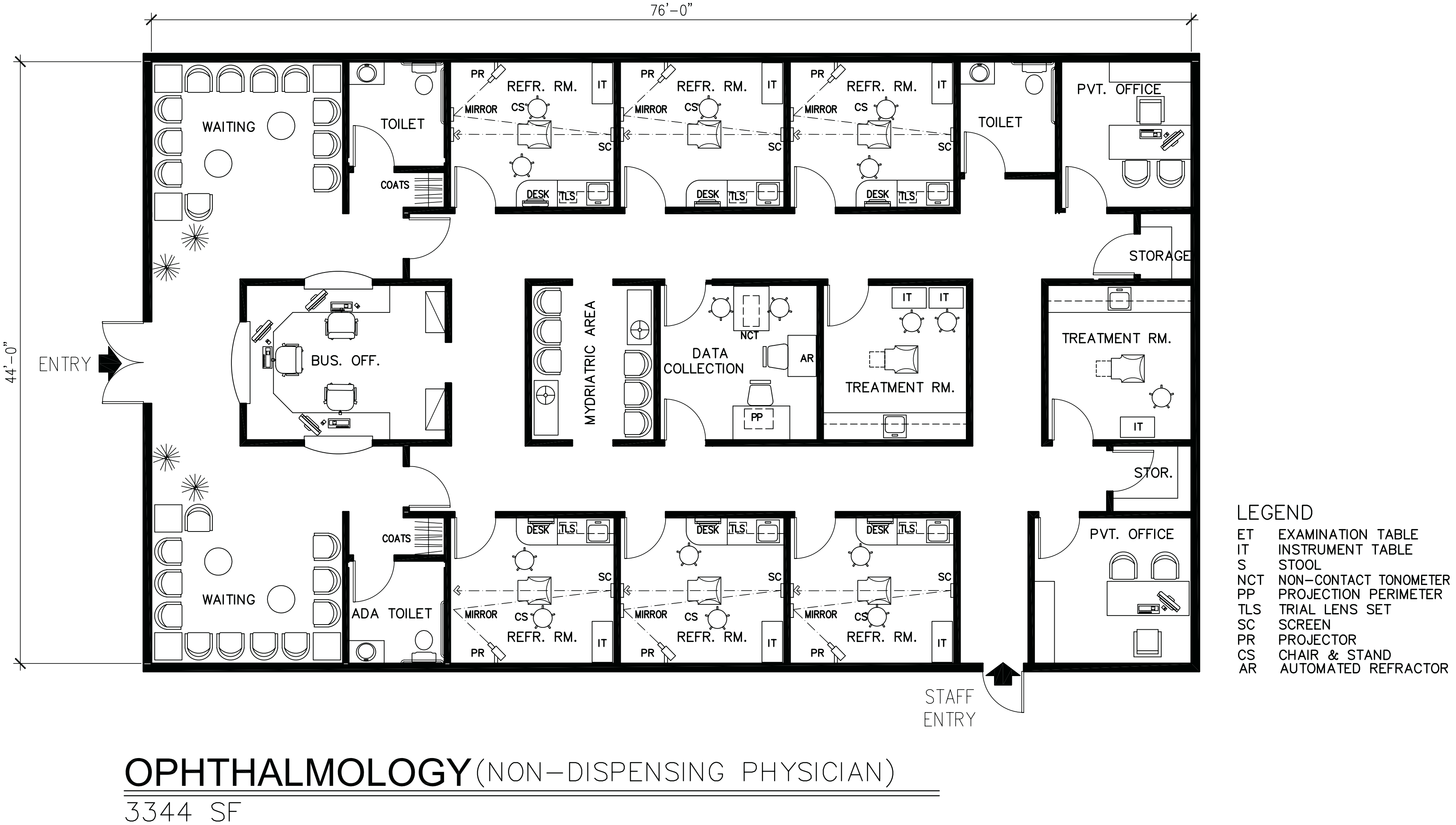
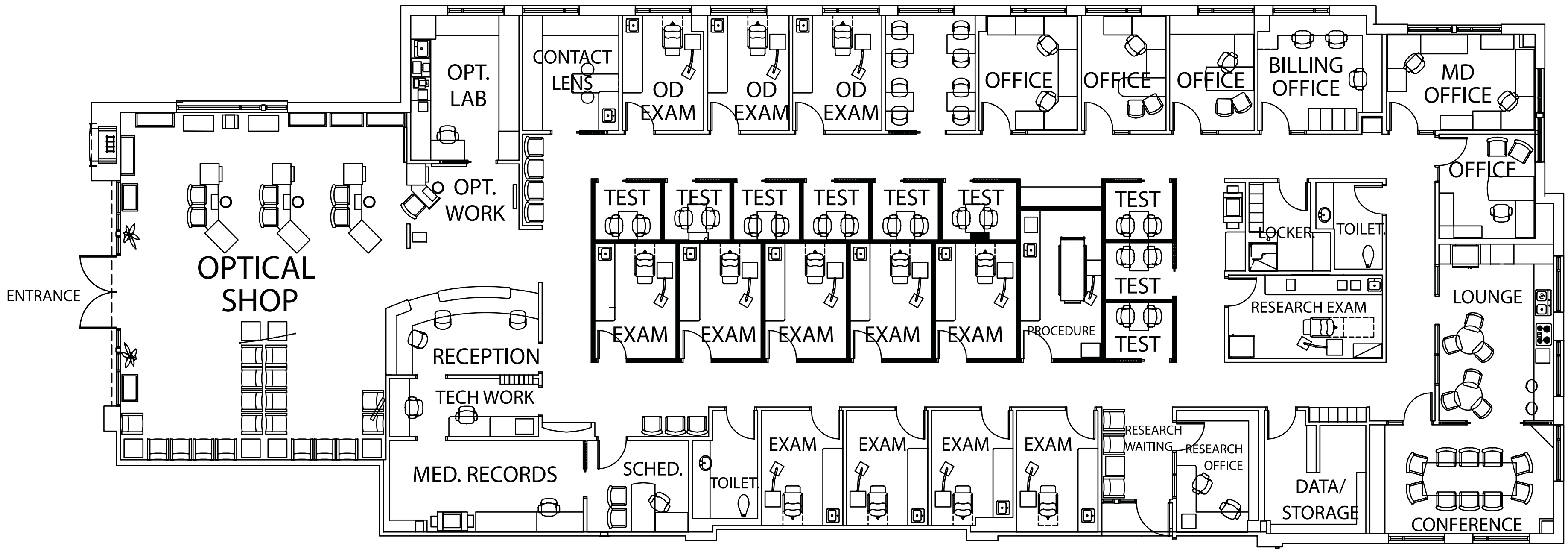


Figure 5-73. Space plan of ophthalmology suite, 3,344 square feet. *(Design: Jain Malkin Inc.)*

(Figure 5-77). A *keratometer* measures the curvature of the cornea. A *lensmeter* reads lenses (Figure 5-78).

A direct ophthalmoscope is used to view and illuminate the retina, head of the optic nerve, retinal arteries, and vitreous humor even through an undilated pupil. The focus in the eyepiece is equal to the image on the video monitor.

Examining chairs are available in tilt or nontilt models and some are able to be raised or lowered. A motorized chair will require a floor receptacle. Some chairs have a pneumatic lift feature. If the physician prefers to write notes at a desk that enables him or her to face the patient, the room would be set up with the chair positioned so that



OPHTHALMOLOGY CENTER
7925 SF

Figure 5-74. Space plan of ophthalmology suite, 7,925 square feet. *(Courtesy of Boulder Associates)*

the instrument stand console is to the patient's right, although this means that a right-handed physician is always reaching for instruments with the left hand as well as reaching across the patient. The chair should be positioned in the room so that the physician can walk behind it (allow 3 to 4 feet behind it) even when the chair is in the reclined position. The chair and attached instrument stand console together are approximately 4 feet wide. A clear space of 24 to 30 inches to the right side of the patient and 5 to 6 feet to the left is desirable (measured from the center of the chair). As with any medical equipment, the designer must verify dimensions and critical spatial relationships before designing the room.

The instrument stand console may be wired so that the physician can control the room lights, fixation light, projection chart, and other instruments from it. Or, the sink cabinet may be extended to include a knee space and an electrical panel for remote control of these items. (Switches and controls may be located on the face of the cabinet or in the kneespace opening so that they are within easy reach of the ophthalmologist during the examination.) Thus, from a seated position alongside the patient, he or she may control illumination and instrumentation from either the instrument stand or the wall cabinet.

Room lights should have a three-way switch so that they can be controlled from the wall and the console, and

Figure 5-75. The AP250 high-resolution ophthalmic projector. *(Photo courtesy of Reichert Technologies and AMETEK, Inc.)*

Figure 5-76. Sample trial lens set. *(Photo courtesy of Reichert Technologies and AMETEK, Inc.)*

they should have a dimmer control. (Local codes must be checked with reference to controlling room lights from the instrument stand. Low-voltage wiring is usually required.) Indirect lighting works best in an ophthalmology exam room such as a long, shielded uplight mounted on one long wall about 18 inches from the ceiling to eliminate the glare of overhead lights when patients' pupils are dilated.

Other electrical requirements for the room include an outlet for a *fixation light* mounted on the wall at approximately a 72-inch height directly behind the patient; an outlet for the *projector*, usually at a 60-inch height on the wall to the left of the patient or behind the patient (the designer must specify wood blocking in the wall to support the weight of the projector); two duplex outlets above the countertop for miscellaneous instruments and recharger modules for the cordless hand instruments; and a floor outlet (15-ampere circuit) for the instrument stand console. All outlets should be grounded. The electrical requirements of refraction rooms are highly specialized. A thorough review of the practitioner's habits and specific instrumentation is necessary before planning the electrical layout.

The trial lens case may be placed on a countertop (see Figure 5-76), or it may fit in a drawer or be built into a mobile cart designed for that purpose. If it is to fit in a drawer, the designer must determine if the rack should be tilted for easier visibility, in which case the drawer must be deeper.

All refracting rooms should be exactly alike in layout, arrangement of instruments, and quality of equipment. If one room has a better slit lamp than another, the rooms will not get equal usage. Patients will be shifted around so the doctor can use favored equipment, defeating the basic efficiency of the suite.

Mydriatic Area

Prior to an eye examination, the patient may receive eye drops to dilate the pupil. The patient is often asked to wait in a secondary waiting area adjacent to the refraction room called a *drop* or *mydriatic room* for 15 to 20 minutes before being admitted to the refraction room for the

examination. In some offices, drops are placed in the eye while the patient is in the main waiting room.

Automated Refraction

An *automated refractor* (Figure 5-79) is an electronic tabletop instrument for objectively measuring the patient's visual acuity. It is commonly used by a technician, thereby reducing the number of physician-performed refractions and streamlining those that are necessary. One of the advantages of this unit, in addition to the time it saves over the conventional method of refraction, is that it does not rely on the patient's subjective comparison: *Is this clearer than that?* The patient looks into the viewing window of the unit and adjusts a knob until the image is in focus. The machine automatically gives a digital readout of the patient's visual acuity. It can also compare the patient's current prescription with the new one.

When used as a general screening device, this machine would be located in the data collection room along with the other instruments used by aides (see Figures 5-72 and 5-73). After a patient has been refracted by this instrument, he or she moves to an examination room where the ophthalmologist reviews the findings and the patient's medical history.

In spite of the advantages afforded by an automated refractor, many ophthalmologists prefer the traditional method of refraction done in the examination room. It is generally performed by a technician or aide, who also takes the patient history in advance of the ophthalmologist's entering the room. The ophthalmologist then examines the eye with a slit lamp and will use the Non-Contact™ Tonometer to check for ocular pressure (glaucoma) or perform other procedures, as required, to diagnose the patient's problem.

Visual Fields

The charting of visual fields is done with an automated projection perimeter, a piece of equipment that sits on a 24 × 30-inch instrument table (Figure 5-80). The patient's

Figure 5-77. Refraction room, Manhattan Ear Eye + Throat Hospital, Outpatient Facility, New York. *(Courtesty of Ewing Cole; Photographer: Bernstein and Associates)*

Figure 5-78. LM-1800 automatic lensmeter. *(Courtesy of Nidek Incorporated)*

visual field is charted automatically and accurately since the patient's head is firmly held. The instrument fits in a room as small as 6 × 6 feet. It may be placed in a visual fields room or in a data collection room, but the room illumination must be controlled by a dimmer, since the procedure is done in a dark room.

Procedure/Surgery Room

A number of procedures can be done in a large (12 × 14 feet) room similar to special procedure rooms in primary care offices. A full wall of casework should be provided, with an undercounter refrigerator and a sink with foot-pedal control. An autoclave for sterilizing instruments will sit on the countertop. A ceiling-mounted surgical light is required along with a sheet vinyl floor and self-coved base.

Lasers

Laser surgery makes possible the correction of many vision problems on an outpatient basis in the ophthalmologist's office. Lasers are used to treat diabetic retinopathy, macular degeneration, retinal tears, glaucoma, retinal vein occlusion, and to open the clouded posterior capsule that sometimes forms following cataract surgery. Laser light is within the normal visible spectrum, but it is coherent light of a single wavelength—all the energy works together and in one direction. This allows it to be focused precisely on a certain point. Choosing a wavelength color that the eye tissue being treated can absorb, controlling the power and time of exposure, and varying the size of the laser beam allow the physician to use the laser to seal tears, make tiny openings, evaporate small amounts of tissue, and stop bleeding.

Ophthalmologists use several types of lasers. The color associated with each type enables it to target specific tissues without damaging others. Yttrium aluminum garnet (YAG) lasers use infrared rays in the near-visible spectrum to treat problems in the front of the eye. The YAG is called

Figure 5-79. M3 autorefractor. *(Courtesy of Nidek Incorporated)*

Figure 5-80. Sample automated projection perimeter. *(Photo courtesy of HAAG-STREIT-AG)*

a *photo disruption laser*, and it uses rapid, tiny bursts of energy to make tiny openings in the eye. Other lasers are called *photocoagulation lasers*, which heat (light) to spot-weld tears and leaks in the retinal vessels of the eye and to produce openings in the iris in the front of the eye. The Nidek *MC-500 Vixi* offers three wavelengths of color (Figure 5-81) in one laser.

A laser room may be as small as 10 × 10 feet. Ophthalmic lasers come out of a slit-lamp microscope, which sits on a portable stand. The ophthalmologist sits on one side of the table and the patient on the other, resting the chin in a support to immobilize the head (see Figure 5-81). A sink cabinet 6 feet long is a general requirement for any special procedure room, and room lights must be able to be dimmed during the procedure.

Since lasers are expensive, some physicians do laser procedures in an outpatient eye clinic at a nearby hospital, while others may have them in their offices. The advantages of laser surgery are many: The eye is not opened surgically; there is no needle used or stitches; and the risk of infection is minimal.

It should be noted that laser use requires the observance of safety precautions. The American National Standards Institute (ANSI) publishes standards for the safe use of laser systems. Specific safety devices and warning labels must be used. The eyes are highly susceptible to laser injury. Rooms in which lasers are in use must have a warning sign posted on the door that reads *DANGER—Laser Radiation—Avoid Eye or Skin Exposure to Direct or Scattered Radiation*. When using infrared wavelengths

Figure 5-81. MC-500 Vixi multicolor pattern scan laser photocoagulator. *(Courtesy of Nidek Incorporated)*

such as the YAG, the word "invisible" must be included in the warning sign.

It is important to have nonspecular (nonreflecting) and fire-resistant material in or near the beam path. Doors may require safety latches or interlocks to prevent unexpected entry into laser-controlled areas. If the door to the room has a window, it must have a window shade that can be rolled down during laser use. Everyone in the room must wear goggles to protect his or her eyes. (Goggles are specific to each type of laser that is used.)

Fluorescein Angiography

Not all ophthalmologists do fluorescein angiograms in their offices. Some refer their patients to a retinal subspecialist or to an outpatient eye clinic associated with a nearby hospital. Fluorescein dye is injected into the patient's arm. The resulting photographs of the retina show if there is leakage of fluids, edema, or poor circulation. This procedure can be done in a minor treatment or special procedure room; it is performed by a technologist, not the physician.

No special accommodation is required in the room, as the patient sits on a standard chair on one side of an instrument table, with the tech on the other side. A retinal specialist would have a dedicated room for angiograms, with an adjacent office for the technician, and a mydriatic or drop room nearby. The entire procedure, including waiting time for dilation of the pupil, can take as long as 45 minutes.

Office-Based Surgery

It is a matter of personal preference whether an ophthalmologist chooses to do surgery (nonlaser) within the office. Some may elect, for a variety of reasons, to use an ambulatory surgical center located in the medical office building or one located in a nearby hospital. The advantages of performing surgery in one's office are convenience for the patient, convenience in scheduling

procedures, and revenue generated for the medical practice. Disadvantages include the initial cost to create a surgery facility that meets state licensing and/or Medicare certification criteria, the cost of equipping it, additional coverage, and the risks assumed, however slight, when performing surgery outside the hospital or ambulatory surgical center settings.

Since eye surgery is generally not elective in nature, a physician would want to be certain the office-based surgery facility meets requirements for reimbursement by third-party payers. In fact, the majority of patients needing surgery are over 65 years of age, and Medicare reimbursement would be essential to an ophthalmologist's practice.

Removal of cataracts is one of the most common types of ophthalmic surgery. It is generally performed using a local anesthetic (eye drops) and is sometimes accompanied by conscious sedation, administered by a nurse anesthetist or an anesthesiologist. This type of surgery is performed in a sterile room, which means it's generally done in an ambulatory surgical center. An incision is made, the clouded lens (cataract) is removed, and an intraocular lens (artificial lens) is inserted. The surgical portion of the procedure takes 15 to 30 minutes. The patient recovers in a recliner chair for about 15 minutes before being released to go home.

For surgery done in the office, some use a room no larger than a standard minor treatment or special procedure room, with an adjacent nurse station, small recovery area, and clean utility room. State fire marshal and Medicare certification requirements are strict. Many Life Safety Code regulations must be met. The reader is referred to Chapter 8 for a more complete discussion of this issue.

Ophthalmic surgery is done while looking through a microscope. Therefore, vibration can be a problem. If the office is in a medical building near a railroad track or close to a major freeway, there could be some undesirable vibration, depending on the height of the building, the location of the suite within the building, and the type of structural system that supports the building.

Other Considerations

The consultation room functions as a private office, a place to relax between patients, to read mail, or to make phone calls. It is not used for consulting with patients; thus, it can be small.

Interior Design

The interior design of this suite should be cheerful, and lighting is of critical importance. The waiting room should have good reading light, as many of the patients are elderly, which means they need a high intensity of light to be able to read with comfort. Those with cataracts, however, will find glare very uncomfortable. A high level of indirect light, supplemented by table lamps, would meet the needs of most individuals.

In refraction rooms, the designer must be extremely careful to select wallcoverings that have absolutely no visual rhythm or figure-ground reversal. People who visit an ophthalmologist have a variety of vision problems, some of which include distortions. A person who sees a triple image or one whose vision is blurred might experience considerable discomfort in looking at a busy wallpaper or a geometric design. As the lens ages, it thickens and yellows. To know how colors might be perceived by the elderly, one can look through a pair of yellow lenses.

The waiting room in Color Plate 10, Figure 5-11, would be quite appropriate for an ophthalmologist's office if patients are predominantly elderly. Many educational brochures are dispensed in this specialty, necessitating brochure racks.

Laser Eye Surgery

Photorefractive Keratectomy

Photorefractive keratectomy (PRK) is a procedure to correct mild nearsightedness. In PRK, the surgeon scrapes away the outer surface of the cornea and then reshapes the underlying tissues with a cool ultraviolet beam. Only "eye drop" anesthesia is required. As this procedure may result

in scar tissue and can correct only mild nearsightedness, it is losing ground to the highly touted LASIK procedure.

LASIK

LASIK—an acronym for laser in situ keratomileusis—has been made possible by the excimer laser (Figure 5-82), which reshapes the cornea to correct nearsightedness, farsightedness, and astigmatism. Using an instrument called a microkeratome, the surgeon folds back a thin protective flap of corneal tissue. The excimer laser then removes a predetermined amount of tissue from the inner cornea to correct the refractive error. The corneal flap is replaced in its original position where it bonds without sutures.

So popular is this procedure that a number of ophthalmologists do nothing but LASIK in specialized facilities designed for this purpose (Figure 5-83a). Taking only 15 minutes for the entire procedure, it is hugely profitable and carries little risk in competent hands. As this is an elective procedure, insurance companies do not cover it. LASIK surgeons often use multimedia marketing (TV, print ads, telemarketing, and websites) to drive up patient volume and may even resort to customer-pleasing amenities such as limousine service. Although some LASIK specialists may abhor this level of commercialism, others unabashedly buy time on local TV stations to create advertorials that tout the surgeon and satisfied patients. A waiting room that can double as a seminar room in the evening works well. An adjacent storage room for folding chairs, a credenza for refreshments, and a large screen TV are needed for this activity. The facility depicted in Color Plate 16, Figures 5-83c and d has a sleek design with dramatic use of fountains in both the waiting room and the internal corridor. The procedure room (Figure 5-83b) has a wall of floor-to-ceiling glass.

Layout of Rooms

A facility will generally have one procedure room approximately 14 ×16 feet, which may be connected to a small lab (for sterilizing instruments), two standard preop refraction rooms, a small topographic room, a small slit-lamp room to be used by the surgeon postsurgically to check the patient prior to discharge, and a small recovery room in which the patient spends a few moments in a recliner chair while receiving discharge instructions. The patient does not change clothes or gown; however, lockers for handbags, briefcase, and coats are useful. The “topo” room has a tabletop autorefractor and a diagnostic instrument that measures the curvature of the cornea to produce a topographical map of the surface. Both instruments fit on a 2 × 4–foot table with a stool for the tech on one side and a chair for the patient on the other.

LASIK Room

HVAC Considerations. Although this is not a sterile room, sterile technique is followed. Control of humidity and temperature is essential for proper functioning of the equipment and mixing of gases. Relative humidity of 35 to 65 percent and temperature of 60 to 80 degrees Fahrenheit is the desired range according to VISX®, one of the leading manufacturers of the Excimer laser (the *Star S4 IR* from VISX). A dehumidifier may be required. The surgeon needs to be able to adjust the room humidity and temperature to keep the machine calibrated.

The room should have positive pressure to keep the air clean and, ideally, a HEPA filter. The HVAC must be separate from the rest of the facility to achieve this level of control and should be activated by controls within the procedure room. In case of a gas leak, the room air must be evacuated in two minutes.

Optimally, the exhaust would be vented to the outdoors but, if this is not possible, a room scrubber system can be installed to filter the fluorine out of the air. A built-in detection system monitors gas leaks.

Observation Window. An observation window (with a blind controlled from the procedure room) that enables a family member to watch is a popular feature (see Figure 5-83).

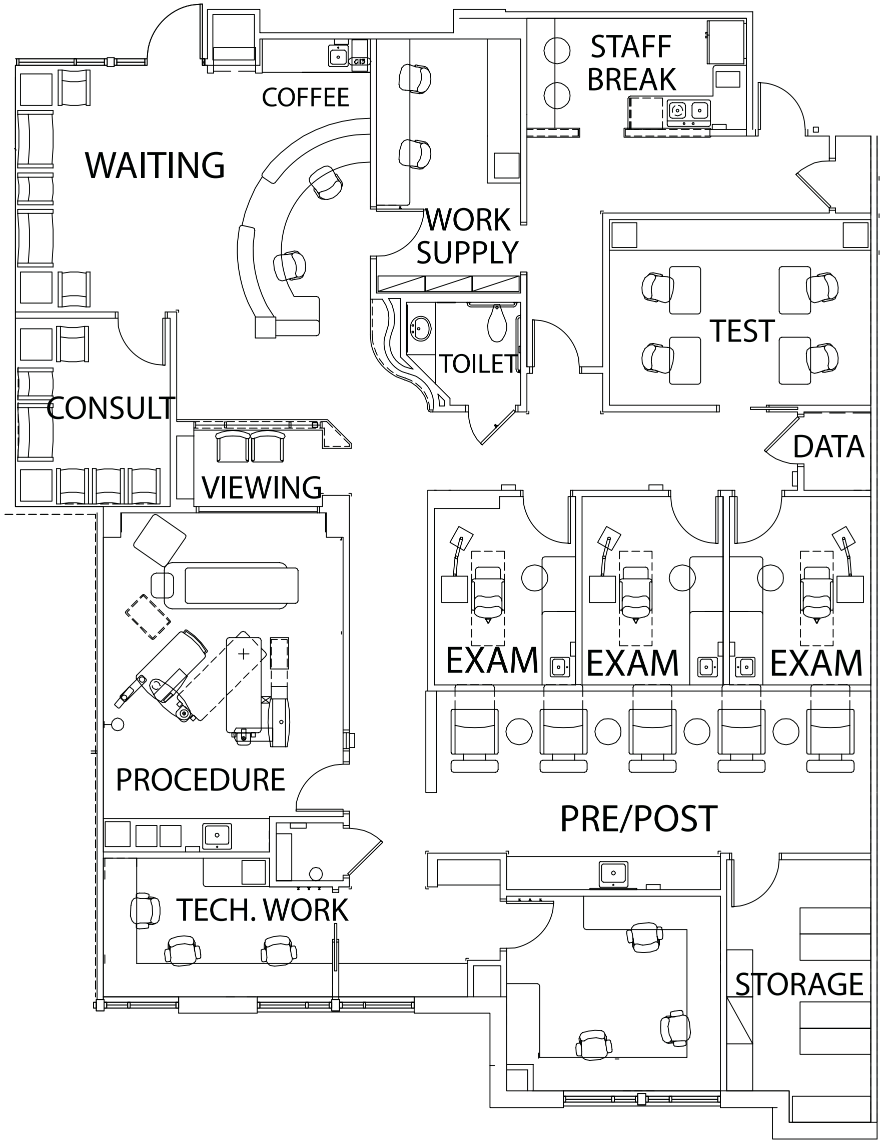
Lighting. There are no special lighting requirements. However, there is an advantage to being able to dim the lights when using some accessory devices on the machine.

Finishes. Reflectance of walls and floors is not a problem as the laser beam is narrowly focused on the eye. A large window (glass), whether exterior or interior, depending on placement in relation to the machine, can create annoying glare.

Figure 5-82. WaveLight® Excimer Laser refractive suite. *(Courtesy of Alcori, Alcon Laboratories, Inc.)*

PLASTIC SURGERY

Plastic surgery suites vary considerably, depending on the focus of the practice (cosmetic or reconstructive) and whether there is an intention to provide skin care or spa services. Skin care/spa services may include microdermabrasion skin resurfacing, chemical peels, permanent hair removal by a diode laser, facials, Fraxel laser procedures, body and cellulite treatments, lymphatic drainage, as well as makeup tattooing of eyeliner or brows. These procedures are explained in greater detail, and room requirements discussed, in the Dermatology section of this chapter and at the end of the Plastic Surgery section. See Table 5-6 for space program.



INSIGHT LASIK
3373 SF

Figure 5-83a. LASIK suite, 3,373 square feet. *(Courtesy of Boulder Associates)*

Figure 5-83b. LASIK surgery suite, operating room. *(Photo by Clear Sky Images.com, North Carolina)*

Another factor that will influence space planning is whether the plastic surgeon uses an advertising practice model. Some practitioners allocate a significant budget for advertising, publicity, or media consultants, and many offer educational seminars. As an example, a plastic surgeon in a building that contains a sizable breast care center may wish to conduct seminars on breast reconstruction for mastectomy candidates or may wish to conduct a seminar on skin resurfacing techniques. In these practices, the waiting room may have to double as a meeting room for Power Point or other presentations. If the design of the office makes a great first impression, it will be more valuable to entice prospective patients into the office than to conduct a seminar offsite at a hotel. Plastic surgery is highly competitive since most procedures are elective and not reimbursed by insurance. Plastic surgeons who have a practice oriented to cosmetic work have great earning power as they have been relatively unaffected by the vagaries of healthcare financing

Figure 5-83c. LASIK surgery waiting room with interesting lighting and unique water feature. *(Photo by Clear Sky Images.com, North Carolina)*

Figure 5-83d. LASIK surgery internal corridor features ceiling-to-floor rain wall. *(Photo by Clear Sky Images.com, North Carolina)*

and they realize that making an investment in outstanding interior design can enhance their image. Surgeons who do reconstructive work, however, have seen the reimbursement drop significantly.

A plastic surgeon with a cosmetically oriented practice needs to "market" his or her skills and successes. Dentists specializing in cosmetic or aesthetic dentistry are in somewhat the same situation in terms of being interviewed by prospective patients and having to "sell the case." Often, people self-refer, based on a successful outcome of a friend or relative, but the quest for an idealized self-image and the desire to restore one's youthful appearance cause many women (90 percent of plastic surgery patients are women)[5] to interview a number of plastic surgeons.

[5]ASAPS (The American Society for Aesthetic Plastic Surgery) Press Center, www.surgery.org/media/news, (accessed June 3, 2013).

As it is time consuming for the busy surgeon to do these initial evaluations, factors that increase the likelihood of that patient returning to have the procedure are worthwhile. This means that the appearance and function of the office are important. The patient may be greeted by the patient care coordinator who will discuss the type of procedure the patient has in mind and who may take the patient into a private office and allow her to peruse a book of "before and after" photos of patients who have had that procedure. Or the patient may be handed an iPad with digital before-and-after images. The next stop might be the physician's consultation room, where the physician will interview the patient, perhaps sketch some possibilities, and show slides of patients who started out with a similar problem that has now been resolved. After the surgeon determines which procedures are necessary to

accomplish the goal, the patient would move to the financial counseling office, or patient care coordinator, to discuss fees and payment plans and to answer any "process" questions. Ideally, the financial counseling office and consultation room would be near the front of the suite so that these patients do not have to mix with those who have already been scheduled for procedures and may be there for the preop workup or postop visits.

Plastic surgeons often do surgery in their offices in a properly equipped office-based surgery center, described more completely later in this section. Those who don't will do their cases in an ambulatory surgery center, which may be available in the medical office building or a freestanding surgery center where they have privileges or a hospital, which is probably the least desirable alternative for plastic surgery unless it is so extensive that the patient has to stay overnight and receive an intensive level of monitoring. It should be mentioned that there are, in some cities, 72-hour-stay recovery-care centers that allow more complicated cases to be safely handled in an ambulatory surgical setting.

There are a number of reasons for performing plastic surgery on an outpatient basis in the surgeon's office. Principally, the patient is more comfortable in a physician's office because it is a less clinical environment than a hospital, and it affords more privacy. Patients undergoing cosmetic procedures are often very concerned about bumping into friends and neighbors. It is not uncommon for people to visit a plastic surgeon in another city in order to safeguard their "secret."

There are other advantages to surgery outside the hospital setting. The surgeon has more control over scheduling when procedures are done in the office, and the patient avoids the generally frightening experience of being admitted to a hospital. It usually lowers the cost for the patient and permits the physician to charge a fee for the use of the operating room, rather than lose that fee to the hospital.

In some plastic surgery practices, approximately 95 percent of the surgery caseload can be performed in a properly equipped operating suite within the office. *Liposculpture* has become one of the most commonly performed procedures for removing unwanted fat from the stomach, buttocks, thighs, or other areas. Briefly, in this procedure, an incision is made in the skin, a *cannula* (tube) is inserted, and the fat is suctioned out. Other procedures commonly performed by plastic surgeons include facelifts, brow lift, breast augmentation (or reduction), *blepharoplasty* (eyelid surgery), *rhinoplasty* (reshaping the nose), hair transplants, hand surgery, skin grafts for burn survivors, and repair of cleft palate (both usually done in a hospital setting), breast reconstruction associated with cancer surgery, and other disfiguring malformations of the face and head. The top three cosmetic procedures, in order of volume, in the United States are breast augmentation, liposuction, and abdominoplasty with eyelid lifts a close fourth place.[6]

Circulation Patterns and Patient Flow

If a plastic surgeon is going to do office-based surgery, the optimum flow would be that shown in Figures 5-84 and 5-85, in which surgical patients are separated from the preop and postop examination areas of the suite. There are separate waiting rooms, but there is no duplication of staff required since the receptionist can monitor both rooms although ideally, in terms of Medicare, even the reception/business office for the surgery suite should be separate. To comply with Medicare certification, there should be complete separation of the surgery suite from the office practice during hours of operation of the surgery center and it must be a separate business entity maintaining separate records. The door to the surgery suite (from the medical office) should be able to be secured by means of a keypad to prevent unauthorized entry (Figures 5-85, 5-86, and 5-87). Few plastic surgeons, however, seek Medicare certification; AAAHC or AAAASF accreditation is more common.

The flow through the suite for elective cases would begin with the initial consultation and, if the patient decides to proceed, would then include one or two preop visits, the actual surgery, plus multiple postop visits. Trauma cases

[6] Ibid.

Table 5-6.
Analysis of Program
Plastic Surgery

No. of Physicians		1		2
		(Without Surgery Suite)		(With Surgery Suite)
Consultation Rooms		12 × 12 = 144	2 @	12 × 12 = 288
Exam Rooms	3 @	10 × 12 = 360	6 @	10 × 12 = 720
Minor Treatment		12 × 14 = 168		10 × 14 = 168
Nurse Station		10 × 10 = 100		10 × 10 = 100
Operating Suite[a]		—		1600
Primary Waiting Room		16 × 18 = 288		16 × 18 = 288
Surgery and Postop Waiting		10 × 10 = 100		12 × 12 = 144
Business Office		16 × 20 = 320		16 × 24 = 384
Surgery Scheduling		10 × 12 = 120		10 × 12 = 120
Financial Counseling		10 × 12 = 120		10 × 12 = 120
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Storage	2 @	6 × 8 = 96	2 @	6 × 8 = 96
Shampoo/Makeup		—		12 × 12 = 144
Spa Services/Skin Care		20 × 30 = 600		20 × 30 = 600
Staff Lounge		12 × 12 = 144		12 × 12 = 144
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		2,724 SF		5,144 SF
20% Circulation		544		1,028
Total		3,268 SF		6,172 SF

[a]Includes two ORs, nurse station, scrub, clean and soiled utility rooms, recovery, equipment storage (vacuum, O_2, air, generator), patient toilet/lockers, and male/female staff dressing: 1,600 square feet is a minimum.
Note: The above is merely an approximation, since plastic surgery suites can vary considerably in size and number of rooms, depending on the physician's scope of procedures and practice philosophy.

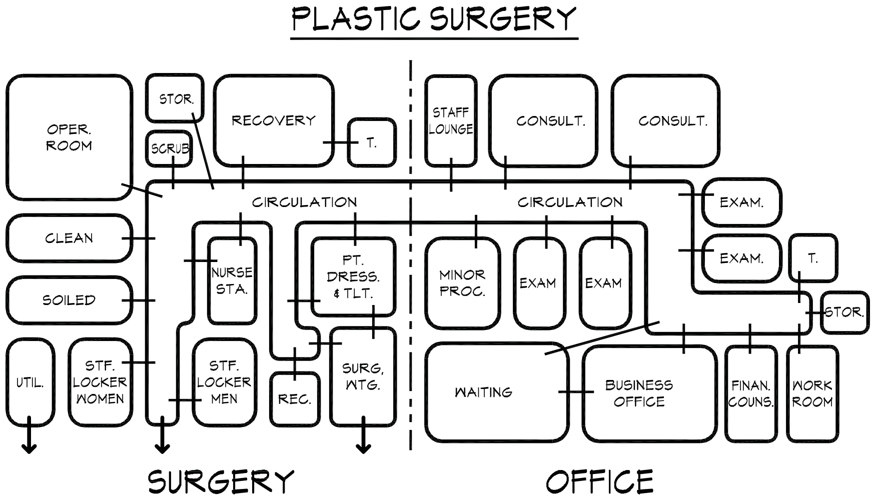


Figure 5-84. Schematic diagram of plastic surgery suite.

or emergencies would generally be seen at the hospital initially with follow-up visits in the office.

The practice documents results with "before" and "after" photos of patients. Photographs are an important part of the plastic surgery practice. These photos can be taken in the examination room (where a pull-down panel of blue fabric is mounted to the wall as a background) or in a small windowless 6 × 8–foot room designed for that purpose (Figure 5-88).

With most procedures, the patient is operated on in the morning, spends one or two hours in the recovery room, and goes home that afternoon. The doctor's afternoons would be spent visiting hospitalized patients, conducting consultations in the office with prospective patients, and seeing postoperative patients to change dressings or remove sutures. If the doctor doesn't have a surgery facility in-house, the schedule may be arranged as "OR days" and "office days," which also accommodates OR staff who want to work full days.

Secluded Entry

The composition of the plastic surgeon's practice will dictate the design features that need to be incorporated. A practice dedicated to cosmetic surgery may cater to an affluent clientele who expect a luxurious office. Of particular importance is a secluded entrance so that clients may park their cars and conveniently enter the office without being seen. After the procedure, they can slip out a private exit and elude others in the waiting room.

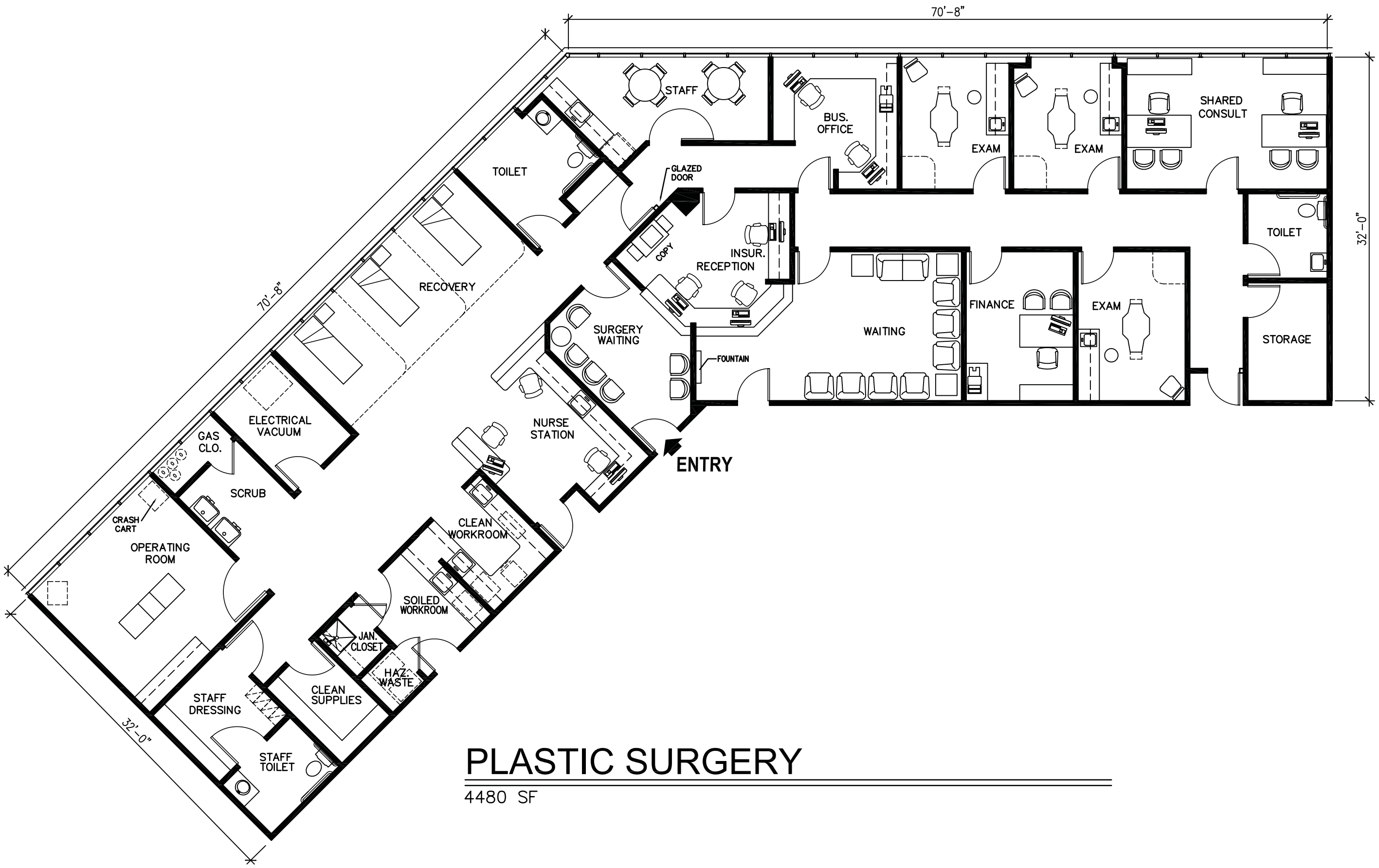


Figure 5-85. Space plan of plastic surgery suite, 4,480 square feet. *(Design: Jain Malkin Inc.)*

For this reason, plastic surgeons who specialize in cosmetic surgery frequently prefer a ground floor location, with a private driveway or turnaround so that patients need not walk through the lobby or public areas of the medical building (see Figures 5-86 and 5-87). This is valid even when the practice is composed of a less affluent population. Patients who elect to have cosmetic surgery may be self-conscious about it and prefer privacy. It is very important to understand the practice's patient base and procedure mix. A common design mistake is to tailor it for the wrong target market. Today, plastic surgery has a wide middle-income base and, depending on the demographics, a high-profile design may be intimidating.

Concierge Reception Desk

A concierge-type reception desk is often preferred to a typical medical office reception window (see Color Plate 1, Figure 3-10, Figures 5-15 and 5-89, and Color Plate 32, Figure 10-150.

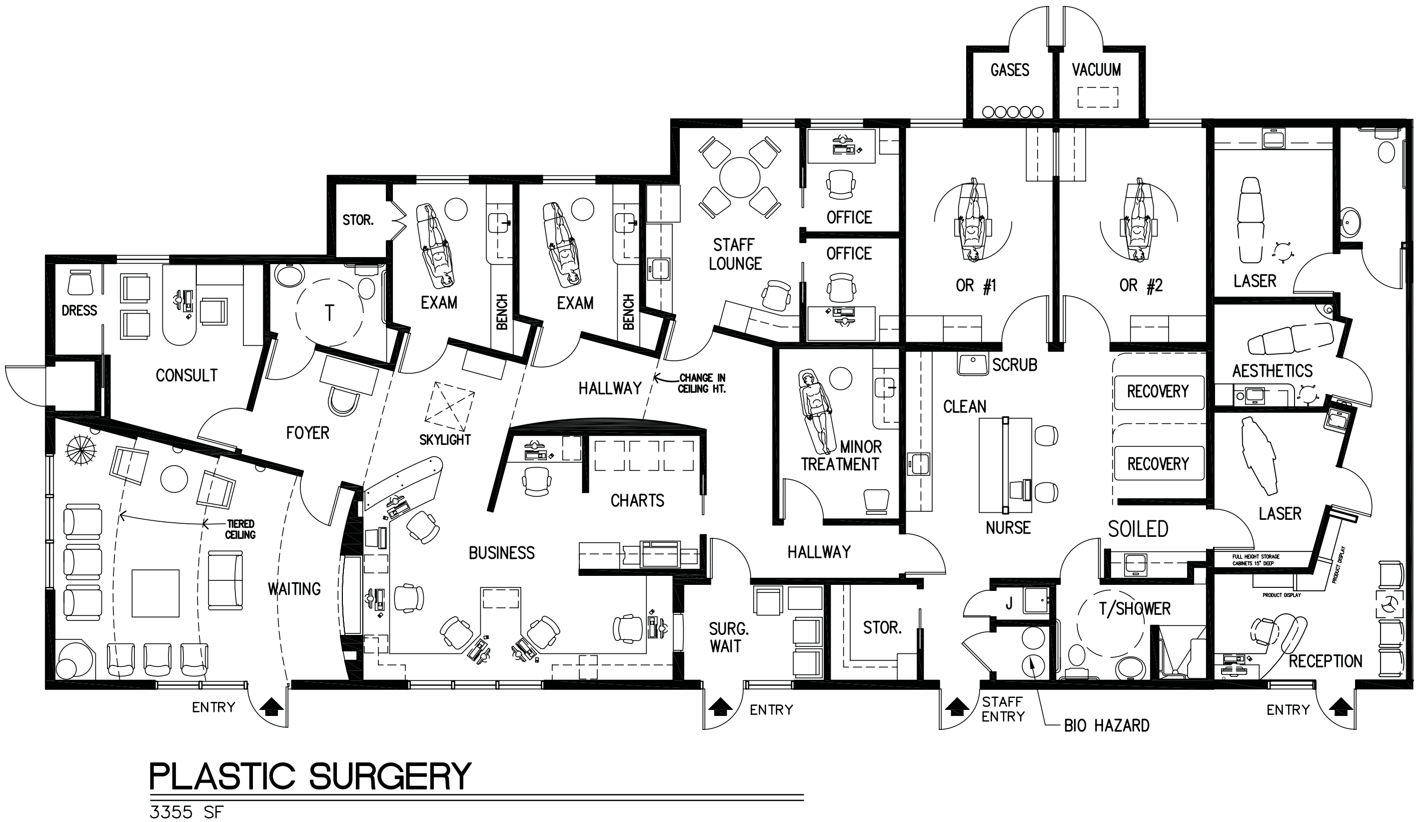


Figure 5-86. Space plan of plastic surgery, 3,355 square feet. *(Design: Jain Malkin Inc.)*

Examination Rooms

Exam rooms in a plastic surgeon's office are quite different from those in other types of medical offices in that they generally use a motorized chair (see Figures 5-64 and 5-90). Plastic surgery exam rooms may be large and elegantly designed, especially if used as the consultation room as well (see Figures 5-90 and 5-91 a and b).

Plastic surgery offices are sometimes compact which calls for design features that make them appear larger. An illusion is created by the *trompe l'oeil* mural at the end of the exam corridor in Color Plate 17, Figure 5-92, en route to the surgical suite in Figure 5-86. In this same suite, high ceilings make possible a geometry of intersecting planes complemented by cable lights that dance through clerestory openings (see Color Plate 17, Figure 5-93).

Electronic Medical Records/Practice Management System

A number of practice management software systems are available for plastic surgery practices, often using an iPad or tablet. The EMA system (www.modmed.com) has been developed for a number of medical specialties, including plastic surgery. It streamlines clinical documentation, codes exams and procedures, orders lab tests, and prints pathology requisitions. It is a cloud-based electronic medical records (EMR) system.

PLASTIC SURGERY

5978 SF

Figure 5-87. Space plan of plastic surgery suite, 5,978 square feet. *(Design: Jain Malkin Inc.)*

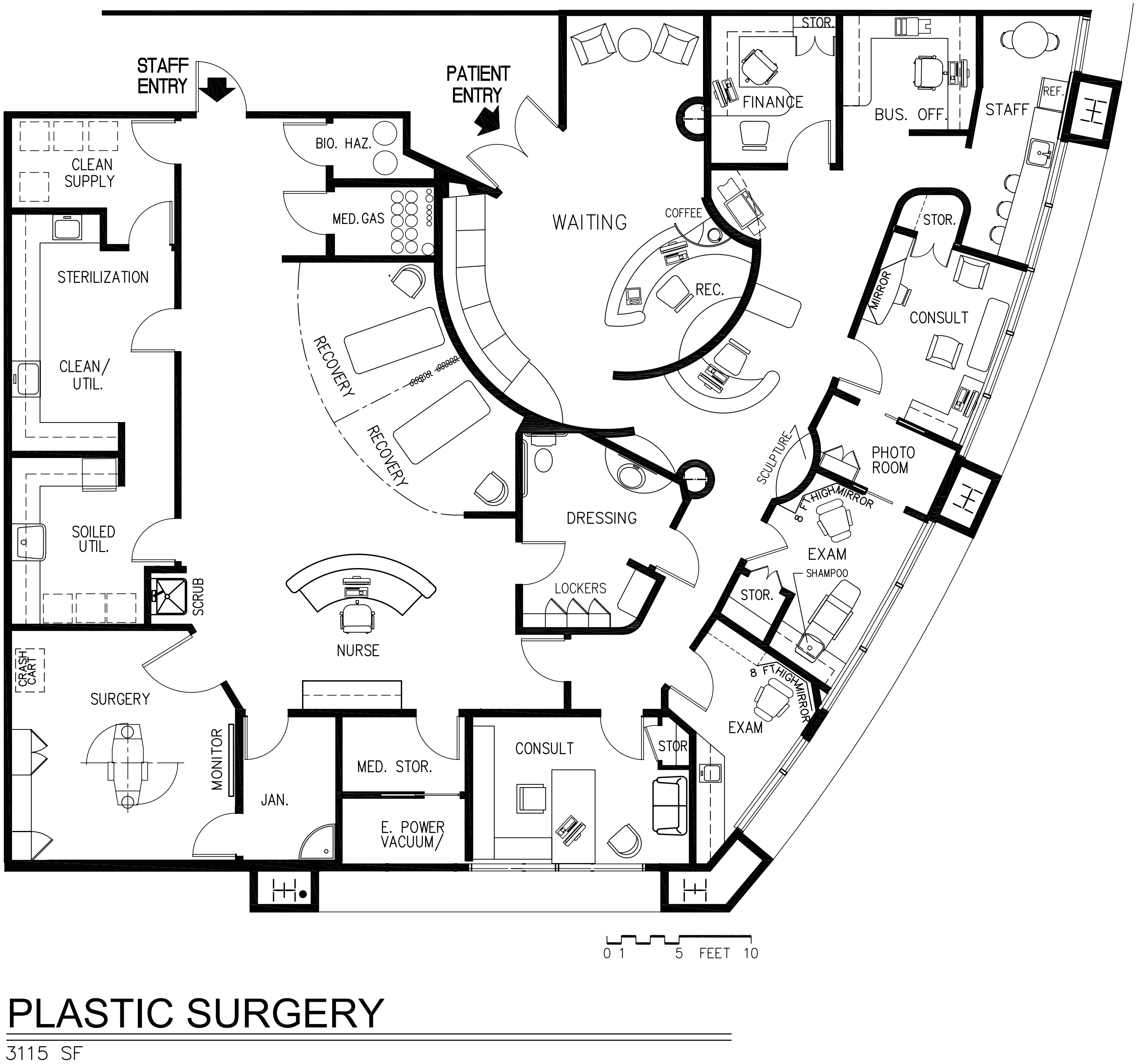


Figure 5-88. Space plan of plastic surgery, 3,115 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-89. Reception desk at a plastic surgery suite. *(Design: Jain Malkin Inc.)*

Consultation Room

Patients considering surgery often interview more than one physician who may spend half an hour or more with a patient showing slides or photos of other patients who have had similar procedures, reviewing costs, and discussing the probable outcome. This initial consultation is an important element of a plastic surgeon's practice, because it is generally just this one meeting by which the patient decides whether he or she is comfortable with the surgeon's personality, qualifications, and results.

Plastic surgeons often use their private offices (consultation rooms) to make case presentations (see Color

Figure 5-90. Exam/consultation room in plastic surgery suite. *(Courtesy of Proteus Group, Dimitri Photography, www.dimitri.com © 2013)*

Plate 21, Figure 5-91c), or a special room may be designed for this purpose (see Figures 5-86 and 5-88). It is desirable to functionally and visually integrate the monitor used for presentations into a custom-built desk or wall unit depending upon the surgeon's style and preference. Some merely use a handheld iPad. The trend is the use of flat screen monitors displaying "before and after" photos located in exam rooms or wherever the surgeon prefers to do initial interviews/consults. Networked software allows photos to be accessed wherever there is a computer and monitor.

Some physicians use a photo-imaging system to demonstrate to patients possible outcomes from surgery. The *Vectra XT* 3D camera and sculptor software system (www.canfieldsci.com) is 60 inches wide and projects from the wall 17 inches. The patient stands in front of it and it captures his or her image. If this is to be used, the designer must plan well to accommodate it. It may be located in a small photo room where before-and-after photos are routinely taken.

Another tool used to help patients visualize the results of surgery makes use of an iPhone and a free app that

Figure 5-91a and b. Consultation/exam room, plastic surgery suite. (See Figure 5-91b for opposite side of room.) *(Interior Design: Kelly Wearstler, Los Angeles; Photo courtesy of Grey Crawford©.)*

Figure 5-91c. Plastic surgeon's private office. *(Interior Design: Kelly Wearstler; Photo courtesy of Grey Crawford©)*

Figure 5-91d. Waiting room, plastic surgery suite. *(Interior Design: Kelly Wearstler; Photo courtesy of Grey Crawford©)*

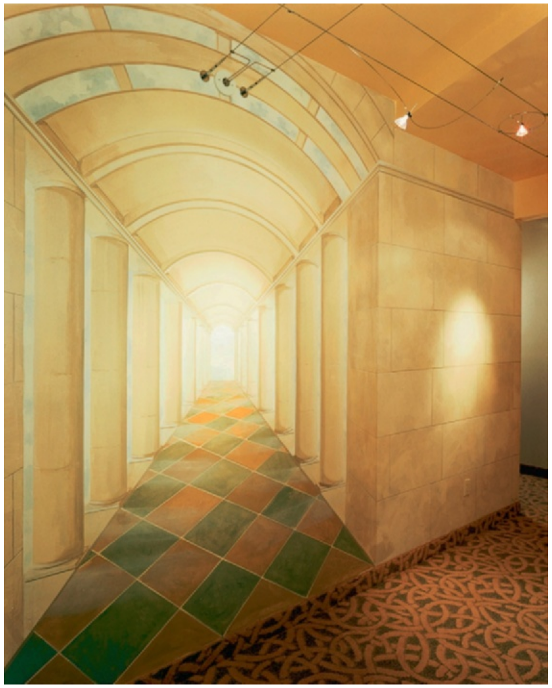


Figure 5-92. Trompe l'oeil mural at end of corridor, plastic surgery suite, expands the space and creates the illusion of an outdoor portico. *(Interior Architecture: Jain Malkin Inc.; Photographer: Steve McClelland; Artist: Jean Karam)*

Figure 5-93. Corridor of plastic surgery suite with view of checkout desk. Note custom-designed black wrought iron chart rack. *(Interior Architecture: Jain Malkin Inc.; Photographer: Steve McClelland)*

can be downloaded. The iPhone is used to capture patient images, then the surgeon can sketch on it and save it to be viewed later by the patient online or on her iPhone (http://touchmd.com). This enables the patient to review the images with a family member or friend and also to access educational information such as postsurgical instructions and to see examples of what one might look like several days after surgery. Postsurgically, a patient who is concerned about something can photograph it with the iPhone and send it to the surgeon for a consult without having to come into the office.

The consultation room should convey a solid, successful image, but not be flamboyant or trendy. This room might be styled more conservatively than the remainder of the suite, although this is determined in large part by what would be appropriate for the patient population served. A plastic surgeon in Beverly Hills, to be competitive, would probably have a more lavishly designed office than one in Des Moines, Iowa. The space should be designed with the female patron in mind although it should be noted that some plastic surgeons have perfected a specific procedure for men that brings them a higher number of male patients than the average.

The surgeon's diplomas and awards should be prominently displayed here in elegant frames and mats. Sometimes patient education is accommodated in the consultation room (a large flat screen monitor would be provided with the content streamed from the in-house network of educational videos). More likely, a dedicated room would be created for this purpose.

Office-Based Surgery

Surgery performed within the physician's office is called *office-based surgery*, compared with that which is performed in a *freestanding* ambulatory surgical center. The latter is called freestanding, because it is not attached to or associated with a physician's office and is physically separate from a hospital. The reader is referred to the beginning of this chapter and also to Chapter 8 for additional information.

Any discussion of office-based surgery begins with the issue of reimbursement. Unlike surgery performed by ophthalmologists, most plastic surgery is elective in nature and, as such, would not be covered by third-party payers. Therefore, designing the surgery suite to meet the criteria for reimbursement by third-party payers seems a moot point. Those cases that would be reimbursed (for example, reconstructive surgery to attach a severed finger or surgery to restore a burn victim's appearance) would be done outside the office in an ambulatory surgical center or hospital.

Most insurance companies and Medicare will pay the physician's fee for any covered procedures done in the physician's office, but if the surgery suite itself does not meet certain requirements, they will not reimburse for the use of the facility.

Accreditation, Licensing, and Medicare Certification

Major changes have recently occurred with respect to enhancing patient safety in the office-based surgery setting. While there are many differences among individual states, from the national perspective the American Society of Plastic Surgeons and the American Society for Aesthetic Plastic Surgery mandated January 1, 2002 compliance for their members to operate in facilities that are accredited by one of the national accreditation organizations, be Medicare certified (even a more rigorous standard), or be state licensed, also quite stringent.

What triggers compliance with NFPA fire codes is whether more than four persons are incapable of self-preservation at one time. If not, meeting occupancy codes will generally suffice. As most plastic surgeons (according to AAAASF) have only one operating room, it is unlikely that four or more persons would be in that condition. But this is certainly a gray area and open to interpretation. Common sense dictates that even one patient deserves the maximum in safety and protection, especially if you are that one person. But this explains why, for many years, plastic surgeons in some states have been able to get occupancy permits for undersized surgery suites that fall short, according to many criteria, of what is expected today.

For those to whom this may be new, states license hospitals and all types of hospital-based surgery facilities, imposing what are generally regarded as the highest or most rigorous standards in terms of patient safety, minimum sizes of rooms, and a host of other issues. Most facilities that are state licensed will also have achieved Medicare certification. Medicare uses NFPA 101 (Life Safety Code) and a local fire marshal—and sometimes an additional inspector who may be a retired surgeon—to inspect for compliance. With either licensing or Medicare certification, a fee for the use of the facility may be billed. Of the national accreditation associations, the AAAASF (American Association for Accreditation of Ambulatory Surgery Facilities), located in Gurnee, Illinois, considers itself to have the most rigorous standards with very tough quality assurance and, according to the director, is the only organization that requires semiannual peer review. The AAAASF accredits facilities for all surgical specialties as listed by the Board of Medical Specialties, including OB-GYN, urology, ophthalmology, ENT, plastic surgery, orthopedics, endoscopy, and also dermatology, even though it is not actually a surgical specialty.

It is not possible to print a definitive guide to negotiating the minefields of accreditation, certification, or licensing because one will encounter codes that are contradictory, gray areas that are ambiguous, and local inspectors whose personal experience leads them to make demands that are not stipulated in the code manuals, yet they are in a position to deny certification if their requests are not satisfied. All of this is nasty business for the designer or architect who wants to turn over a successful project and meet the client's expectations. To add complexity to these matters, one agency might use a different version of the code than another. Medicare might require the NFPA 101 2000 edition and this is what AAAASF uses, as of this writing. In general, where there is a discrepancy, the more stringent code applies. Some states require a Certificate of Need (CON) for Medicare certification, whereas other states require state licensing as a precursor to Medicare certification, and some states don't require either of these. In California, dermatologists must be accredited in order to do surgery. AAAASF does not preempt local or federal codes and the facility must always be in compliance with OSHA. AAAASF requests written documentation to prove that the physician has "like" privileges at a local hospital to do the kinds of procedures that will be performed in the office-based setting.

As a general statement, according to the executive director, AAAASF prefers not to give minimum sizes of rooms or be draconian in terms of facility design, but rather to be flexible in order to allow the physician to meet the objective of safety in a variety of ways. This is what it means by "adequate" when it states "a separate and adequate recovery room must be maintained free and clear of litter." AAAASF specifies that there must be 4 feet of open space around all sides of the OR table for patient safety during resuscitation. This is stated as, "needs sufficient space around OR table for emergency personnel to get access to the patient." Separate clean and soiled rooms are required, without giving sizes. Instead, it might read, "instrument prep and assembly area must be separated by a wall from the space where instrument cleaning is done or, if not, a policy to disinfect the area each time must be in place." Corridor widths are required to be "adequate" for movement of gurneys for facilities not participating in the Medicare program which is stated as: "Hallways, stairways and elevators are sufficiently wide to allow emergency evacuation of a patient by emergency personal and their equipment."

The standards imposed by these various agencies with respect to facility design and architectural issues are accompanied by standards and protocols for processing of tissue samples, peer review, number of kits of Dantrolene on hand for malignant hypothermia (general anesthesia is the triggering agent)—all issues that have nothing whatsoever to do with design but protect patient safety.

The reader is referred to Chapter 8 for additional discussion about accreditation and, specifically, the Accreditation Association for Ambulatory Healthcare (AAAHC).

American Association for Accreditation of Ambulatory Surgery Facilities

The American Association for Accreditation of Ambulatory Surgery Facilities publishes three booklets for facilities that do not participate in Medicare (as well as three for facilities that do) that will guide both the designer and the facility's staff if they wish to meet the *voluntary* accreditation standards of this organization. One booklet is the *Inspector's Manual*, another is the *Standards Manual*, and the third is the *Surveyor's Handbook*. An increasing number of states mandate accreditation by a national accrediting body or accept it in lieu of a state requirement.

The major determinant of design criteria relates to the type of anesthesia used. This, in turn, relates to the types of procedures that can safely be done in the office. The AAAASF standards classifications used in the manual are as follows:

Class A—performed under topical anesthesia or local anesthesia

Class B—performed under topical anesthesia, local anesthesia, parenteral sedation, field and peripheral nerve blocks, or dissociative drugs (excluding propofol)

Class C-M—performed under topical anesthesia, local anesthesia, parenteral sedation, field and peripheral

nerve blocks, dissociative drugs (including propofol), spinal anesthesia, or edipural anesthesia

Class C—performed under topical anesthesia, local anesthesia, parenteral sedation, field and peripheral nerve blocks, dissociative drugs (including propofol), spinal anesthesia, epidural anesthesia, or general anesthesia (with or without endotracheal intubation or laryngeal mask airway anesthesia.

The AAAASF standards cover the Basic Mandates, OR Policy, Environment, and Procedures; Postanesthesia Care Unit (PACU), General Safety, IV Fluids and Medications, Medical Records, Quality Assessment and Quality Improvement, Personnel, and Anesthesia. The process involves an onsite survey of the facility the first year, followed by self-evaluation the second and third years, and another onsite survey the fourth year.

Although accreditation by AAAASF is voluntary, it does certify to the medical community and the community at large that the surgery facility meets nationally recognized standards such as those set for members of the American Board of Plastic Surgery. The AAAASF recommendations are not considered codes, but they are guidelines (standard of care issues) for the safe handling of patients.

Operating Suite Design

After a thorough discussion with the physician about goals for certification, accreditation, and/or licensing, appropriate code references must be consulted. The reader is referred to Chapter 8 for a discussion of these issues.

The *minimum* size of an operating room, in terms of function, number of personnel, and equipment (based on doing Class A procedures), is 14 × 16 feet clear, which may include one full wall of built-in cabinets for supplies. Outside the room, provide a scrub sink; storage for linens, gowns, caps, disposable supplies, and surgical dressings; drawers or carts for sterilized surgical instruments; clean and soiled utility rooms; a sterilization area; and male and female staff dressing area with lockers if space permits. Note that ORs may not have sinks in them as this compromises infection control.

For more specific details on sizes and features of Classes A, B, and C operating rooms and for required ancillary areas, consult the *Guidelines for Design and Construction of Health Care Facilities* (2010). *Comment: A new edition of the Guidelines will be published in 2014*.

Utility Areas

One may find, in plastic surgery offices, attempts to save space by combining rooms like clean and soiled into a common "prep" area. It may even open off of the operating room. This is typical of many office-based facilities that try to cram two pounds of program into a one-pound space. In Figure 5-86, the soiled utility is quite small and recovery bed area is undersized. Space is tight throughout the surgery suite. In this case, the surgeon found the "perfect" location, a high-profile freestanding building, with the ideal address, but the suite was locked in on all sides with no additional space to be acquired. To be functional, and meet business plan objectives, no rooms could be eliminated. High ceilings, however, allowed for dramatic interior design (see Color Plate 17, Figures 5-92 and 5-93). Full-height maple doors have wood transoms and custom flush door jambs to direct the eye to the ceiling treatments.

As regulations tighten, the common "prep" room will be replaced by separate soiled and clean utility rooms as in Figures 5-85 and 5-88. Instruments will be sterilized and wrapped here; dressings and medications are prepared. Do not underestimate the amount of space required for sterilizers and workspace and also a rather sizable piece of equipment, a blanket warmer, which is very important. The clinic service sink or hopper in the soiled workroom should have plaster traps.

Falling in Love with a Space That's Too Small

One may note considerable variation in these space plans with respect to the composition of the operating

room suite. Typically, a plastic surgeon finds an "ideal" lease space in terms of location, views, the "right" building, and it invariably has less space than required to design an optimum operating room suite. If the surgeon does not intend to seek accreditation to be able to bill a facility use fee, and does not intend to allow other "outside" surgeons to use the facility, there is some leeway in terms of minimum sizes of rooms, minimum sizes of recovery bays, separation of clean and soiled, and numerous other factors that are highly controlled in state-licensed facilities and those accredited by Medicare. Refer to Chapters 8 and 14 for more specific information on codes.

Figure 5-94. Plastic surgery operatory. *(Courtesy of Stephen J. Ronan, MD, FACS, Blackhawk Plastic Surgery)*

In a busy practice, while the nurse is prepping one patient, the surgeon may be completing surgery on another, and a nurse may be applying a dressing on a third before moving the patient to a nearby recovery room. On this basis, three operating rooms could be in use simultaneously, sometimes even with just one plastic surgeon working, but it would be very expensive, in terms of space, to build three ORs in a one-physician practice.

Design of the OR

An OR will have a motorized operating table and ceiling-mounted surgical lights (which require support above the ceiling) overhead. A crash cart containing resuscitation equipment and a defibrillator must be in the room as well as an anesthesia machine. Oxygen and suction (vacuum) can be either piped into the room or portable, but most plastic surgeons would want central (not portable) medical gases. Some prefer that they be piped through the ceiling to keep cords off of the floor (see Figures 5-94 and 8-12) The designer must check local fire code requirements for storage of anesthetic gases. (See Chapters 8 and 14 for additional discussion.)

If Class B and Class C anesthetic procedures are to be done, there will be a number of pieces of monitoring equipment, plus the anesthesia machine, in the room. There will also be an anesthesiologist or nurse anesthetist, one or two nurses, and the physician. This is the reason that operating rooms are often 16 × 18 feet or 18 × 18 feet in size. Access to supplies within the OR is necessary. Often, a full wall (full height) of 15-inch-deep cabinets with adjustable shelves and glass doors is either recessed into the wall or, if not, designed with a sloped top to avoid collecting dust (Figure 5-94). Prefab metal cabinets specifically for ORs are available or they can be custom plastic laminate casework.

Plastic surgeons have specific needs for storage inside the OR for breast augmentation prostheses and sizers and for a variety of equipment that may be used for certain procedures. One should not have to leave the room to

retrieve things that are used interoperatively. Typically, the machines used for liposculpture and lasers are kept in the OR but those for Fraxel and Thermage may be kept in a storage room. These are individual preferences that need to be discussed with the surgeon so that adequately sized storage rooms are well located. A refrigerator is needed in a prep room close to the OR for medications. An ice machine is also needed. A large flat screen monitor is required (wall or ceiling mount) if laparoscopic procedures are done.

Some practices use a lift frame and sling to move patients off of the OR table. This requires two persons instead of four and puts less stress on the spine. Allow space for storage of this apparatus near the OR.

Lasers are often used in plastic surgery. Refer to a discussion and photos of lasers in the Dermatology section of this chapter and in Chapter 8.

Interior Finishes

The operating room must be easy to clean. Walls should have an eggshell enamel paint finish. This does not preclude, however, having an artist stencil or paint a decorative border around the room to make it less intimidating to patients. A floor with no seams or joints is required—a hospital-quality sheet vinyl with self-coved base and heat-welded seams. In addition, the ceiling must be cleanable. Refer to Chapter 12 for suggestions. The finishes in this room are very important in regard to licensing or accreditation because they either enhance or impede infection control.

Access by Vendors

A lot of linen is used in a surgery facility, and accommodation must be made for large carts of soiled linen and storage of clean linen. It is ideal if the linen supply company can enter the soiled workroom directly, pick up the dirty linen, and drop off the clean (see Figures 5-85, 5-87, and 5-88). Similarly, vendors picking up biohazardous waste or delivering medical gas cylinders should be able to do this without walking through the surgery suite.

Emergency Power

An essential element is the emergency back-up power system. Based on NFPA 70 requirements, it is likely a generator will be necessary in most ASCs where a Type I System is required. According to Medicare's Survey and Certification Letter from May 2007: "A Type III Essential Electrical System is permitted to supply emergency power in facilities that do not provide electrical life support or use general anesthesia, provided the batteries are large enough to handle the equipment and there is sufficient back-up power to emergency lighting of corridors, exitways, and alarm equipment. A Type III System is not permitted where a Type I System is required." There are very specific requirements as to the capacity of the generator and the number of items that must be tied to it as well as the number of hours it must be able to function in an emergency. Obviously, all of this relates to the number of ORs, recovery beds, type of anesthesia used, and average length of procedures.

Dressing Area/Recovery Room

A dressing room, with lockers for valuables, may be provided for patients. This is a moot point, however, since patients are told not to bring valuables and must have someone drive them home. Often, one's clothing and shoes are placed in a basket on the lower portion of the gurney, which travels with the patient, both eventually ending up in the recovery room. Sometimes the dressing area is combined with the recovery room. The recovery area should be located immediately adjacent to the operating room and nurse station so staff can keep a watchful eye on the recovering patient (see Figures 5-85, 5-86, and 5-88). Each recovery bed must have suction, oxygen, and electronic monitoring equipment.

Typically, recovery beds are wheeled transport gurneys with rails approximately 30 $\times$ 80 inches in size. A patient would be moved off the operating table onto a gurney and wheeled into the recovery room, so room layouts must allow for easy maneuvering of gurney carts without bumping into walls. One must be certain that all turns can be navigated.

Other Considerations

A busy plastic surgeon who specializes in cosmetic procedures may wish to have separate waiting rooms for male and female patients. A hairstylist may be on hand several afternoons a week to shampoo and style the hair of patients who have just had bandages removed after a facelift. Patients recovering from facelifts will have dried blood and scabs on their scalps, or even staples, which can make some hairstylists squeamish. Such patients may, understandably, be timid about visiting their own stylist in public until the bruises subside.

A small room should be set aside for this purpose with a standard beautician's shampoo chair, professional hair dryer, and good-quality mirrors (see Figures 5-87 and 5-88). A gray-tinted mirror will downplay bruises, yet still provide enough reflection. Attractive wallcovering and accessories will help lift the patient's spirits. The color of the room should be complementary to skin tones. Light fixtures should be placed on both sides of the mirror to avoid shadows on the face and the color temperature of the light is critically important: 3500 Kelvin is desirable.

A plastic surgeon may also offer the services of a professional makeup artist for patients recovering from facial plastic surgery. This could be done in the same room as hairstyling.

Plastic surgeons who specialize more in reconstructive surgery—skin grafts for burn victims, surgery of the hand, repair of cleft palate, trauma—may by less concerned about providing privacy and anonymity for their patients, and they may be less interested in the appearance or image of their offices.

Skin Care/Spa Services

Whether a plastic surgeon does or does not have a surgery center associated with the office, he or she may wish to have a suite of rooms that can be used for skin care or spa services (see Figure 5-86). This requires at least two rooms 10 × 12 feet; a 10 × 10–foot room with a sink for prep, storage of clean linen, and a hamper for soiled items; a reception area with three or four chairs; and display cases for cosmetics and private-label skin care products that are available for sale. See Figures 5-100 and 5-102 for layouts of these areas in dermatology offices. In planning these types of rooms be aware that the sinks must be very functional in their operation. It is important to be able to have hot water instantly when turning on the faucet. If infrared controls are used make certain the temperature can be preset and that an instant hot water booster is installed under the sink. Do not assume that the aestheticians working there will understand that temperature adjustment is possible under the sink. The author has visited many such facilities and heard the complaints of staff that have to literally stand there with their hands in front of the sensor waiting for the water to run until it gets hot. Otherwise, depending upon the travel distance from the hot water heater (and the size of it) it can take quite a while for warm water to arrive. A laundry facility is useful if it can be located so that the noise of the washer and dryer cannot be overheard in the treatment rooms. These rooms, plus circulation space and a restroom will total approximately 500 to 600 square feet, which, if not professionally managed, can result in a loss rather than profit when compared to the additional rent for the space.

In many cities, spas have sprung up on every block, which means there is a lot of competition. However, a busy plastic surgery practice can generate many referrals with patients having a higher level of confidence about the efficacy of the procedures than they might have in a commercial setting not associated with a physician's office. The ambience of a spa or skin care salon is very important. Color, music, fragrance, burning candles, and an environment that appears clean and bright, with good lighting that flatters skin tones and highlights products to be sold, optimizes the experience for patrons and increases sales. Treatment rooms should have soft lighting and feel soothing. Figure 5-95 shows a massage room designed for a corporate wellness center.

One can design a dual-use exam room that will also work for skin care services, optimizing use of the room even when the physician is out of the office. The room must be at least 10 × 12 feet, and have a full wall of cabinets in the long dimension. This results in a 6-foot-wide

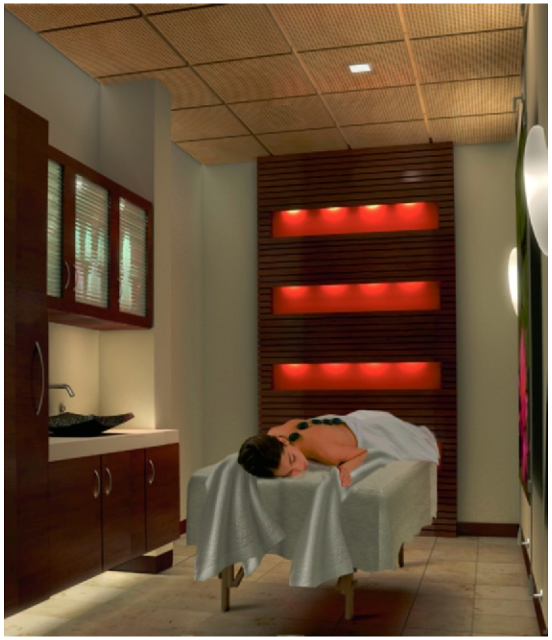


Figure 5-95. Spa massage room. *(Design: Jain Malkin Inc.)*

base cabinet with sink and upper cabinet and a 6-foot-wide full-height cabinet with three tall doors that conceal equipment and provide linen storage (see Figure 5-99).

Interior Design

Since this is a low-volume medical practice, ease of maintenance and durability in finishes and furnishings are generally not an issue outside the surgery suite. Materials used may be residential in character (see Figures 5-91a–d, Color Plate 17, Figures 5-92 and 5-93 and 5-96, Color Plate 32, 10-149, and 10-150. The plastic surgeon trades in the quest for an aesthetic ideal and the eternal fountain of youth. The office is an expression of his or her attention to detail and an indication of aesthetic awareness; the image the surgeon projects is very important. People want to deal with a surgeon who appears to be successful—this amounts to third-party endorsement of the plastic surgeon's skills. To this end, the elegant procedure room in Figure 5-97, on the 38th floor of the John Hancock tower, offers patients a dramatic view of the Chicago loop.

The plastic surgeon who spends a considerable sum on office design and furnishings will generally reap the rewards. No medical specialty benefits more from a high-profile image. Even the plastic surgeon's letterhead and business card, as well as brochures, should be striking and imaginative and coordinated with the office design to establish a brand.

All rooms of this suite may be carpeted, except for the surgery suite and a treatment room for small in-office procedures. Office design should be stylish but comfortable, and lighting should be soft and flattering in all rooms, except good light (probably LED) is needed in exam rooms and the operating suite. The waiting room will benefit from a mix of lighting, including LED and perhaps some halogen in addition to table lamps if consistent with the style of décor (see Figure 5-91d). The waiting room especially benefits from a low level of illumination to mask bruises resulting from surgery and to keep patients out of the spotlight. This means that the specific type of fixture is an important consideration.

The color temperature of fluorescent (and also LED) lamps is critical in examination and consultation rooms. A color temperature of 3500 Kelvins with a high CRI (85 or more) is desirable. Consult Chapter 12 for more detail on lighting.

Bathroom design is important in this specialty. Large gray-tinted mirrors and interesting lighting may be incorporated into the vanity cabinet (see Figure 10-105). Walls and ceiling may have wallcovering, and bathroom accessories (tissue boxes, paper towelette holders, soap dishes) should be elegant and residential in character. Other items a patient might use in light grooming before or after medical consultation may be provided. Grab bars, required by the ADA, should not be the typical institutional stainless steel product. Instead, solid color nylon grab bars can be matched to blend into the wall.

Figure 5-96. Waiting room with "residential" ambience. *(Photo copyright © Nathan Padilla Bowen)*

Today, many people consider having plastic surgery to correct physical imperfections. Taboos about vanity have all but disappeared, and society places greater emphasis on self-expression, personal fulfillment, and an internal state of well-being. There is an increased exposure to the benefits of plastic surgery in the media, which has given more people the confidence to seek treatment. Plastic surgery is no longer just an option of the affluent; many persons of modest income also consider it a viable option, as do an increasing number of men.

DERMATOLOGY

A dermatologist treats diseases of the skin. It is not uncommon to find a one- or two-physician practice. Since dermatologists rarely make hospital rounds or emergency house calls, their appointment schedule is strictly adhered to without the sort of interruptions that plague many other physicians. A one-physician suite would be composed of three examination or treatment rooms, a waiting room to accommodate eight to ten persons, a small lab, a toilet room, a business office, a consultation room, a minor

Figure 5-97. Plastic surgery procedure room. *(Courtesy of Proteus Group Dimitri Photography, copyright © www.dimitri.com 2013)*

surgery, and a large storage closet for drug samples. Larger practices may include a surgery facility, as well as offer ancillary services such as laser hair removal, chemical peels, facials, injections of Botox (botulinum toxin) and fillers, sclerotherapy, skin resurfacing, and massage. Figure 5-98 shows the relationship of rooms and Table 5-7 details a space program. The four-physician practice in Figure 5-99 provides four exam rooms and four procedure rooms plus an aesthetician's room. By contrast, the four-physician practice in Figure 5-100 has a Mohs surgery suite and a sizable skin care suite, but the physicians do not have private offices. They touch down at "hoteling"–type desks near the nurse station. This provides more income from the use of the space. There are three exams rooms, four procedure rooms, and a multipurpose room in addition to the spa procedure rooms. The spa/skin care area has a separate entry from the medical office.

Procedures

The procedures performed in a dermatology office vary widely, depending on the number of providers and their

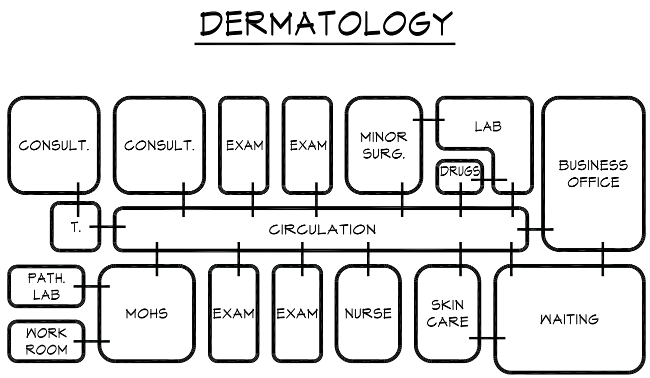


Figure 5-98. Schematic diagram of dermatology suite.

entrepreneurial inclinations and training. Those having a more cosmetically oriented practice may do a considerable amount of cosmetic surgery and would need an office-based surgery facility similar to that used by plastic surgeons (see the Plastic Surgery section in this chapter for details). The types of procedures may include brow lifts and liposculpture.

Perhaps one of the physicians in a group practice may have been trained to do Mohs surgery (more fully explained later in this section) for skin cancer. One of the physicians may be known for sclerotherapy techniques (treatment of varicose and spider veins) or perhaps hair transplantation.

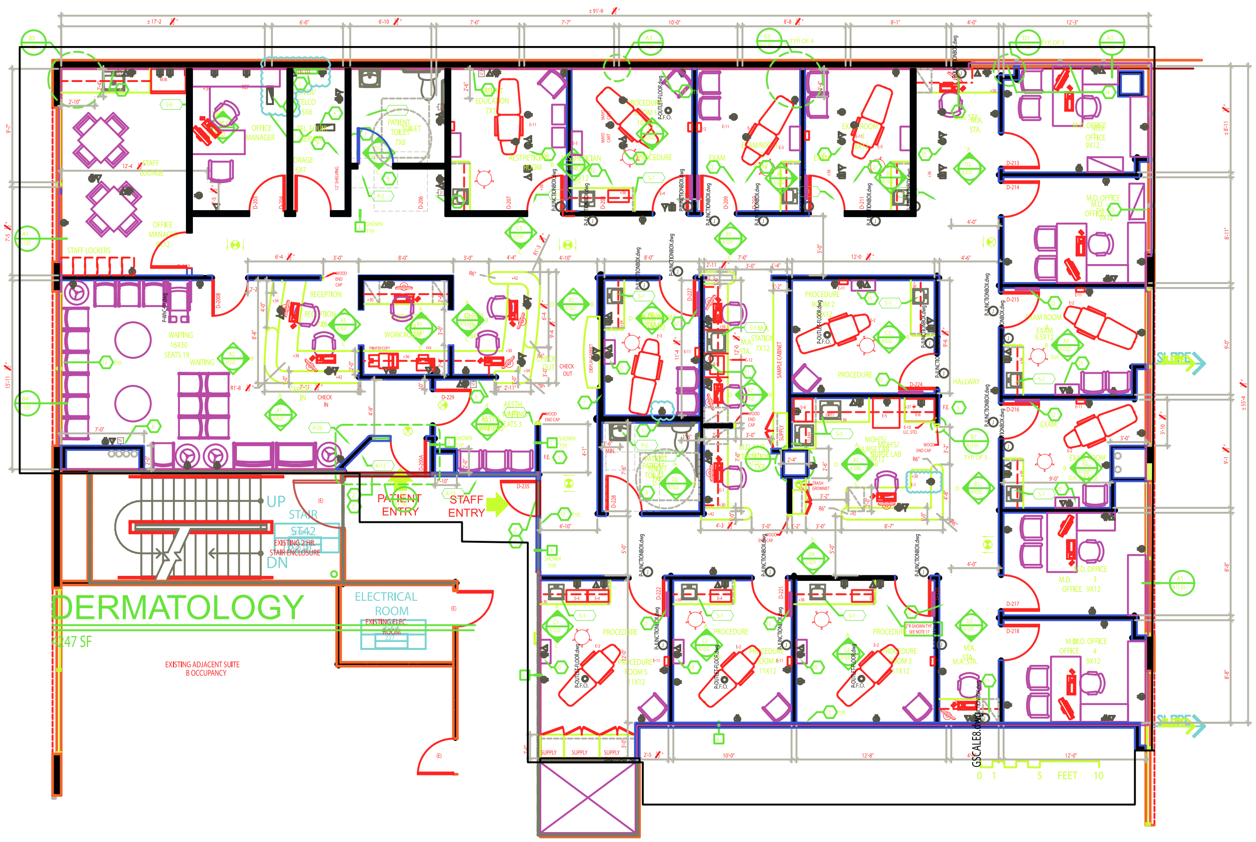


Figure 5-99. Space plan of dermatology suite, 4,247 square feet. *(Design: Jain Malkin Inc.)*

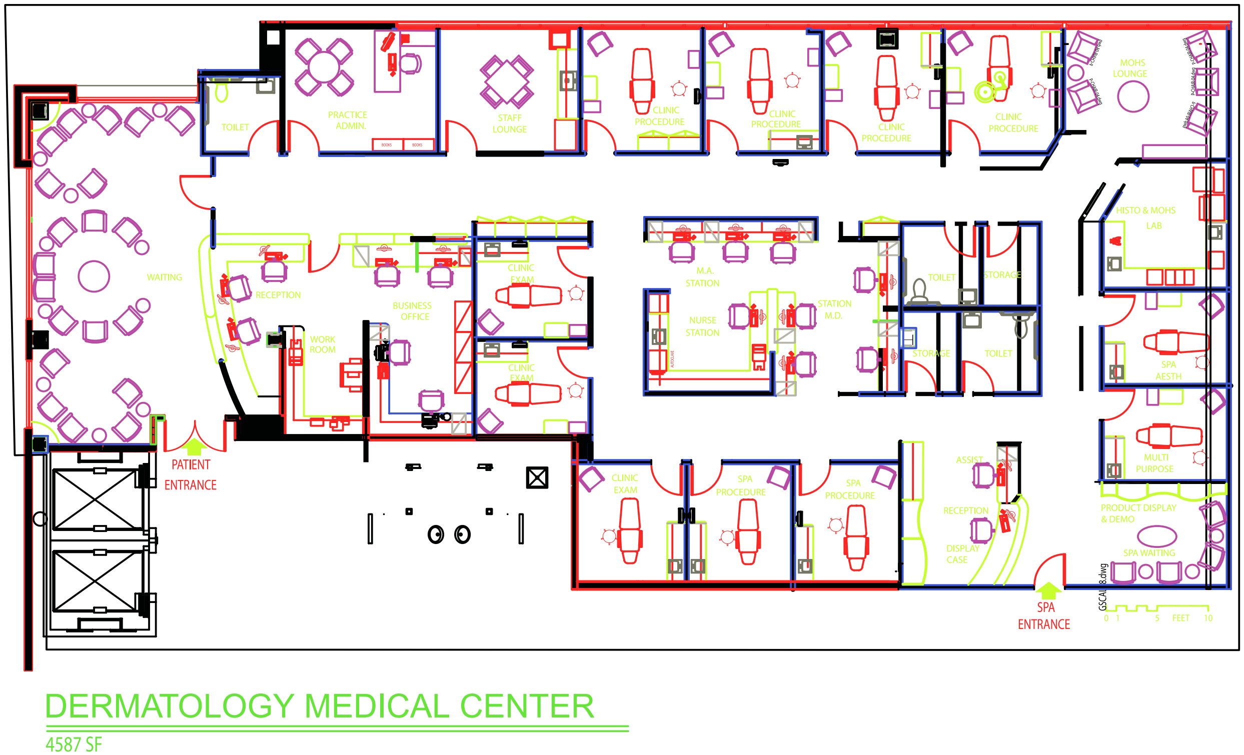


Figure 5-100. Space plan of dermatology suite, 4,587 square feet. *(Design: Jain Malkin Inc.)*

Dermatologists, especially those with a cosmetically oriented practice, use many different types of lasers to perform hair removal (Cynosure *Elite*™ and *LightSheer*® *Duet*™ by Lumenis®, Figure 5-101e), to do facial peels, remove sun damage, birthmarks, red or brown spots and tattoos (Figure 5-101f, *Fotona QX MAX* by Lumenis®) as well as vascular lesions like port-wine stains (Figure 5-101a, Candela *V-Beam Perfecta*). The Cool Touch *Cool Lipo*™ (Figure 5-101b) is used for liposculpting and the *Zimmer Cryo 6* chiller by LaserMed (Figure 5-101d) is used to cool the skin after certain types of procedures such as hair removal, which leave the skin hot. The Cutera® *CoolGlide XEO* laser is multipurpose (Figure 5-101c).

The more entrepreneurial practitioners sell skin care products, employ a number of estheticians or cosmetologists to do facials, acne therapy, massage, cellulite therapy, facial chemical peels, and may even have a satellite suite for spa services (Figure 5-102). It is easy for a busy practice to generate many skin care referrals, and since most of these treatments require multiple visits, the volume of patients is steady and the profit can bolster sagging reimbursement for the clinical dermatology practice. Each state regulates the types of procedures estheticians can do under their licenses; some practices employ a registered nurse to oversee this type of enterprise.

Practitioners who do a lot of costly laser procedures need to have an office designed to present and sell the case similar to the manner in which plastic surgeons work. Often a patient may visit two or more dermatologists to

Figure 5-101. a. Vbeam, b. Cool Touch, c. XEO Coolglide, d. Zimmer Chiller, e. LightSheer Duet, and f. QX-Max system. *(a. Photo courtesy of Syneron Candela. b. Photos of Cool Touch CVT™ 1320nm laser, courtesy of Cool Touch, Inc. c. Courtesy of Cutera, Inc. d. [TK] e. Courtesy of Lumenis Ltd., f. Courtesy of Lumenis Ltd.)*

Table 5-7.
Analysis of Program
Dermatology

No. of Physicians		2		3
Exam Rooms	6 @	10 × 10 = 600	9 @	10 × 12 = 1080
Minor Surgery	2 @	12 × 14 = 336	2 @	12 × 14 = 336
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Business Office		16 × 20 = 320		16 × 20 = 320
Office Manager		10 × 12 = 120		10 × 12 = 120
Financial Counseling		10 × 12 = 120		10 × 12 = 120
Mohs Surgery				
Lab				10 × 12 = 120
Procedure Room				10 × 12 = 120
Patient Lounge				8 × 10 = 80
M.A. Station		5 × 12 = 60		5 × 16 = 80
Staff Lounge		10 × 12 = 120		12 × 12 = 144
Waiting Room		14 × 20 = 280		18 × 20 = 360
Consultation Room/Private Office	2 @	10 × 12 = 240	3 @	10 × 12 = 360
Lab/Nurse		10 × 10 = 100		10 × 12 = 120
Spa/Aesthetician	2 @	10 × 12 = 240	2 @	10 × 12 = 240
Storage		6 × 8 = 48		6 × 8 = 48
Tel Equip./Server Closet		4 × 5 = 20		4 × 5 = 20
Biohazard		4 × 4 = 16		4 × 4 = 16
Subtotal		2,748 SF		3,856 SF
20% Circulation		550		771
Total		3,298 SF		4,627 SF

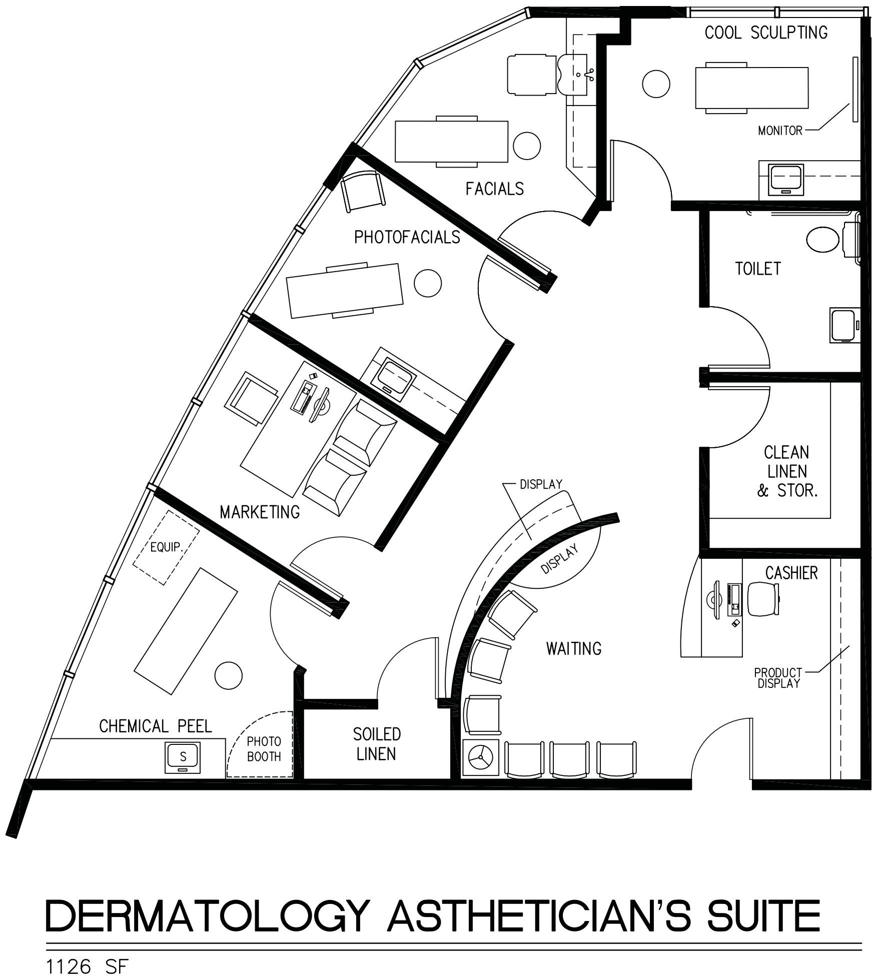


Figure 5-102. Space plan of dermatology aesthetician's suite, 1,126 square feet. *(Design: Jain Malkin Inc.)*

discuss a specific procedure and obtain a cost proposal. An office for a financial counselor may be required near the front of the suite. The practitioner's personal preferences for flow and process need to be considered.

Explanation of Procedures

Hair Restoration. This is accomplished by laser micrografts, transplanting hair from one area of the scalp to another. It often employs a robot for graft removal, which is a large machine that requires quite a bit of space.

Vascular Therapies: Sclerotherapy involves injections into affected blood vessels to reduce unsightly veins. It is often done under ultrasound guidance. *Endovenous laser treatment* involves passing a small laser fiber into a vein to deliver pulses of laser light that cause the vein to collapse. This is performed with local anesthesia. *Removal* of veins through small incisions is

performed under local anesthesics. *Surgical* "stripping" of larger vessels, a more involved procedure, requires general anesthesia or conscious sedation plus a local anesthetic.

Botox Injections. A form of botulinum toxin is used to smooth out and soften wrinkle lines. It causes temporary paralysis of the muscles so that they are unable to contract. An injection lasts about six months.

Microdermabrasion. A skin resurfacing technique using an abrasive instrument to sand the skin to gently remove damaged cells from the outer layer of the skin.

Fractional Laser Skin Resurfacing. Used to treat wrinkles, acne, blotchy skin, and similar facial problems by using a laser to penetrate into the top layers of skin to stimulate collagen growth and resurface the top layer. It requires two or three sessions with a period of time in-between visits.

Chemical Peel. A blend of retinoic acid and alphahydroxy acids to smooth the skin.

CoolSculpting® by Zeltiq. Reduces fat by a cooling process that kills the fat cells underneath the skin, freezing them to the point of elimination.

Photofacials. Intense pulse light (IPL) using laser energy treats many skin abnormalities such as skin damage due to sun or to aging, redness, or broken capillaries.

Tumescent Liposculpture. Localized fat deposits are removed by a high-pressure vacuum through tiny incisions through which a small cannula (hollow "tube") is inserted. Liposculpture uses a smaller cannula than liposuction and is performed with local anesthesia with oral and/or conscious sedation, rather than general anesthesia. These procedures are done in a surgery room with resuscitation equipment on hand.

Laser Surgery. Laser stands for *Light Amplification by the Stimulated Emission of Radiation*. The laser beam can cut, seal, or vaporize skin tissue and blood vessels. Lasers produce one specific wavelength (color) of light, which has variable intensity and pulse duration. When the laser light hits skin tissue, its light energy is absorbed by water or pigments in the skin, all of which absorb laser light of different wavelengths. A variety of lasers are used in dermatology because they are highly specific: the pulse of light that will vaporize a black tattoo will not affect red pigmented spider veins, for example.

Designing for Lasers

In this specialty because there are so many variations in practice and procedures it is important to understand which rooms will be used for laser treatments and the types of lasers used. Often one or more rooms are designated procedure rooms and the lasers are kept in those rooms. Some lasers produce a lot of heat, such as the one used for hair removal, which can increase the room temperature by 10 degrees. The YAG laser is dangerous to the eyes; most of the beam dissipates in about 3 feet. A black drape or black-out shade is required on the window and/or glazed panel in door if such exists. Refer to additional discussion on lasers in the Plastic Surgery section of this chapter. The casework in a room in which lasers are used should have a drawer for storing the protective goggles worn by staff. Most lasers require 220 volts and a dedicated circuit. Lasers and some electrosurgical procedures generate a hazardous plume of smoke that must be evacuated by a machine like the Surgimedics® *Surgifresh Turbo* (Figure 5-103).

Photo Room

As in plastic surgery offices, a photo room is required in offices in which liposculpture is done. Some dermatologists feel that black is a better background than blue for body sculpting and some have developed a grid for the floor to make sure the patient is standing exactly in the same place when the photo is repeated on successive visits postsurgically. Some have highly specialized lighting in this room.

Figure 5-103. Surgifresh Turbo Smoke Evacuation System. *(Courtesy of CSL Specialty Medical & Surgical Specialties, copyright © 2013 Coastal Life Systems, Inc.)*

Examination Room

Exam rooms can be 10 × 10 feet instead of the standard 8 × 12 feet or 10 × 12 feet to provide more room and the flexibility to maneuver equipment around. The exam table is often adjustable height (Figure 5-104) and may be more of a chair (see Figure 5-107) such as that used in plastic surgery. It is the physician's preference whether the head of the table is placed facing the door or away from it. Natural light (a window) is important in dermatology exam rooms. The room should have a sink cabinet as well as a high level of illumination, free of shadows, supplied by full-spectrum fluorescent lamps or LEDs with color temperature either 3500 or 4100 degrees Kelvin. Because the quality of the light is so important in this specialty, samples of light fixtures should be obtained for evaluation. Adequate lighting is essential in all exam, treatment, and procedure rooms. This may be a challenge with increasingly restrictive energy allowances (watts per square foot).

One exam room may have a *Dermascope*, a diagnostic videoscope for examining the skin surface microscopically. It provides a printed photo for the patient and also digitally uploads the information onto an electronic medical record or transmits the image, provided broadband cable is available, to a remote location for a real-time consultation. The unit does not require a dedicated circuit but does need to plug into a surge suppressor.

Lab

The lab will have a microscope and an autoclave for cleaning instruments and possibly an ultrasonic cleaner (Figures 5-105a and 105b). If there is an autoclave, there needs to be a 36-inch countertop space for wrapping instruments. A good layout of the countertop would be (moving from left to right) the autoclave, wrap area, double stainless steel sink, and ultrasonic cleaner. The wrap area needs drawers exactly that size (about 24 × 36 inches) underneath to accommodate the two different sizes of wraps that fit the autoclave. In addition, the autoclave requires storage space for distilled water. On the opposite side, provide a sit-down or stand-up space for a microscope. In a small office, the nurse station may be combined with the lab. In a large suite (see Figure 5-100), the pathology lab serves the Mohs surgery area, and the centralized nurse station serves the exam rooms.

In a practice that focuses on laser surgery, an operating room suite may be created with ancillary rooms such as clean and soiled utility rooms, prep and recovery spaces as in Figure 5-106. In this case, the autoclave and ultrasonic cleaner, as described above, will be in the soiled utility room and the clean utility room will not have a sink. It may have a pass-through window from the soiled

Figure 5-104. Dermatology exam room. *(Photo: Jain Malkin)*

room for wrapped items that have been processed in the autoclave and placed in plastic or wire baskets. The clean supplies needed in the procedure rooms would be stored here.

Surgical Procedures

The minor surgery or procedure room is often 12 ×12 feet, with a long sink cabinet along one wall. Medical equipment to be accommodated in this room would depend on the scope of the procedures. However, the equipment would include an operating table or chair that adjusts to different positions (Figure 5-107) and a ceiling-mounted surgical light over the table. If an office-based surgery suite is required, consult the Plastic Surgery section of this chapter.

Dermatologists perform many surgical procedures in the office. Surgery may be done to improve the skin's appearance, to biopsy tissue to establish a diagnosis, or to prevent or control disease. Different types of surgical procedures include:

Curettage—scraping the tissue with a sharp surgical instrument called a curette.

Excision—cutting into the skin surgically, removing the tumor or growth, then closing the wound with stitches.

Cryosurgery—using liquid nitrogen sprayed on the tissue to freeze it and thereby destroy the unwanted cells.

Laser Skin Resurfacing—to remove scars, acne, or damage done by exposure to the sun.

Laser Surgery—using a highly concentrated, focused beam of light to eradicate unsightly skin abnormalities such as tattoos, port-wine stains, birthmarks, and broken blood vessels. The CO_2 laser is the most common type used in dermatology practice. The Lumenis® *Encore* requires a standard 110/115-volt electrical outlet and is air cooled. Another commonly used laser is the erbium:YAG. (The reader is referred to a discussion

Figure 5-105a. Dermatology lab with microscope with cryostat. *(Photo: Jain Malkin)*

Figure 5-105b. Dermatology lab. *(Photo: Jain Malkin)*

of lasers under the Ophthalmology section of this chapter and also to Chapter 8.)

Mohs Histographic Surgery—a specialized surgical technique developed by Frederic Mohs, M.D., some 60 years ago, it is a method of detecting the extent and spread of the tumor through the use of a sequential examination of tissue with a microscope immediately after the tissue has been excised. Because the microscope guides the physician in how much skin needs to be removed, taking "extra margins" of tissue just for safety's sake is unnecessary. This technique is used especially where larger skin cancers have occurred on cosmetically prominent areas or where they are at high risk of recurring. This differs from other surgical techniques because the excision of tissue is guided by the use of diagrams, dyes, microscopes, and specific surgical techniques. A local anesthetic is used during this procedure. The suite plan in Figure 5-100 shows a Mohs suite with adjacent pathology lab, and subwaiting area.

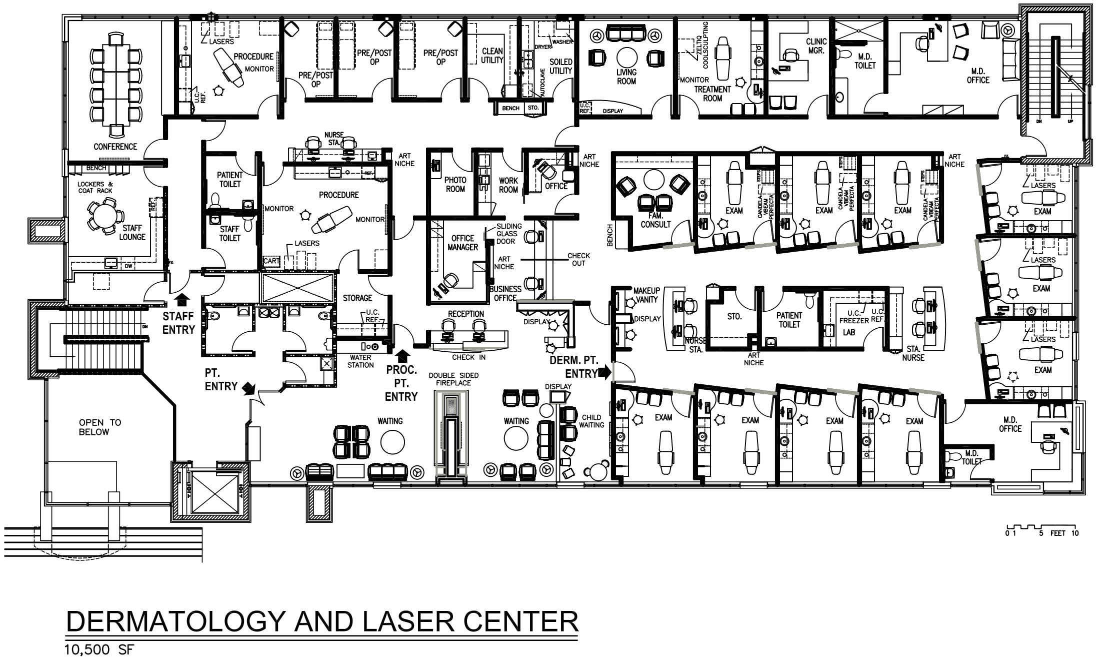


Figure 5-106. Space plan dermatology, 10,500 square feet. *(Design: Jain Malkin Inc.)*

Pathology Lab

The layout of the pathology lab is important. The three main pieces of equipment are the cryostat (Figures 5-105a and 5-108), which freezes the tissue specimen and slices thin sections to be examined under the microscope (the second piece of equipment), and the autostainer (Figure 5-109), which uses colored dyes to stain the tissue. The cryostat should be opposite the autostainer to save steps, and the autostainer must be next to the sink as it connects, through a hole in the countertop, to water and drain. A stainless steel counter and sink are best as the dyes stain badly. The autostainer needs an electrical outlet and fume hood; some require a water source. Excellent lighting is essential. Other room requirements are an undercounter refrigerator for meds, considerable storage for gallon bottles of fixative and reagents for the autostainer, and a low countertop (less than 30 inches high) with kneespace to support a heavy microscope without incurring vibration. The microscope should be close to the cryostat. The sequence is that the tissue goes first to the cryostat, then to the stainer, and, finally, to the microscope.

Storage and Surgery

Both the general surgery room and the Mohs room require a full wall of cabinets to store many supplies and disposables. Space is needed for a 20 to 30–inch tall dewar (canister) of liquid nitrogen. A good location is a room near the staff or service entry that can be used for pickup of soiled laundry and hazardous waste. A small "gun" is filled from this cryogen tank and used in the exam room for cryosurgery.

Patient Course

A diagram or map is made during Mohs surgery to guide the excision and examination of tissue. While each sequential specimen is stained, frozen, and examined under the microscope, patients may leave the office and return 45 to 60 minutes later. Depending upon the size of the practice and the number of Mohs procedures, a small lounge is a nice amenity to enable patients to relax during the examination of the tissue. A patient may be in the office two hours, then return the next day for the closing of the wound and, 10 days later, return for suture removal.

Psoralen Ultraviolet Light

Psoralen ultraviolet light, type A (PUVA) and narrow band UVA are used for treatment of severe psoriasis that cannot be controlled by conventional therapies. Psoriasis is a noncontagious skin disease characterized by elevated red patches on the skin, covered by a dry scale. The disease is the result of an excessive buildup of skin cells. PUVA reduces this cell reproduction and temporarily clears symptoms for anywhere from a few weeks to a couple of years.

PUVA involves a combination of long-wave ultraviolet light (type A) and a prescription oral medication. Patients

Figure 5-107. Procedure room. *(Courtesy of Midmark Corporation)*

Figure 5-108. CM1520 Cryostat used in a Mohs lab. *(Courtesy of Leica Biosystems)*

Figure 5-109. ST 4020 Stainer used in a Mohs lab. *(Courtesy of Leica Biosystems)*

usually require three treatments a week for a total of approximately 30 treatments.

Most dermatologists do not do PUVA treatment in their offices because PUVA equipment is fairly expensive, requires a dedicated area, and would need a high volume of patients to make the investment worthwhile. The equipment generates a great deal of heat, and a separate air-conditioning unit is required for the PUVA treatment room.

Other Design Considerations

Dermatologists dispense a lot of drug samples, salves, ointments, and shampoos. A specialized closet should be provided in a convenient location in the corridor for storage of drug samples. The closet might have doors fitted with compartments or bins for sorting and making accessible frequently used products.

Ultrasound is used for diagnosis of vascular conditions prior to treatment by one of the several types of vein therapies. This requires a set of three stairs in the exam room because the patient needs to be standing while the transducer images the blood flow. The patient walks up the stairs and holds onto a horizontal grab bar on the wall for stability. This enables the physician to sit on a stool and be at the right height to be able to do the ultrasound and also to inject veins in the legs during sclerotherapy.

A large flat screen monitor is needed on the wall in the room used for *CoolSculpting*® as the patient lies on a table usually for three to four hours.

Consider providing a lounge for family who are waiting for a patient in surgery (see Figure 5-106). Comfortable lounge chairs, a Keurig coffee machine on a table, and a desk with Internet connection and ability to recharge mobile devices will be appreciated. A large flat screen monitor with access to quality programing (other than television) will make the time pass more quickly.

Many of the treatment tables and exam chairs require power. A floor receptacle needs to be coordinated precisely with the base of the equipment. In this specialty there are many pieces of equipment that have specific utility requirements that need to be carefully considered. Layouts of every treatment and exam room should be prepared showing the placement of lasers and other machines so that electrical outlets are in the correct location and cords are not in the way.

Undercounter refrigerators are needed in or near exam rooms in which injectable fillers are used. A number of products need to be refrigerated. Some practitioners may want a freezer section for small ice packs.

Thin client monitors may be placed in exam rooms, family lounge and other locations for display of educational content that may include before-and-after photos of various procedures or an explanation of types of procedures. These are relatively small and can fit into wall-mounted holders. The name was coined in 1993 by Tim Negris of Oracle Corp. (en.wikipedia.org/wiki/thin_client; accessed June 13, 2013) and is a generic term for a computer terminal that has only a graphical interface for which the operating system is a remote server. This makes it very easy to update content from one central location.

An increasing number of physicians are moving away from creating a private office. Note that physicians in Figure 5-100 work at hoteling stations in the core of the suite near the nurse station. This is a way of increasing revenue by utilizing space that would have been used for private offices as additional exam rooms which works well for physicians serving multiple office locations. Private offices are not used as much in some specialties now especially since electronic charting is done in exam rooms during the procedure.

Interior Design

There are no special interior design considerations in a dermatology suite. However, lighting is critically important in all areas. Full-spectrum lamps are best for evaluating skin tones. LED lamps are good choices as long as the degrees Kelvin are 3500 to 4100. Refer to Chapter 12 for more information on this topic. Patients include those of all ages and those who are in relatively good health. Exam rooms are often used for treatment; therefore, a hard-surface floor is preferable to carpet.

Product Display
Dermatologists often sell branded skin care products and sometimes cosmetics that need to be prominently displayed in casework with halogen or LED lighting in the waiting room or other areas where it is convenient for patients to sample products and have staff nearby for consultation. The style or design of this casework should coordinate with the interior design of the office. The waiting room in Figure 5-110 has a Craftsman-style design and a corner display cabinet for products. The offices in Figures 5-100 and 5-106 have prominent areas for product display.

Figure 5-110. Dermatology waiting room in Craftsman-style design. *(Photo: Jain Malkin)*

ORTHOPEDIC SURGERY

An orthopedic surgeon deals with diseases, fractures, or malformations of the bones, as well as arthritis, birth defects, industrial accidents, and sports injuries that affect the bones and joints. Orthopedics has become increasingly subspecialized into anatomic specific practices such as hand, spine, joint, foot, and sports medicine. With a tendency to group in large practices, it is not uncommon to find six or seven or more physicians working in the same office (Figure 5-111). Schedules may be arranged so that each doctor performs surgery two days a week, is off one day, and is in the office the balance of the time. Therefore, all the surgeons are seldom in the office at once. Figure 5-112 shows a flow diagram and Table 5-8 lists a space program.

Required Rooms

A two-physician practice would typically have six exam rooms (three per physician), one cast room, a minor procedure room, a small nurse or tech station, two private offices, a large business office, a large waiting room, a radiology room, two toilet rooms, and a large storage room. The cast room can double as a minor procedure room. A larger practice might also have a physical therapy area (may even be a separate suite adjacent to the orthopedic practice as in Figure 5-111) additional cast rooms and exam rooms, and a conference room. A practice with three surgeons seeing patients at the same time will need two radiology rooms. In this specialty, many patients have an X-ray prior to seeing the surgeon whether it is preop, postop, or a visit not associated with surgery—perhaps an injection in an arthritic joint. Orthopedists typically do not have conventional nurse stations; it is more a workstation for the M.A.s and/or nurse who assist the physician in the exam rooms. The X-ray tech generally stays in the radiology area.

ORTHOPEDICS WITH PHYSICAL THERAPY

10,600 SF

Figure 5-111. Space plan of orthopedics suite, 10,600 square feet. *(Design: Jain Malkin Inc.)*

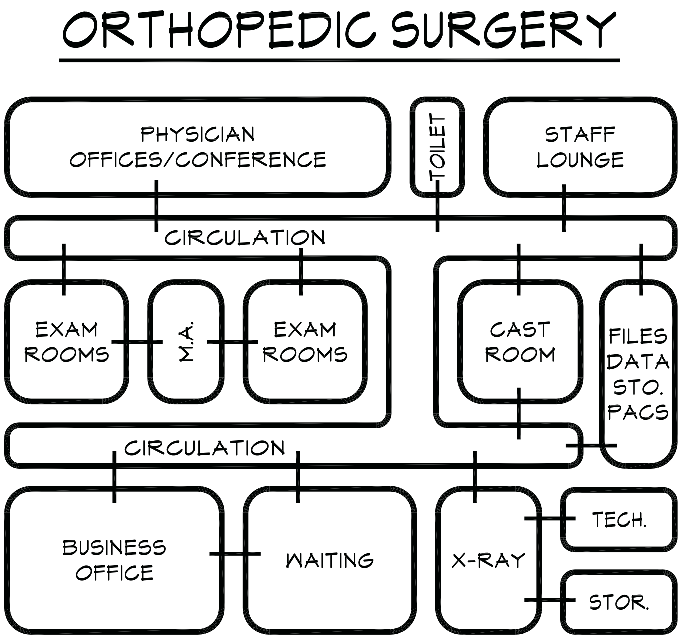


Figure 5-112. Schematic diagram of orthopedic surgery suite.

Physical Therapy

Physical therapy (PT) is an ancillary service affected by the Stark legislation, designed to eliminate conflict-of-interest self-referral opportunities for physicians. This has reduced the number of PT facilities associated with physicians' offices, as has managed-care contracting, which may dictate that patients go to specific facilities for physical therapy services. If an orthopedist has a facility adjacent to the suite, it must have its own entrance (see Figure 5-111). Refer to Chapter 9 for more information on planning PT spaces.

Examination Rooms

Exam rooms may be 9 ×12 or 10 ×10 feet since an orthopedist often uses a 27-inch-wide by 80-inch-long physical therapy table, which is sometimes placed parallel to the wall to save space but this is not as desirable as placing the head of the table perpendicular to the wall so that the provider can walk around three sides of it (Figure 5-113), in which case the room needs to be 10 feet wide. The table may have pull-out leaves for examination of limbs. Sometimes a row of drawers is provided under the upholstered tabletop. Alternatively, a standard examination table with pull-out foot rest may be used.

Table 5-8.
Analysis of Program
Orthopedic Surgery

No. of Physicians		**2–3[a]**		**4–6[b]**
Consultation Rm./Private Office[c]		12 × 12 = 144	3 @	12 × 12 = 432
Exam Rooms	8 @	10 × 12 = 960	12 @	10 × 12 = 1440
Cast Rooms	2 @	12 × 12 = 288	2 @	12 × 12 = 288
Business Office		20 × 20 = 400		20 × 26 = 520
Office Manager		10 × 12 = 120		10 × 12 = 120
Surgery Scheduling		10 × 12 = 120		10 × 12 = 120
M.A. Station		6 × 12 = 72		6 × 16 = 96
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Staff Lounge		10 × 12 = 120		14 × 16 = 224
Waiting Room		20 × 24 = 480		24 × 30 = 720
Physical Therapy (Optional)		—		20 × 25 = 500
Tech /M.A. Workstation		8 × 8 = 64		8 × 8 = 64
Radiology		14 × 16 = 224	2 @	14 × 16 = 448
Conference Room		—		12 × 16 = 192
Storage		8 × 8 = 64		8 × 8 = 64
Tel. Equip. Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Server/PACS Closet		4 × 4 = 16		4 × 4 = 16
Subtotal		3,236 SF		5,472 SF
25% Circulation[d]		809		1,368
Total		4,045 SF		6,840 SF

[a]Assumes two physicians seeing patients while the third is in surgery. Add another private office for the third physician.
[b]In a six-physician practice, it is unlikely that more than three or four surgeons would be in the office at the same time.
[c]Assumes shared consultation rooms (private office), two in each 12 × 12 office.
[d]Allows for 6-foot-wide hallways.

Orthopedic exam rooms are quite different than those for primary care and for many other specialties in terms of placement of the sink and cabinet. It is often placed on the wall with the door, which allows adequate space around the foot end of the PT/exam table (see Figure 5-111). Sometimes they do not have a sink. Diagnostic instruments such as the typical Welch Allyn wall-mounted panel are not required. A sharps container should be provided because injections are given in these rooms.

At least one exam room needs to have an extra wide door to accommodate large wheelchairs, stretchers, and patients who may have significant disabilities and require a two-person assist.

Digital Technology

Each exam room needs a flat panel monitor that may be placed at stand-up height to make it easier for the M.A. to bring up X-rays onto the monitor prior to the physician entering the room. Two monitors would allow one for films and another for viewing the patient's medical record. If one of these screens is larger and mounted on the wall, patients would be better able to see the images as the surgeon narrates. Outside the exam room, accessible to physicians, there may be a central PACS viewing station and a large vertical monitor for viewing nondigital spine films a patient may have brought with them. One four-panel view box illuminator

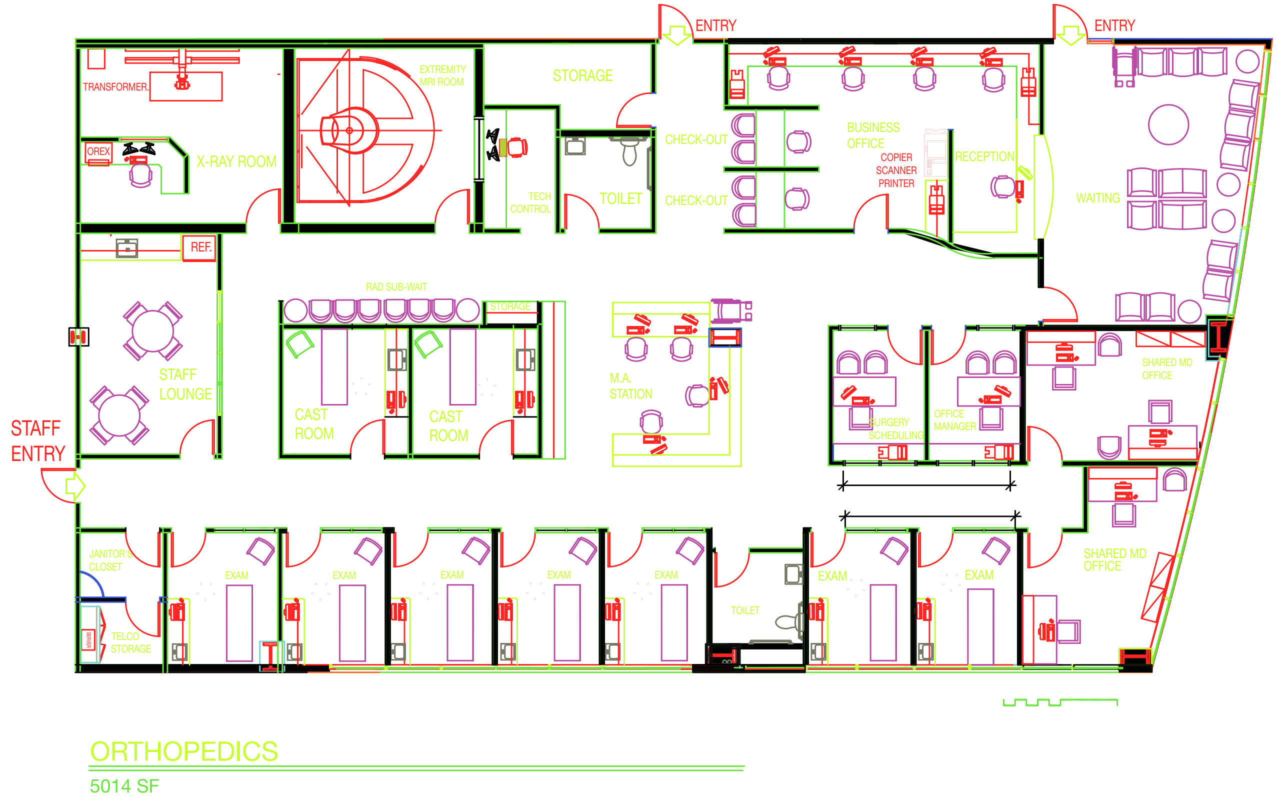


Figure 5-113. Space plan of orthopedic surgery suite, 5014 square feet. *(Design: Jain Malkin Inc.)*

should be available in a central location somewhere in the office for viewing film-based X-rays. There is considerable interaction between physicians and M.A.s, physician assistants, and/or nurses in the examination area and a centralized hub facilitates communication (see Figure 5-113).

Hand Surgeon

A hand surgeon works at a T-shaped desk (Figures 5-114a and b). The patient is seated on one side of the stem of the "T" and the surgeon on the other. Drawers and a flip-top countertop hold instruments and tools. There is also a need for storage of sterile supplies. Functionally, this room may be as small as 8 × 8 feet, although it must be large enough to accommodate a wheelchair.

A hand surgeon also requires a minor procedure or cast room for dressing wounds and building casts. Removal of sutures can be done in the hand room. Each exam room and cast room must have a flat screen monitor for viewing digital films and of course a keyboard. There are options for location depending upon physician preference. Some like it above the countertop on the wall with the door. This puts it at a convenient stand-up height. When the physician enters the room, often the first thing he or she does is to examine the X-rays prior to examining the patient. There exist numerous options and hardware for mounting computers, monitors, and keyboards in clinical settings.

Figure 5-114a. Hand room, orthopedic surgery suite. Note: To update this room it would have a flat screen monitor for PACS viewing. *(Design: Jain Malkin Inc.; Photographer: John Christian)*

Figure 5-114b. Hand room, detail of cabinet. *(Design: Jain Malkin Inc.)*

Cast Room

The cast room will have one full wall of cabinets designed precisely to accommodate the numerous splints, bandages, plaster, and required tools. The design of a cast cabinet is extremely important to the efficiency of the room. Plaster comes in rolls in widths of 2, 3, 4, and 6 inches. Slots in the face of the cabinet allow the rolls to feed through easily, when pulled. Stockinette may be fed through other slots. Drawers hold padding; open bins hold elastic bandages; and a drawer contains cast tools. Often a prefabricated cart on casters is used (Figure 5-115).

A large hinged trash bin may be built into the cabinet, if space permits. If possible, this bin ought to be vented to the outside, since cast cutoffs have a foul odor. If this is not possible, the room should have an exhaust fan. As an alternative, a large trash bin needs to be placed in the room for this purpose. The sink in the cast cabinet should have wrist blade faucets, or foot-pedal control, a gooseneck spout (so a bucket can be put under it), and a plaster trap.

Surfaces of the cast room must be washable since the room is exposed to plaster dust when casts are sawed off

Figure 5-115. Harloff cast cart.

and wet drippings when new casts are built. A sheet vinyl floor and vinyl wallcovering or paint are recommended.

Orthopedists often use fiberglass casts. This requires no special accommodation in the cast room as the fiberglass comes in rolls, like the plaster. The rolls come sealed in foil packets in varying widths. The same type of padding is used for both plaster or fiberglass casts. Private cast rooms are preferable to multi-station cast rooms as they can also be used as exam rooms and comply with HIPAA privacy regulations (see Figure 5-113). Whereas plaster casts are used for repositioning a bone because they can be molded more precisely to hold a bone in position, fiberglass is often used when the bone is not out of position or if the healing process has already started.

Minor Surgery

Orthopedists—especially hand and foot surgeons—use a minor surgery room for procedures such as incision and drainage, wound debridement, laceration repair, fracture reduction (if not done in the cast room) and for percutaneous pinning and minor hardware and foreign body removal. Podiatrists use it for removing toenails and related procedures.

Consultation Room/Physician Office

The consultation room will usually be used as the doctor's private office and as a place to return phone calls and review X-ray films. For this purpose, a large flat screen monitor should be available either on the wall or the desk. These offices should not be near exam rooms, but rather, in a more private area of the suite.

Adjacency of Rooms

Cast rooms and radiology should be located in proximity to each other (Figure 5-112). There is a need for a

tech work area near the cast room and radiology room. It would have a 6-foot-long countertop and monitors for viewing/checking digital films and also for retrieving lab reports and patient histories. In a smaller practice, the X-ray tech may assist the physician in the cast room if the schedule permits. A workspace for the nurse or M.A. needs to be close to the exam rooms (see Figures 5-111 and 5-113).

Radiology Area

The reader is directed to Chapter 3, Family Practice, for design of a radiology room and control area. Since almost all "films" are now digital, there is no need to discuss film filing storage or a dark room. One must be sure that the door to the X-ray room is large enough to move in the equipment. The ceiling height of this room must be at least 9 feet high. A busy practice with three orthopedists seeing patients at the same time will require two radiography rooms.

Digital X-Ray

The embrace of digital technology has become so widespread that few medical facilities use film. However, they may have radiology machines that are analog and need to convert the images to digital. If a provider does not want to invest in a new digital machine, then there are two ways of achieving digital images. By a process called CR (computed radiography) a reusable imaging plate fits inside the cassette to replace the film. They are then placed inside a machine that reads the image on the plate and sends it to a PACS unit for distribution. This really slows down the process and is not nearly as good an option as retrofitting the radiology machine with DR (direct radiography), which is more expensive but saves a step and therefore leads to increased throughput. In this option, the cassette is replaced with an imaging plate called a flat panel detector (FPD) which fits into the bucky instead of film and does not require a reader unit before the image can be viewed.

Other Considerations

Corridors of the suite should be 5- to 6-feet wide for easy passage of patients on crutches and in wheelchairs. The corridor is also used as a gait lane. Sometimes a patient education room is included so that patients can watch a video on a specific procedure. However, with You Tube and easy access to just about anything on the Internet, this type of study can occur at home.

Toilet rooms in this suite, as in any other, must accommodate the disabled (see the Appendix).

Interior Design

The interior design of the suite must please patients of all ages. Artwork might include sports photos or perhaps educational exhibits dealing with prevention of sports injuries or other orthopedic topics. All floors except cast rooms and the X-ray room can be carpeted with a level-loop commercial carpet glued to the slab without a pad, although many practitioners would say they prefer a hard-surface floor like wood-look sheet vinyl. Any other type of carpet installation will be unsuitable for wheelchairs and people on crutches. A firm feeling under foot is desirable here.

The waiting room needs to be large enough to accommodate people in wheelchairs without ambulatory patients tripping over them. Chairs should be firm, with high seats, and have arms to help arthritic patients, for example, raise themselves out of the chair. Chairs should be well balanced, to avoid tipping when patients lean on them for support. It is practical, in an orthopedic waiting room, to offer several types of seating to provide comfort for the widest number of people. Also plan for a couple of "hip" chairs, which are high chairs with a footrest that enable a person with a painful hip joint to sit without having to bend down into a conventional height chair seat. Many healthcare furniture manufacturers such as Nemschoff offer this type of seating.

If the budget allows, walls (at least corridor walls) should be covered with commercial vinyl wallcovering, since wheelchairs and crutches can damage paint.

ALLERGY

Patient Histories

Allergy is defined as an overreaction in some individuals by a specific defense mechanism of the body responding inappropriately to certain environmental substances and resulting in annoying and sometimes debilitating reactions. The substances that cause these reactions to occur are called allergens. A methodically detailed patient history is a part of any preliminary examination or interview. Often, a lengthy printed questionnaire is given to the patient prior to the first visit to be filled out at home. In some situations, patients may fill out a history, or update it, while sitting in the waiting room working on an iPad handed to them by the staff (Figure 5-116). Alternatively, a patient may be able to log on to a secure portal on a physician's website, answer the questions online, and email the completed questionnaire to the physician's office where it can be downloaded into the patient's electronic medical record. Figure 5-117 shows the flow for this type of practice and Table 5-9 provides a space program.

Providing carrels or alcoves in the waiting room allows patients to update information on their electronic medical record to reflect changes since their last visit. They can also be used for accessing information about allergies on the Internet; the physician may have set up on the home page icons for websites with the best medical resources. Most people are familiar with researching health topics online and do so from home.

Frequently, a combination of staff interview and self-administered questionnaire will be used. If a practice includes a large number of pediatric cases, the interview room/exam room will have to accommodate one or both parents, the child, and the interviewer, since parents will usually answer questions for the younger child.

Some allergists prefer that the patient history be taken by the staff. In this case, small rooms (8×10 feet) may be provided with a desk that has a monitor and keyboard and a chair for both the patient and the interviewer, and perhaps one for a companion (Figure 5-118). Alternatively, a large monitor can be placed on the wall, where it is visible to the patient and nurse as information is entered. The nurse can also take the history in a standard exam room. Sometimes allergists may take the patient history themselves, using the consultation or exam room. In this, as in many other medical specialties, increasingly the consultation room is used as a private office and all transactions with patients occur in exam and treatment rooms.

Pediatric Allergy

There are pediatric allergists whose entire practice focuses on children (Figure 5-119). These offices should be designed according to the needs of an allergist, but with design and color palette suitable for a pediatrician's office. The treatment or test rooms, instead of having number designations, may have large animals or cartoons painted alongside them so that staff can tell the child to go to the "butterfly" or the "frog" room. However, one must take care to not make it too pediatric, which may offend adolescent patients. A digital technology theme or one based on surf culture, if it is relevant to the locale, would appeal to children of all ages. In a pediatric practice, there will be a high volume of allergy shots given after school.

Patient Flow

Allergy patients generally fall into several categories in terms of flow and treatment.

Acutely Ill

These patients proceed to a treatment room immediately upon entering where they are evaluated by a nurse and the physician who will make a decision about the immediate intervention required. This may include treatment with an aerosolized nebulizer, the placing of an IV line in the patient's arm, delivery of oxygen, or administration of systemic medications. The procedure room would be used for the more acutely ill patients,

Figure 5-116. iPad station for updating medical histories. *(Photo copyright © Nathan Padilla Bowen)*

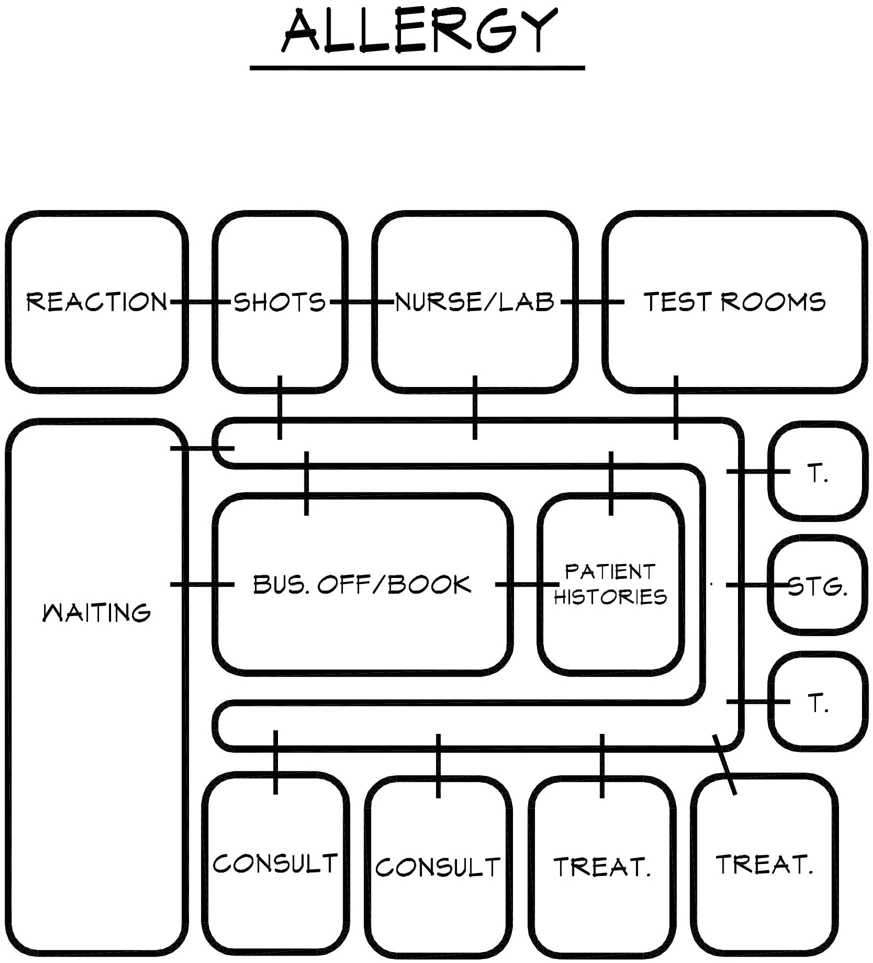


Figure 5-117. Schematic diagram for allergy suite.

Table 5-9.
Analysis of Program
Allergy

No. of Physicians		**1**		**2**		**3**
Exam Rooms[a]	3 @	10 × 10 = 300	6 @	10 × 10 = 600	9 @	10 × 10 = 900
Treatment Rooms		12 × 12 = 144	2 @	12 × 12 = 288	2 @	12 × 12 = 288
Consult/ Private Office		10 × 12 = 120	2 @	10 × 12 = 240	3 @	10 × 12 = 360
Waiting Room		16 × 16 = 256		16 × 26 = 416		20 × 25 = 500
Subwait (shots)		10 × 10 = 100		10 × 15 = 150		10 × 15 = 150
Storage		6 × 8 = 48		6 × 8 = 48		8 × 8 = 64
Nurse Station/Lab		12 × 16 = 192		12 × 14 = 168	2 @	10 × 14 = 280
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192	3 @	8 × 8 = 192
Shots		(Combined w/lab)		8 × 10 = 80		8 × 10 = 80
Recovery/Reaction		6 × 8 = 48		8 × 10 = 80		8 × 10 = 80
Audiology Screening		—		10 × 10 = 100		10 × 10 = 100
ENT Exam (optional)		10 × 12 = 120		—		10 × 12 = 120
Staff Lounge		10 × 10 = 100		10 × 12 = 120		12 × 14 = 168
Business Office[b]		12 × 20 = 240		12 × 24 = 288		14 × 22 = 308
Office Manager				10 × 12 = 120		10 × 12 = 120
Tel Equip./Server Closet		4 × 5 = 20		4 × 5 = 20		4 × 5 = 20
Biohazard		4 × 4 = 16		4 × 4 = 16		4 × 4 = 16
Subtotal		1,832 SF		2,926 SF		3,746 SF
20% Circulation		366		585		749
Total		2,198 SF		3,511 SF		4,495 SF

[a]History is done in the exam rooms.
[b]Includes reception, appointments, bookkeeping, and insurance.

Note: The above spaces may vary greatly, depending on the location of shot, test, and recovery/reaction rooms and how they are combined.

most often those with more severe acute exacerbations of asthma.

Initial Evaluation

Individuals experiencing a variety of respiratory tract, skin, and miscellaneous other reactions, or chronic illnesses, will visit an allergist to evaluate these problems and develop a treatment plan. These patients will review their medical histories with the nurse and physician, have a physical examination, and often undergo various tests, which may include skin tests, pulmonary function tests, screening audiology (see Figure 5-67), tympanometry see (Figure 5-68), and, in some practices, rhinolaryngoscopy and inhalation challenge tests. After the physician's examination of a new asthma patient, spirometry (measuring lung capacity) is part of the routine work-up. This is a portable device that uploads to a computer (see Figure 3-85), which means it can be done in an exam room or a treatment room. Afterward, a nebulizer treatment with a bronchodilator medication may be administered for diagnostic or therapeutic reasons. These inhalers get medication deep into airways. Established asthmatic patients periodically undergo spirometry as part of their ongoing care. Even though the spirometer and nebulizer are small devices, providing a room for this purpose near the lab (see Figure 5-119) is useful. Allergists perform tympanometry and audiology screening to diagnose middle-ear disease. Rhinolaryngoscopy is performed in an exam room with a specialized equipment cart (refer to the discussion in the Otolaryngology section) to evaluate the condition of the sinuses, the nasal cavity, larynx, and throat. If a fiber-optic scope is used with a tiny camera on the end (connected to a video monitor), the internal structures can be visualized in color on the monitor, which can be helpful to both the physician and the patient.

Desensitization Injections (Allergy Shots, Immunotherapy)

A series of injections may be given once or twice per week for a period of months, eventually reaching a four-week interval that may continue for several years. Patients check in at the reception desk and proceed immediately to the nurse station for the shot. Afterward, the patient will sit in a subwaiting area, in view of the nurse, for a period of 20 to 30 minutes to check for an adverse reaction. It is necessary to find out how many patients come in for shots at one time to make sure that the subwaiting area will accommodate them.

ALLERGY

4350 SF

Figure 5-118. Space plan for allergy suite, 4,350 square feet. *(Design: Jain Malkin Inc.)*

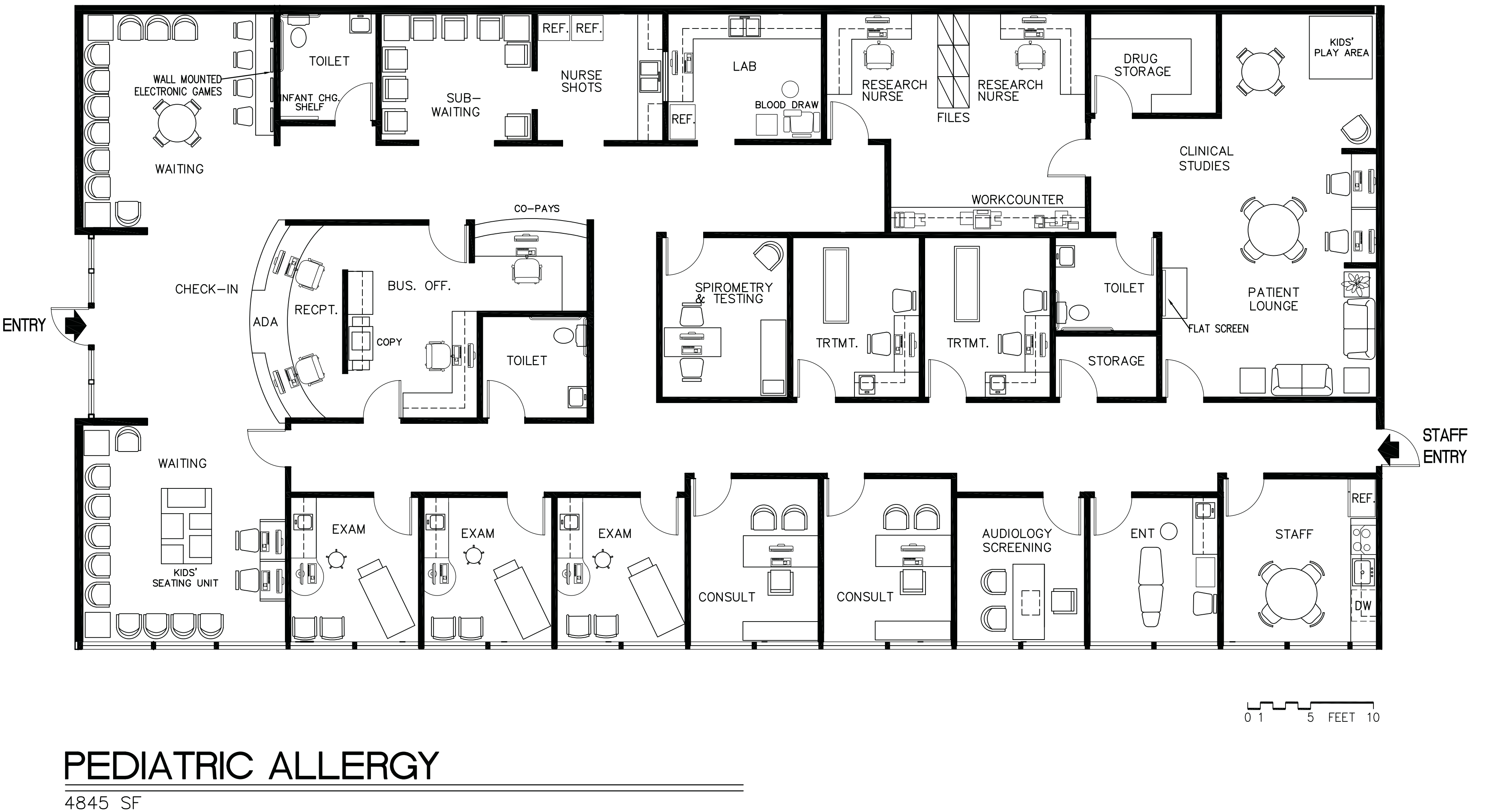


Figure 5-119. Space plan of pediatric allergy suite, 4,845 square feet. *(Design: Jain Malkin Inc.)*

Follow-Up Visits

From time to time, patients will return to report new symptoms or to have a tune-up. These are routine visits such as might be encountered in any primary care or specialist's office. The patient would be seen by the physician, nurse practitioner, or medical assistant in the exam room, followed by any procedures deemed necessary by the doctor or nurse practitioner.

Inhalation Challenge Tests

In some practices, patients suspected of having asthma, or those participating in research studies, undergo the

serial inhalation of chemicals or allergens known to induce asthma in the procedure room. A dosimeter and spirometer are used to provide exact dosages and to measure effects, respectively.

Clinical Research

Some allergists are involved in clinical research studies. Patients participating in these investigations may be present 10 to 12 hours, or more, in the physician's office where they are given medications and have their lung functions tested periodically. It's important to have a lounge setting for this purpose and a pediatric playroom (for pediatric research), as well as a kitchen to prepare food for patients and their companions (see Figure 5-119). This involves a considerable outlay of space, which, when patients are not present, may double as a staff lounge. However, it is unlikely the research office could be shared by other personnel due to the amount of records, paperwork, and experimental drugs stored there during ongoing clinical trials.

The clinical research nurse does a lot of teaching in this room. There is a great deal of paperwork and mail, both received and sent out, which requires a work counter with postage meter, letter opening machines, copier and fax machine, printers, and computers. In the evening, the waiting room or research lounge area can be used to explain the study to groups of 20 people or more to interest them in participating. Lots of file cabinets and bookshelves are required for binders, journals, paperwork, and study drugs.

Each research nurse needs desk and file space as well as shelves for manuals and binders. Files cannot be stored where patients can access them. An 18-inch-deep storage area (cabinets with locking doors) is needed for drug samples involved in the studies. Opposite this cabinet, a shelf or work counter should be available to place a box while it is being accessed. It is clear, from looking at Figure 5-119, that a sizable area is required for clinical studies. Since this is a lucrative endeavor, however, resulting in sizable fees from pharmaceutical companies, the cost of the lease space is usually not an issue.

Patient Volume

An allergy practice has a high volume of patients (as high as 50 to 60 per doctor per day), which fall into two categories: short visit (to receive an injection or have a follow-up visit) and long visit (patient interview, procedures). Of the 50 patients per day per physician, 20 to 25 will be shots, which means they likely will not see the physician. Due to the high volume of patients, an efficient layout is of utmost importance. A large number of patients come once or twice a week, and others at various intervals up to four to six weeks, to receive allergy shots. Thus, the nurse station where injections are given should be located off the waiting room or just inside the suite near the waiting room so that these patients do not have to mingle with the long-visit patients (see Figures 5-118 and 5-119). Functions requiring quiet, such as audiology screening, as well as the research area (if it exists), should be at the rear of the suite. Look at the nurses' principal functions and activities and group them together to avoid needless steps.

Injection Protocol

After receiving the injection, as just explained, the patient will return either to the main waiting room or to a subwaiting area off of the nurse station to sit for a period of time (typically 20 to 30 minutes) to check for an adverse reaction. The waiting room must be large enough to accommodate the high volume of patients. One may wish to include a small "reaction" room furnished with a recliner chair so that a patient after receiving an injection may lie down and be observed by the nurse.

Skin Tests

After the physician has reviewed or completed the initial history taking and the physical examination, the patient frequently has skin tests administered by a nurse or

technician. Two types of skin tests are used, either alone or in combination. If both are used, the doctor usually starts with prick tests on the back or upper extremities on a patient who is sitting or lying down. This may be followed by intradermal tests, in which a small amount of an allergen is injected just under the skin, on the upper extremities. Skin tests may be performed in small procedure rooms 8 × 10 feet in size or in a standard exam room. The patient lies on a physical therapy–type flat table that is often placed against a wall, although a table that allows the nurse or tech to access both sides of the patient may be desirable. Patients sometimes sit up for these tests. The technician sits alongside the patient, working off a cabinet or a mobile cart. A rack of small vials containing allergens is carried from room to room and placed on the cart. This can also be done in standard exam rooms.

Treatment or Procedure Room

Patients who are in no immediate physical danger are seen in test rooms or exam rooms, but patients who are experiencing severe symptoms such as asthma or vomiting may be examined in a treatment room where the staff has access to IV equipment and respiratory equipment such as nebulizers, oxygen (usually portable), and medications that may need to be injected.

After a diagnosis has determined to which agents the patient is sensitive, desensitization treatment begins. The injections and tests are done by nurses and technicians; therefore, one doctor may have several assistants.

Audiometry

A number of otolaryngologists also do allergy diagnosis and treatment (see Figure 5-63). Full audiometry testing as well as testing for hearing aids may be provided. Refer to the Otolaryngology (ear, nose, and throat) section for photos of an audio testing booth. Trained allergists may perform simple audiometry screening and/or tympanometry (see Figure 5-119). Although this type of test equipment is generally digital, pediatricians or allergists who wish to do basic screening may use a low-cost audiometer (see Figure 5-67) that sits on a table, with the patient (wearing headphones) on one side and the staff person on the other. The room should be as soundproof as possible to screen any extraneous noise and to enable the patient to totally concentrate on the sounds being generated by the machine. A tympanometer (see Figure 5-68) is sometimes combined with the audiometer in one piece of equipment. The tympanometer diagnoses middle-ear disease, which may indicate Eustachian tube dysfunction.

Other Considerations

The physician needs a fairly large consultation room with a desk since not only will the results of the testing and the prescribed treatment be discussed there, but the doctor's reference materials, books, and files will be stored there as well. The nurse station/lab in this suite must be large and have space for two or more full-size refrigerators for storage of injectables and allergen extracts for testing and desensitization.

Interior Design/Construction Issues

Heavy textures, irregular surfaces (e.g., some acoustic ceiling tiles), "shag" carpeting, and many fibers (wool, in particular) collect dust and can cause problems for those with allergies and are to be avoided in the office. Similarly, horizontal blinds, because they collect dust, are to be avoided in favor of mesh blinds. All materials in this suite must be easy to dust or sanitize, and they must be as hypoallergenic as possible. Avoid dust shelves—any nonfunctional surface that might collect dust. Upper cabinets, for example, should continue to the ceiling. A HEPA filter on the HVAC system can be useful.

There are certain building materials that are known to off-gas volatile organic compounds (VOCs), the most

formidable of which is formaldehyde for many individuals. Particle board, often used as the substrate for plastic laminate in cabinets and casework, is made with formaldehyde. At some additional expense, one may buy domestic particle board—made without formaldehyde—but if it is stored even for a period of days in a millwork shop alongside conventional particle board, it will quickly pick up the odor like a sponge. An alternative to plastic laminate casework is solid hardwood cabinets with solid surface tops such as Corian. Moreover, the contact cements used with plastic laminates are high in VOCs. Fortunately, with the greater awareness of LEED and interest in sustainable alternatives in building products, manufacturers have stepped up to the plate with many "green" products that are of great benefit to those with environmental allergies. The Environmental Protection Agency (EPA) publishes excellent literature listing the VOC content of products and the period of years one can expect these potentially hazardous agents to off-gas. There are numerous excellent resources and books that have been written on the topics of "sick building syndrome" and "green design."

Some individuals are so highly sensitive to the components of most construction materials, as well as fibers used in textiles and agents used in housecleaning solutions, that life from day to day is almost unbearable for them, as they try to figure out how to limit their exposure. An allergist may develop a subspecialty in treating patients of this type, in which case the office should be designed as "green" as possible. It may be more practical for an allergist to rent an old house (assuming it is free of asbestos) whose contents may have off-gassed many years ago, as opposed to renting space in a new medical office building. Even in a new building, there are a couple of things that can be controlled. Carpet should be unrolled and exposed to fresh air to off-gas for a couple of weeks prior to installation. Vinyl wallcovering should be avoided in favor of no-VOC paint, which is readily available from most manufacturers. Forbo Marmoleum® is a linoleum sheet goods product containing only natural materials. It does not need waxing and may be a good choice for rooms that are not appropriate for carpet. Finally, if operable windows exist, the suite should be fully ventilated for at least one week after all finishes have been installed, prior to tenant occupancy. Fans are often placed at strategic locations in the suite to direct the flow of air (which may contain petrochemicals) to keep it moving toward the windows.

HVAC Issues

Being able to monitor and control the relative humidity, especially in humid locales such as Florida and Hawaii, will reduce mildew and mold and retard the growth of other fungi, bacteria, and dust mites. Keeping the relative humidity below 50 percent (which may require dehumidification) minimizes these allergens and their irritating by-products, which flourish in moist environments. In addition, exceeding the standard number of room air changes in the HVAC system can keep the air cleaner, as can meticulous attention to changing air filters on a regular schedule.

NEUROLOGY

Neurologists diagnose diseases of the nervous system and brain. Their patients are often referred by other physicians. Patients may complain of headaches, epileptic seizures, damage suffered as a result of a stroke, or perhaps a cerebral palsy condition that has resulted in facial distortion—a distended jaw or a drooping mouth. Neurologists manage progressively degenerative diseases such as Parkinson's disease, Alzheimer's disease, multiple sclerosis, and Lou Gehrig's disease (amyotrophic lateral sclerosis, ALS), which involve considerable "trial and error" manipulation of drugs. Responsibility for diagnosing tumors of the brain and spine falls to the neurologist, who also manages the patient's care postsurgically, if indicated.

This is a low-volume specialty, with the taking of a preliminary history and an interview in the physician's consultation room or exam room requiring 20 to 45 minutes for new patients. Two exam rooms per physician is generally adequate. A nurse or M.A. will take vitals and show patients to exam rooms. A small work area is needed for this individual.

Table 5-10.
Analysis of Program
Neurology

No. of Physicians		1		2
Consultation Rm./Private Office		10 × 12 = 120	2 @	10 × 12 = 240
Exam/EMG		10 × 10 = 100		10 × 10 = 100
Exam Rooms	2 @	10 × 12 = 240	4 @	10 × 12 = 480
Business Office*		15 × 20 = 300		20 × 20 = 400
Waiting Room		12 × 14 = 168		14 × 16 = 224
Toilets	2 @	8 × 8 = 128	2 @	8 × 8 = 128
EEG/Control		10 × 12 = 120		10 × 12 = 120
M.A. & Tech Workstation		8 × 10 = 80		10 × 10 = 100
Storage		6 × 6 = 36		6 × 6 = 36
Staff Break Room		10 × 10 = 100		10 × 12 = 120
Subtotal		1,392 SF		1,948 SF
20% Circulation		278		389
Total		1,670 SF		2,337 SF

*Inclu des reception, appointments, and insurance/collections.

Planning for patients in wheelchairs and walkers is mandatory in this specialty. Individuals with spinal cord injuries may have large motorized wheelchairs, possibly with attached portable ventilators. The waiting room and exam rooms must easily accommodate wheelchairs; a corridor width of 5 or 6 feet is desirable. Figure 5-120 diagrams the flow of this suite, while Table 5-10 provides a space program.

Diagnostic Procedures

Neurologists used to do numerous diagnostic tests within the office, but as reimbursement has steadily decreased, in some locales, there is a trend toward sending the patient to the hospital for tests. This means the physician need not invest in the equipment nor bear the cost of additional space to accommodate it. Moreover, the increased availability of MRI and CT (computer tomography) scans—the gold standard in neurological diagnosis—has greatly reduced the number of electroencephalograms (EEGs) performed although they are still used for epilepsy. It is necessary, nevertheless, for space planners to be familiar with this test and equipment. Figure 5-121 shows a suite designed to accommodate in-house testing.

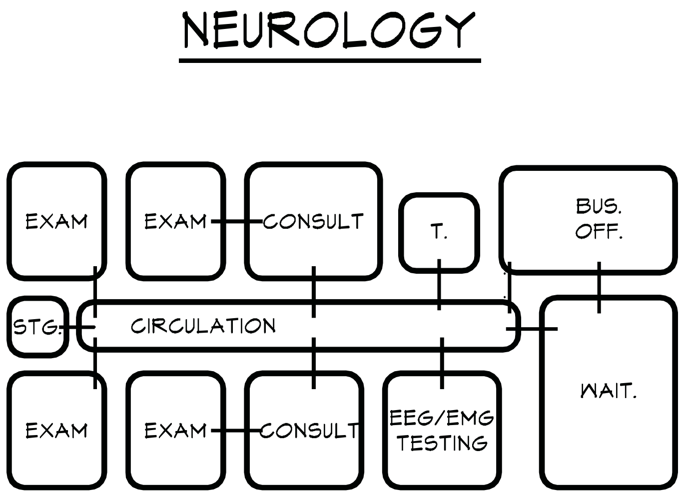


Figure 5-120. Schematic diagram of neurology suite.

After the patient interview, a series of tests may be performed. The most common test is the *electroencephalogram* (charting of brain waves), commonly known as EEG (Figure 5-122). This can be performed in a room as small as 10 × 10 feet, if the technician does not remain in the room with the patient but sits in an adjoining control room.

There are two schools of thought on this point. Some neurologists feel that the patient is comforted by the technician being in the same room, and others feel that it is distracting to the patient. However, most prefer to have the tech in the room with the patient. In either case, the patient usually sits in a comfortable recliner chair, since this seems to make the patient less apprehensive and more relaxed. It is not essential but it is helpful to have a sink in the EEG room for hand washing.

There are two ways to administer the EEG. One method requires the application of conductive paste at the temples before the leads are attached. The paste is messy and the patient must have access to a sink or a bathroom to wipe

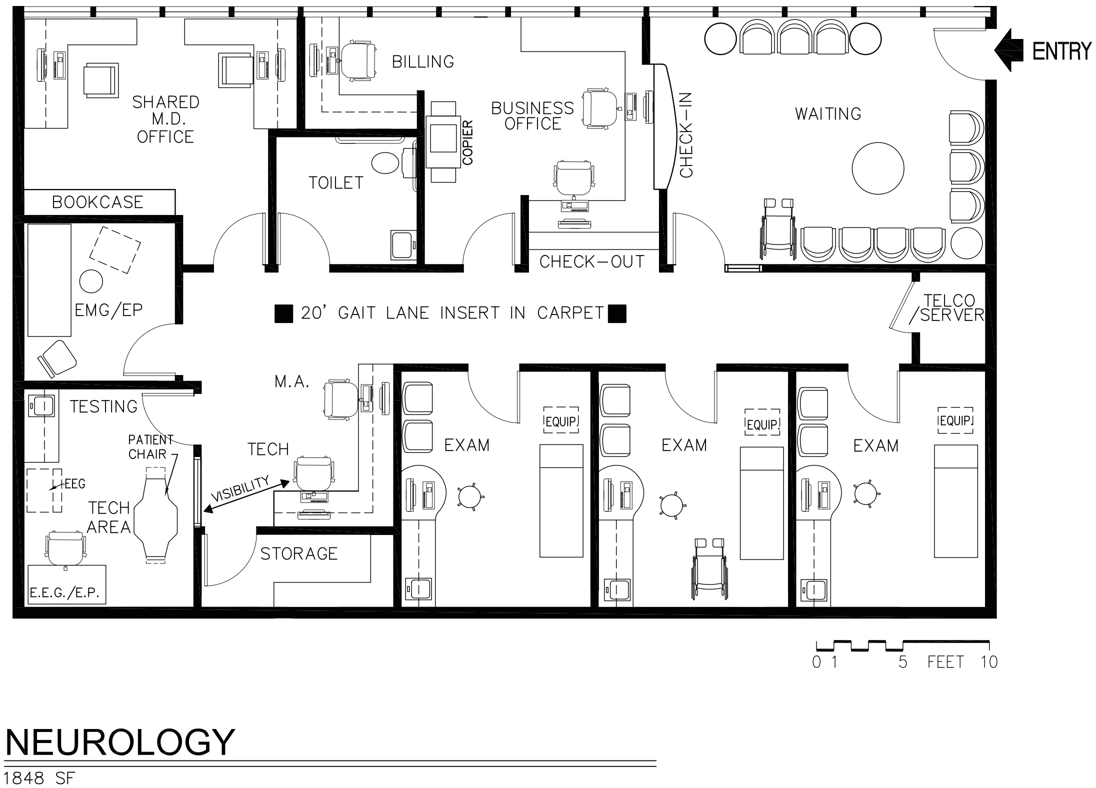


Figure 5-121. Space plan neurology suite, 1,848 square feet. *(Design: Jain Malkin Inc.)*

it out of his or her hair afterwards. A thoughtful designer would provide a vanity counter in the bathroom with paper towel dispenser, soap dispenser, cabinets, and a place to hang a coat or handbag. While one does not expect the patient to shampoo his or her hair in the office, it is necessary to remove the paste at least partially and the technician will often assist in this effort.

The second method is generally considered the simplest for both the tech and the patient. It involves the use of an electrode cap that resembles an old-fashioned swimming cap. With this method, there is very little paste to wipe off the hair. The EEG procedure takes about 40 minutes to perform.

Figure 5-122. Example of a complete EEG system. *(Photo courtesy of Natus Neurology, Middleton, Wisconsin)*

Figure 5-123. Example of a complete EMG/EP system. *(Photo courtesy of Natus Neurology, Middleton, Wisconsin)*

Another commonly performed test is *evoked potential*, which tests the different pathways to the brain (auditory, visual, and somatosensory) (Figure 5-123). Both EEG and evoked potential (EP) testing are done by a technician, and both units may be located in the same room (see Figure 5-121). A room 10 × 12 feet would be adequate. With the EEG unit, the tech sits at the computer keyboard during the procedure. If the neurologist prefers that the technician be in an adjoining control room, there must be a large window so that the patient can be observed at all times (see Figure 5-121). If the patient had a seizure it would be important for the tech to rush in and protect the patient.

In the test room, locked storage is needed for drugs used to sedate patients. Test equipment is all digital with studies being uploaded to the patient's electronic medical record. Lighting in the test room should be able to be dimmed.

Frequently, a neurologist will perform EEGs for other physicians but have no personal consultation with the patient. The EEG technician would perform the test, and the tracing would be read or interpreted by the neurologist, with a report mailed to the patient's physician. However, the neurologist would not consult with the patient unless the physician, after receiving the report, felt the referral was necessary for treatment of the patient's condition.

A neurologist may also perform a *spinal tap* (to drain off fluid) in the office. For this procedure, the neurologist would use an exam room with the patient lying on an exam table, which is usually placed against a wall.

Another office procedure is EMG, *electromyography*, which shows if a muscle indicates electrophysiological abnormalities. It measures the muscle and the nerve and its physiological characteristics. This test is performed by the physician in a dedicated room with a table placed against the wall. The procedure takes about one-half to one hour, and the reason for putting it in a dedicated room is that it saves time in moving the equipment around and in setting up each patient. The room need only be 10 ×10 feet. The equipment is on a mobile cart so that the physician can move it around the patient. The *Synergy On Nicolet*™ *EDX* by Natus (see Figure 5-123) does both EMG and EP and can be used with a notebook or desktop PC.

Other examination rooms may have a physical therapy–type table, a small sink cabinet, and a wall-mounted diagnostic instrument panel (see Figures 3-7a and 3-52) with ophthalmoscope, blood pressure cuff, and otoscope. In addition, these rooms may have an eye chart and perhaps an X-ray view box, although increasingly "films" are digital and patients may arrive with films on a DVD from the radiologist. Some neurologists like a scale in each exam room. The patient's evaluation of his or her weight helps the physician gauge a patient's touch with reality. Patients usually arrive with a family member who may accompany them into the exam room and need a place to sit. A larger exam room, 10 × 12 feet, is well suited to this specialty especially in accommodating those with assistive ambulation devices.

Maximum soundproofing and radiofrequency interference screening is required in the test room as well as special attention to electrical protection. The placement of the equipment needs to be well thought out so that the electrical outlet is in the right location. This testing equipment needs separate dedicated circuits and should ideally be on their own circuit breaker panel, isolated from the other breaker panel that provides service to the rest of the office to avoid interference. Do not locate the door to a bathroom opposite the door of a test room and do not place plumbing for an adjacent room on a wall contiguous with walls of test rooms. See Chapter 13 for soundproofing construction details.

Interior Design

The consultation room should be large and comfortably furnished, since patients may be interviewed here. Furnishings in this room, and the remainder of the office, should be tasteful but understated. All colors and patterns should be selected for their restful quality—anything bold is to be avoided. One must be particularly aware of patterns that have a figure-ground reversal or that have a visual rhythm. Such patterns may cause seizures in people with certain types of neurological disorders.

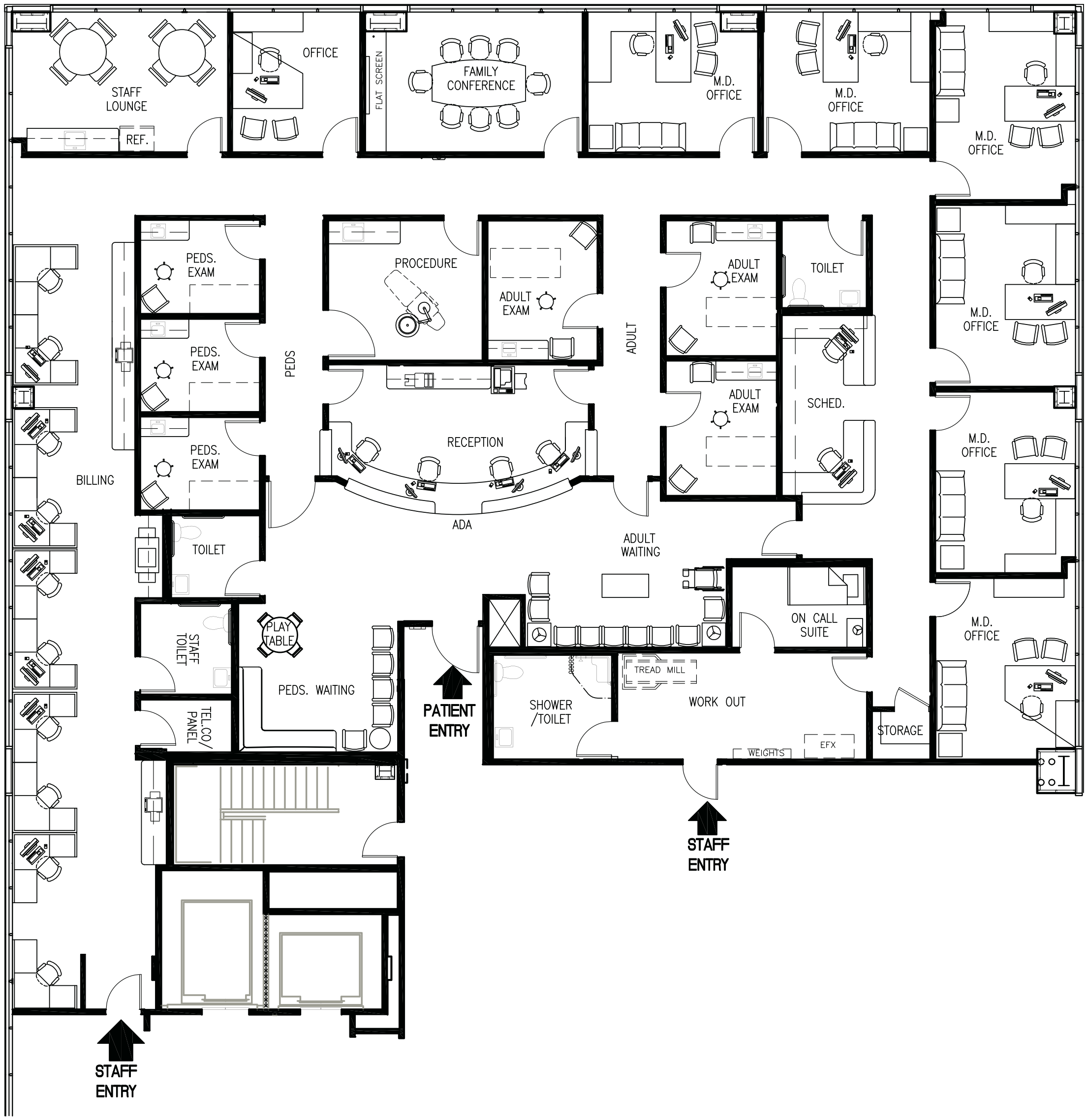
A 20-foot gait lane should be identified in the corridor carpet by insetting an accent color marker in the carpet at both ends of the lane (see Figure 5-121). This can be worked into a subtle graphic design that supports the office décor and isn't immediately obvious as a diagnostic aid.

All rooms in this suite may be carpeted. Most carpet has sufficient antistatic properties to avoid interference from static electricity that might affect electronic testing equipment. Lighting should be able to be controlled so that it can be dimmed when patients are relaxing and being tested. Although LED lighting is increasingly popular as a means to energy conservation, the extremely bright light is not well suited to a neurology practice. If used, fixtures must be well-shielded.

NEUROSURGERY

A neurosurgeon's office is often smaller than a neurologist's office and does not include diagnostic testing equipment. All of the tests would be performed in the neurologist's office, and the neurosurgeon would mainly see patients for preoperative and postoperative consultations. Therefore, a small number of examination rooms is necessary, in addition to a business office, a bookkeeping area, and a consultation room for each physician (Figure 5-124). One exam room per physician is usually adequate since the surgery schedule rarely permits all physicians to be there at the same time. The suite in Figure 5-124 is "split" into a pediatric side and an adult side with a separate pediatric waiting area.

Each physician may have a private secretary to schedule surgeries and handle correspondence. Because neurosurgeons often form group practices of perhaps four to six surgeons, these offices can be large. Each surgeon will have a private office and a personal secretary/surgery scheduler plus the group will have a billing and insurance office, and sometimes a shared sleeping room with bathroom and shower for comfort when one is on call at the hospital. The interior design of the waiting room should be soothing with careful attention to avoidance of geometric patterns or elements that may cause a figure-ground reversal or may "vibrate" or cause dizziness or possibly seizures in sensitive individuals.



NEUROSURGERY SUITE

6256 SF

Figure 5-124. Space plan of neurosurgery suite, 6,256 square feet. *(Design: Jain Malkin Inc.)*

PAIN MANAGEMENT CENTERS

These are hybrid-type suites that are becoming increasingly common. They may involve a multidisciplinary approach to the treatment of pain and this includes interventional procedures. Frequently, one will find anesthesiologists, nutritionists, deep-tissue massage therapists, chiropractors, psychologists, acupuncturists, and biofeedback technicians working together in a holistic manner to change the patient's behavior or symptoms.

In recent years, anesthesiologists have become involved in pain management for persons suffering from intractable (chronic) pain. In a medical office building, it is likely that a pain center is owned by or managed by an anesthesiologist often working with a physiatrist, a physician specializing in physical medicine and rehabilitation. Anesthesiologists who specialize in pain management are physicians who have received additional training in this area after completion of anesthesiology training. According to the American Board of Medical Specialties, certification in pain management recognizes that these physician anesthesiologists have demonstrated competence in providing a high level of care either as a primary physician or as a consultant to patients experiencing acute or chronic pain. Together, anesthesiologists and physiatrists perform interventional procedures.

Procedures Performed by Anesthesiologists

Fluoroscopic-guided injections into the epidural space can be carried out in a minor procedure room but may also be done in an ambulatory surgical center setting, as the cost of radiographic equipment would go beyond what most physicians may want to invest in their offices. All injections, however, are not fluoroscopically guided. More recently, physicians have started to use ultrasound guidance for procedures. Sometimes a local anesthetic is injected into soft tissue, joints, and the spine. Fluoroscopy is used where the space is anatomically small and hitting the target may be difficult without it. Often, there is a recovery area because patients may get up after the

procedure and fall. How patients feel after the procedure is very important and they might be interviewed in a consultation room or exam room after recovery.

Measuring the Problem

Chronic and intractable pain is a huge problem in that it affects approximately 100 million Americans and results in considerable loss of productivity and time away from work (Table 5-11). In the inpatient setting, only for the past decade has pain been documented as one of the vital signs. Patients are asked to rate their level of pain, which is recorded in their chart, along with vital signs. For those with terminal illnesses, there is currently much discussion about the appropriate use of morphine and other narcotics to decrease suffering.

For others, chronic pain—defined as that which no longer serves a biologically useful function—is terribly debilitating and, according to researchers, can actually change the wiring in the brain, spinal cord, and nerve cells by triggering the release of proteins that cause tissue damage. Pain can actually become a disease in itself. Treating it is often a trial-and-error process in which sufferers consult numerous physicians and therapists trying to find the magical cure. Low-back pain is second only to the common cold as the most frequent cause of illness. Other common causes of pain are migraine headaches, fibromyalgia, arthritis, cancer pain, and that which results from traumatic injuries and degenerative disk disease. The American Academy of Pain Medicine (www.painmed.org/patientcenter/facts_on_pain.aspx) is an excellent resource for statistics on this subject.

One of the big issues for physicians specializing in pain management is identifying patients with addictive personalities who run the risk of abusing opioids and possibly dying of an overdose. Some patients may lie about chronic pain in order to get prescription narcotics. According to the Journal of the American Medical Society, overdose deaths from prescription opioids increased fourfold between 1999 and 2010 (www.medpagetoday.com/neurology/painmanagement/37441, accessed June 15, 2013). Another good resource for broad background in the area of pain management and research is the IOM report[7]

Table 5-11.
Impact and Extent of Chronic Pain

Number of Americans who have chronic pain	100 million
Adults who routinely take prescription painkillers	21.6 million
Number who can't do routine activities because of pain	60 percent
Proportion of employees who take time off from work because of pain	20 percent
Annual loss in productivity due to pain	$297–336 billion
Cost to society	$560–635 billion
Amount Americans spend annually on pain care	$100 billion
Most common types of chronic pain that physicians treat	Lower back pain, severe headaches and migraine, neck pain, cancer

Source: www.painmed.org/patientcenter/facts_on_pain.aspx. Retrieved June 16, 2013. From The Institute of Medicine Report from the Committee on Advancing Pain Research, Care, and Education: *Relieving Pain in America, A Blueprint for Transforming Prevention, Care, Education and Research*. The National Academies Press, 2011. http://books.nap.edu/openbook.php?record_id=13172&page=1.

Defining the Program

Because pain treatment providers vary so widely in their specialties, skills, and approach to pain management, the following questions may be helpful in defining the program:

1. What types of patients do you see and do you have a subspecialty in treating certain types of conditions?
2. What is the patient flow after patients have checked in?
3. Do you use physician assistants and other physician extenders and, if so, what is their role?
4. Where does the initial history taking and interview take place? Who performs it?

[7] Institute of Medicine Report from the Committee on Advancing Pain Research, Care, and Education: *Relieving Pain in America, A Blueprint for Transforming Prevention, Care, Education and Research*, The National Academies Press, 2011. http://books.nap.edu/openbook.php?record_id=13172&page=1.

5. What is the frequency of visits or treatments for each type of patient and/or condition?
6. Is anesthesia or conscious sedation used?
7. What do the treatments consist of?
8. What is the type of coordination with the patient's primary care provider, neurologist, neurosurgeon, physiatrist (physician specializing in rehabilitation medicine), oncologist, rheumatologist?
9. What type of recovery is generally required after treatment? If required, what is the length of stay in the recovery room?
10. Is there any equipment used that requires specific or unique utilities? Do you need fluoroscopy?
11. What is the ideal type of lighting in your examination and procedure rooms? Do you require a surgical light?

The plan in Figure 5-125 was developed for an anesthesiologist. It does not accommodate a massage therapist, chiropractors, or others who sometimes work

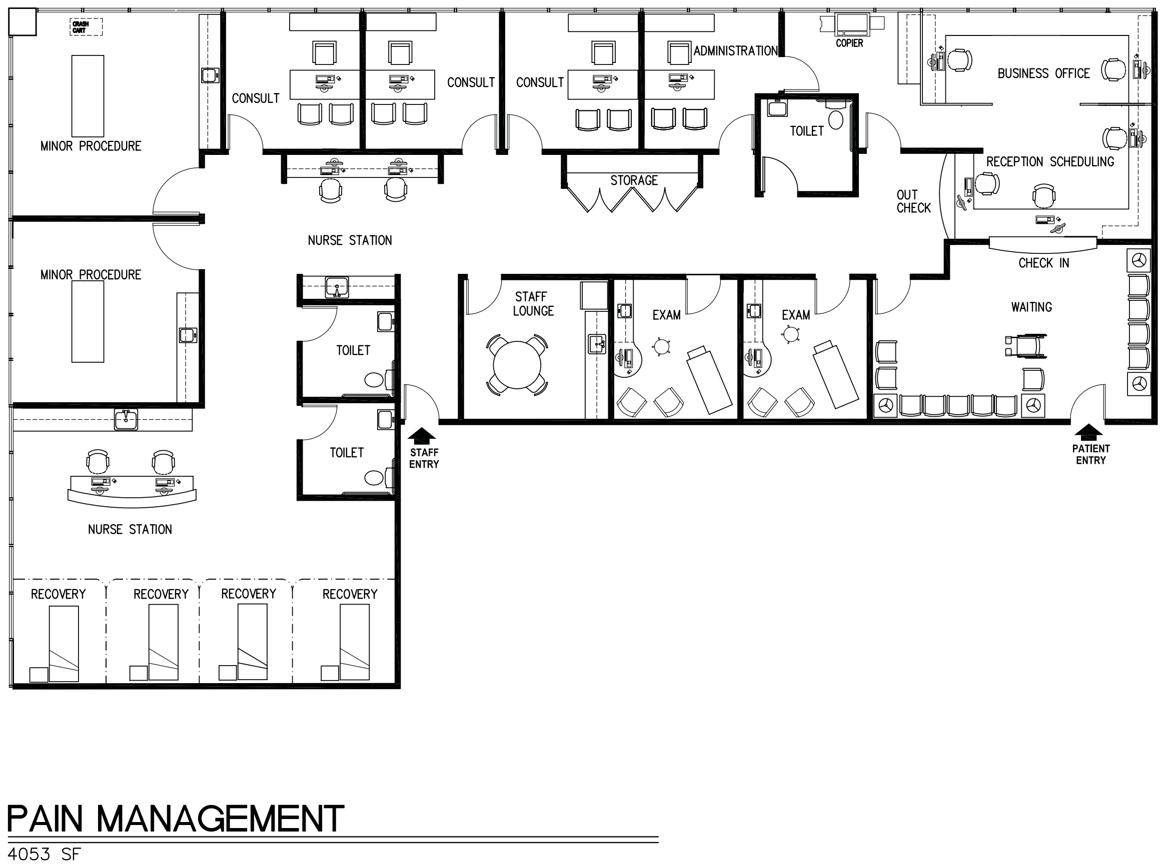


Figure 5-125. Space plan for pain management suite, 4,053 square feet. *(Design: Jain Malkin Inc.)*

together in a coordinated, integrated approach to pain management. It does have an office for a psychologist to help identify patients with addictive personality traits and to provide psychotherapy. In addition, there may be an office for an addictionologist, a medical doctor who is board certified by the American Society of Addiction Medicine.

Types of Treatments

There are many treatments for chronic pain such as physical therapy, massage, chiropractic, electrical therapy, nerve injections and blocks, implantable pain devices, neuromuscular conditioning, biofeedback, and group and individual psychotherapy. In the procedure room, if fluoroscopy is used, a C-arm X-ray machine (see Figures 8-16 and 8-17) will be needed as well as lead shielding in the walls. There will also be anesthesia equipment, and a resuscitation cart.

Design Features

People who suffer from chronic pain need a relaxing, comforting environment in which to receive medical treatment. Lighting is especially important. All attempts should be made to do away with 2 × 4-feet fluorescent lighting overhead in favor of indirect lighting around the perimeter of the room or from wall sconces or other semi-concealed sources.

Temperature control is very important, especially in a biofeedback room, physical therapy room, or massage room. When patients are relaxing and/or undressed, if they are too warm or cold their discomfort may defeat the treatment. With respect to the mechanical system, it is important to zone this suite very carefully and locate thermostatic controls in appropriate rooms.

Depending on the types of specialists represented, the interior design of a pain management suite may run the gamut from clean and clinical, for suites that are more procedure oriented, to “New Age”—serene spaces with soft lighting, soothing music or nature sounds, perhaps a fountain, and nonclinical style of furniture—reflecting the practitioners’ desire to balance mind, body, and spirit.

PSYCHIATRY

This is the easiest medical suite to design (Figure 5-126). The consultation room is the key element in this suite. Each psychiatrist will have a preferred method of working, depending on his or her treatment philosophy. Some prefer a casual living room décor where doctor and patient sit next to each other in lounge chairs. Others offer the patient a sofa or chaise (see Figures 5-127a and 5-127b). Still others prefer a formal directive approach, with the doctor behind the desk and the patient across from it. Those who practice hypnosis often choose to have the patient relax in a recliner chair that rocks back to

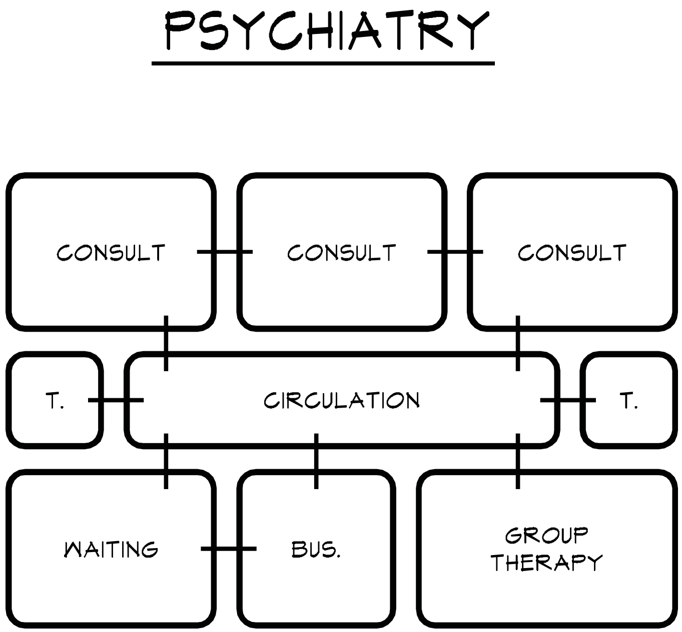


Figure 5-126. Schematic diagram of psychiatry suite.

Figure 5-127a and b. Consultation room,in psychiatry suite. *(Photo courtesy of Marna L. Sherman, Interiors, New York; Photographer: Peter Vitale)*

elevate the patient's legs. Regardless of counseling style, the consultation room should be a minimum of 14 ×14 feet and preferably 14 ×16 feet. Psychiatrists usually house their professional libraries in this room, so adequate bookshelf storage should be planned. Diplomas can be framed creatively and hung as artwork in the room.

Some psychiatrists prefer a consultation room with a window; others find it distracting to the patient's concentration. Illumination should be able to be dimmed.

Sometimes solo practitioners share an office suite. Each would need a consultation room, but the business office, waiting room, and group therapy room would be shared (Figure 5-128). There should be two or three seats per doctor in the waiting room. Since each psychiatrist can see only one patient per hour, this is a very low-volume specialty. The group therapy room should accommodate about 12 persons. Chairs that stack are best, but they must be comfortable. The room needs a sink cabinet for preparation of coffee and perhaps a coat closet.

Interior Design

The waiting room may be residential in character. Patients are often nervous before therapy; thus, the waiting room ought to have a relaxing color palette and feel comfortable, yet afford individuals some degree of privacy. Sound control is very important in this suite. All walls of consultation rooms and the group therapy rooms should have sound-attenuating construction (see Chapter 13).

The ambience of this suite is of utmost importance. Colors and design should be tranquil and serve as a

Table 5-12.
Analysis of Program
Psychiatry

No. of Physicians	**1**		**2**		**3**
Consultation Rooms	14 × 16 = 224	2 @	14 × 16 = 448	3 @	14 × 16 = 672
Toilets	8 × 8 = 64	2 @	8 × 8 = 128	2 @	8 × 8 = 128
Group Therapy	16 × 18 = 288		16 × 18 = 288		16 × 18 = 288
Staff Lounge	10 × 10 = 100		10 × 10 = 100		10 × 10 = 100
Business Office	12 × 14 = 168		12 × 14 = 168		14 × 16 = 224
Waiting Room	12 × 10 = 120		12 × 14 = 168		12 × 16 × 192
Storage	6 × 6 = 36		6 × 6 = 36		6 × 8 = 48
Subtotal	1,000 SF		1,336 SF		1,652 SF
20% Circulation	200		267		330
Total	1,200 SF		1,603 SF		1,982 SF

background rather than be stimulating enough to be distracting. Sharp contrasts in color or pattern should be avoided in favor of mellowness.

Child Psychiatry

Child psychiatrists prefer to observe patients in a natural setting, necessitating a room for play therapy. Typically, this room would have a one-way glass observation window, a play table with chair or carpeted platforms, and an assortment of dolls, games, and other toys (Figure 5-129). If an easel and paints are provided, a sink should be included in the room. An attractive cabinet may be designed to house all the toys in an orderly fashion. If appropriate space is available, a secured outdoor play area can be developed to allow the psychiatrist to study children playing naturally without their realizing they are being observed.

The room in Figure 5-129 has been carefully designed for discreetly videotaping the child's activity, a necessary step for prosecuting child abuse offenders.

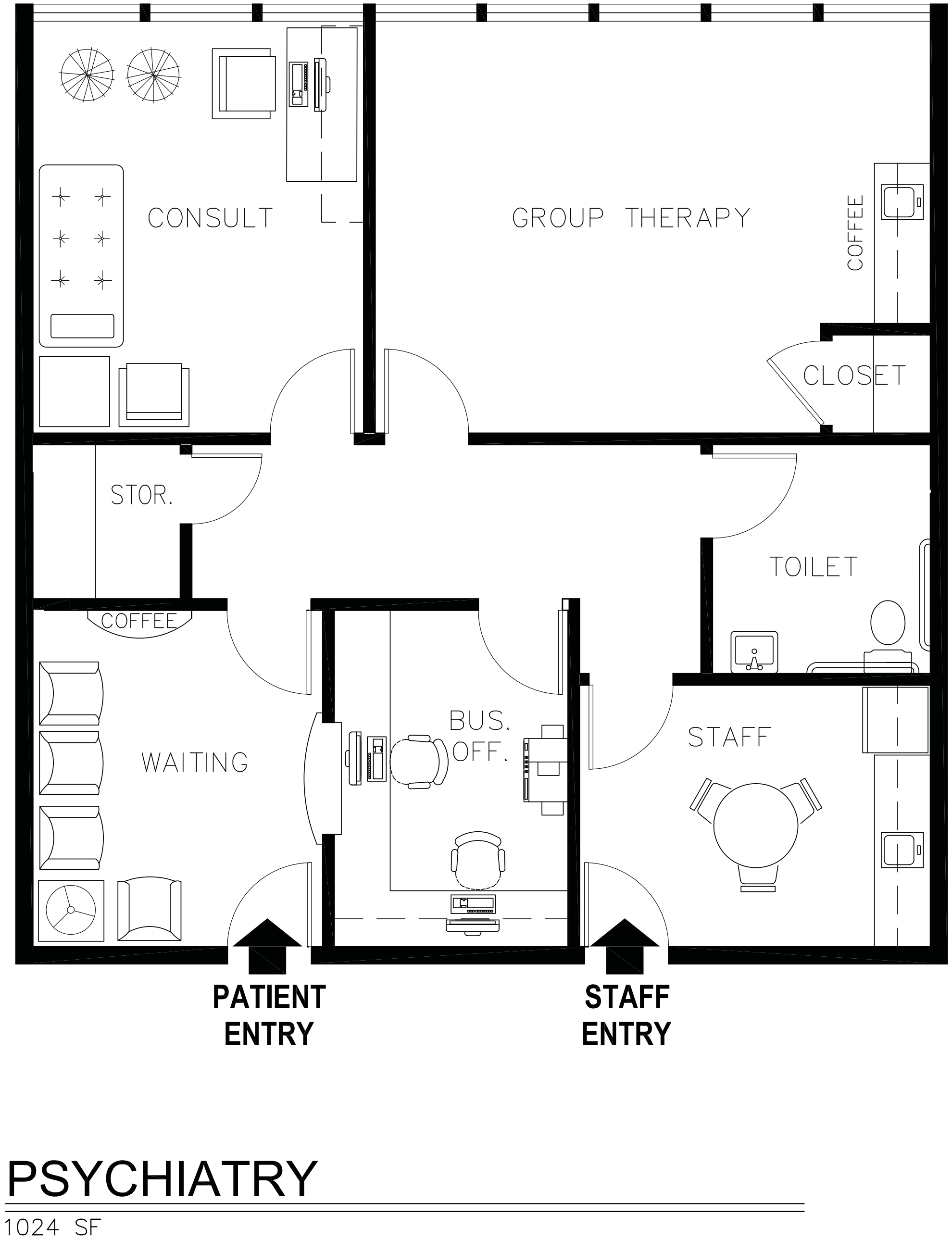


Figure 5-128. Space plan for psychiatry suite, 1,024 square feet. *(Design: Jain Malkin Inc.)*

Figure 5-129. Examination/observation room, child psychiatry suite. *(Design: Jain Malkin Inc.; Photographer: John Christian)*

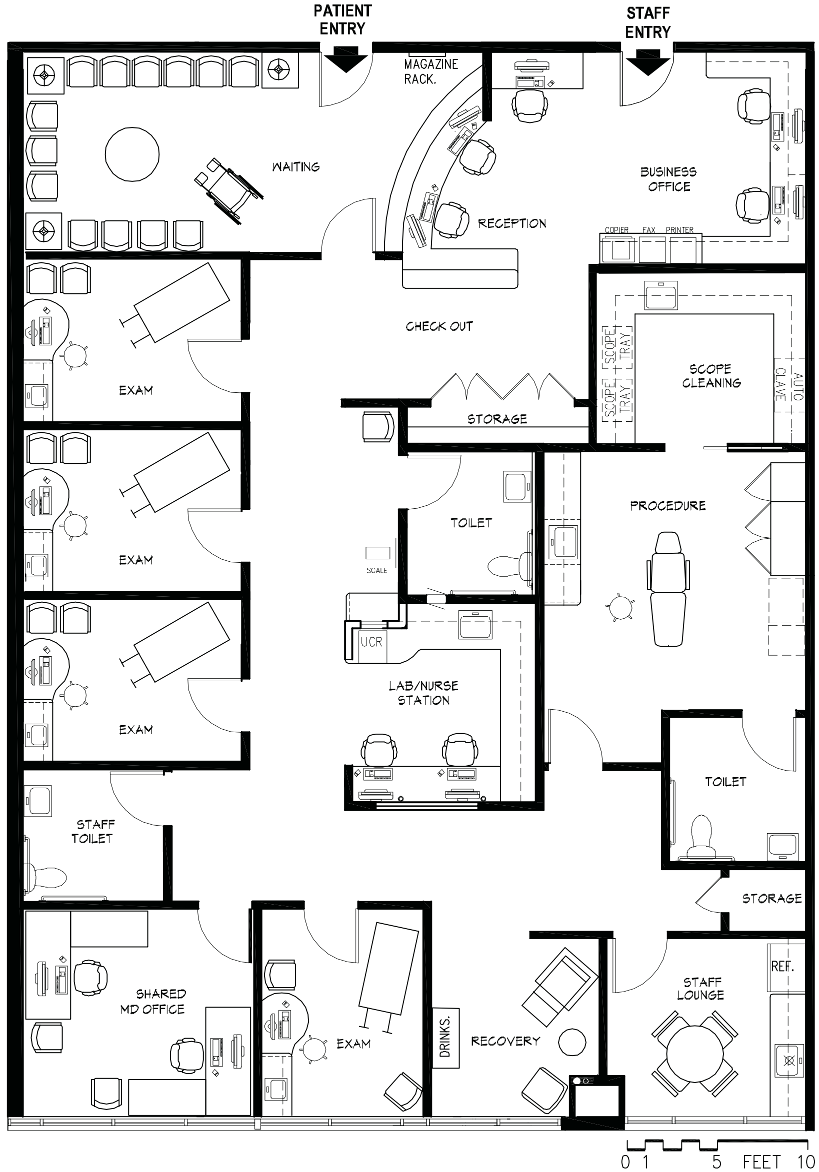
UROLOGY

A urologist treats diseases of the genitourinary tract. Approximately 70 percent of patients are male, however, women are seen for kidney stones, kidney and bladder cancer, urinary tract infections, incontinence, and cystitis. In academic medical centers, one may find specialized urology practices for women such as urogynecology and pelvic floor medicine (refer to prior discussion of this in the OB-GYN section). Most patients will submit a urine specimen before being examined, which means the toilet room should be located close to the laboratory and have a specimen pass-through to the laboratory (Figure 5-130). Sometimes a toilet room is located between two exam rooms (see Figure 5-4). Urologists perform most of their own lab work in the suite, and a minimum of 12 lineal feet of countertop should be provided in the laboratory or lab/nurse station if it is combined. In addition, a solo practitioner would need two to three examination rooms, at least two toilets, a cystoscopy (cysto) room, a business office, waiting room, and a consultation room. This is a surgical specialty, and therefore patients will have pre- and postsurgical consultations, which may occur in the urologist's private office or consultation room although, as with other medical specialists, most consults now occur in the exam room. Figure 5-131 shows the relationship of rooms and Table 5-13 lists the space program.

Patient flow is from the waiting room to the bathroom to the exam room and then to the cysto room, if necessary. The components of this suite are standard, with the exception of the cysto room. A patient with an inflammation of the urinary bladder or prostate would be diagnosed by a cystoscopic procedure to determine the presence of an obstruction or an infection in the urinary tract.

Cystoscopy

In a cystoscopic procedure, the patient lies on a specialized table with feet placed in stirrups. The patient may be lightly sedated with conscious sedation, perhaps Valium via an IV in the arm. An endoscope with fiber-optic light (and optional tiny camera) is inserted into the urethra to diagnose the problem. If the scope has a camera connected to a video monitor, the procedure can be viewed in real time and, with a printer, images can be captured for future reference. Men who have prostate cancer or enlarged prostates, common as men age, routinely have this examination to monitor their conditions. Bladder tumors and kidney stones can also be discovered with this type of procedure. Sometimes the capacity of the bladder is evaluated by inflating it with water. The cysto table has



UROLOGY

1961 SF

Figure 5-130. Space plan of urology suite, 1,961 square feet. *(Design: Jain Malkin Inc.)*

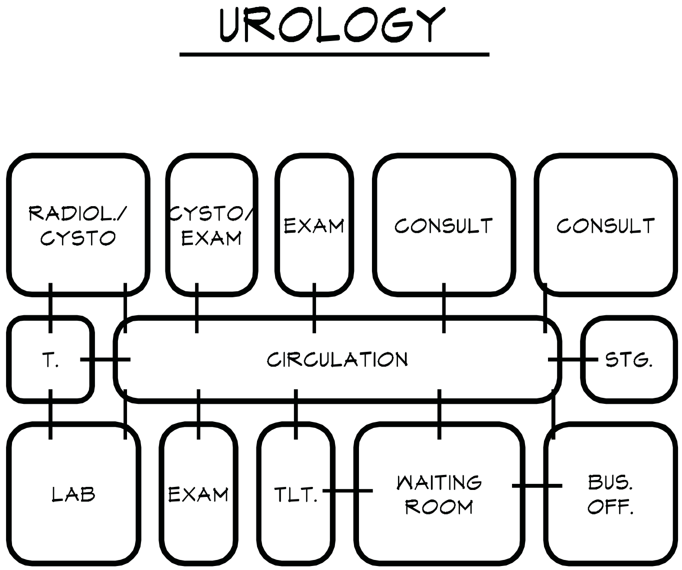


Figure 5-131. Schematic diagram of urology suite.

Table 5-13.
Analysis of Program
Urology

No. of Physicians		2		3
Business Office[a]		16 × 20 = 320		16 × 20 = 320
Office Manager		10 × 12 = 120		10 × 12 = 120
Surgery Scheduling		10 × 12 = 120		10 × 12 = 120
Waiting Room		14 × 20 = 280		14 × 20 = 280
Exam Rooms	4 @	10 × 12 = 480	6 @	10 × 12 = 720
Toilets	3 @	8 × 8 = 192	3 @	8 × 8 = 192
Staff Lounge		10 × 12 = 120		12 × 12 = 144
Consultation Room/Private Office[b]		12 × 12 = 144	2 @	12 × 12 = 288
Nurse Station		8 × 12 = 96	2 @	8 × 12 = 192
Procedure Room		12 × 14 = 168	2 @	12 × 14 = 336
Toilet		8 × 8 = 64	2 @	8 × 8 = 128
Scope Workroom[c]		8 × 10 = 80		8 × 10 = 80
Recovery (Optional)				8 × 8 = 64
Laboratory		10 × 12 = 120		10 × 12 = 120
Storage		6 × 8 = 48		8 × 8 = 64
Tel. Equip/Server Closet		4× 5 = 20		4 × 5 = 20
Janitorial Closet		4 × 4 = 16		4 × 4 = 16
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		2,404 SF		3,220 SF
20% Circulation		481		644
Total		2,885 SF		3,864 SF

[a]Includes reception, bookkeeping, appointments, insurance/collections.
[b]Assumes shared private office as in Figure 5-132.
[c]Assumes this room can be accessed from both procedure rooms.

a tray to catch fluids that are voided during the procedure. A kick bucket on casters may also be used. Cysto rooms used to have ceramic tile floors and floor drains; however, current thought is that a floor drain can be a bacterial reservoir and should therefore be avoided.

Certain procedures require X-rays. A urologist may have a large cysto room for retrograde cystoscopic examinations (with X-rays) and a smaller room for cysto procedures not requiring X-rays. X-rays are used for dye procedures. For example, dye introduced into each ureter allows the urologist to visualize the upper kidney tract to see a stone. Dye is also used to image bladder tumors. Iodinated dye is used in a cystogram to show how a woman's bladder may have dropped downward with gravity. The patient's bladder is X-rayed while lying down (with the table flat) and in an upright position. If the X-ray unit has fluoroscopy, the bladder can be imaged as it fills and empties to see the configuration of the bladder. The digital X-ray images can be viewed directly on the monitor. Following the procedure, the provider selects the most important images, and may print them, save them to a disk, or upload them to a Web-based system where they can be accessed in the patient's electronic medical record.

After the procedure, the patient is able to get off of the table but may be a bit woozy or unstable as the sedation wears off. A recliner chair for brief recovery (see Figure 5-130) is useful. Patients have to undress for this procedure. Dressing rooms may be inside or outside the cysto room. It's important to have toilet rooms accessed directly from the procedure room as patients have the urge to urinate after the procedure (see Figures 5-130 and 5-132).

Some urologists no longer do procedures in the office that require conscious sedation and monitoring due to liability and risk management. Or they use local anesthetics for these procedures. Similarly, a number of urologists no longer do retrograde cystoscopies requiring a C-arm portable X-ray machine in their offices.

Design of the Cysto Room

If designed to accommodate X-ray, the cysto room will likely have lead-shielded walls. In some states, the Department of Health Services (DHS) does not require it for a portable C-arm X-ray. The reader is referred to Chapter 3, Family Practice, for design of an X-ray room. The smaller cysto room can also be used for vasectomies, excisions of scrotal cysts, and minor surgical procedures and for ultrasound imaging of the kidneys, bladder, and

testicles. The procedure room can also be used for biopsies of the prostate gland.

Good-quality sheet vinyl flooring with a self-coved base is recommended. A cysto room not equipped with X-ray may be as small as 12 × 12 feet. With X-ray, it will be about 12 × 16 or even 14 ×16 feet and the room should have a 9-foot ceiling height. In addition, the room will need an exhaust fan.

Scope Room

The cleaning of fiber-optic scopes used in procedures is very important. This room should be able to be accessed directly from the procedure room (see Figures 5-130 and 5-132). This requires quite a bit of countertop space for wrapping surgical instruments to be placed into the autoclave and for the two trays used for soaking and processing the scopes (Figure 5-133). A busy practice may invest in a small automatic reprocessor machine (see Figure 3-97) that provides a higher level of disinfection than manual processing of scopes. A rack is needed for hanging the scopes to dry or they may be laid on a towel to dry. It is important to know which chemical is being used to soak the scopes because some produce fumes that need to be exhausted to the outdoors and may require a fume hood. There is a need for a lot of storage in this room for gallon bottles of agents used to clean the scopes and for various kinds of supplies (Figure 5-134). In this photo the lab and scope cleaning room are combined unlike the layout in Figure 5-130.

Exam Rooms

Communication can be enhanced by being able to sit side by side with a patient to chat after the clinical consult and to look at a monitor together. Two different layouts are depicted in Figures 5-130 and 5-132, both of which enable the physician to chart while facing the patient and family member. In both of these plans, the door opens to shield the patient. Often a cubicle drape is not used if staff observe the principle of knocking before entering. Refer also to alternative exam room designs in Chapter 3.

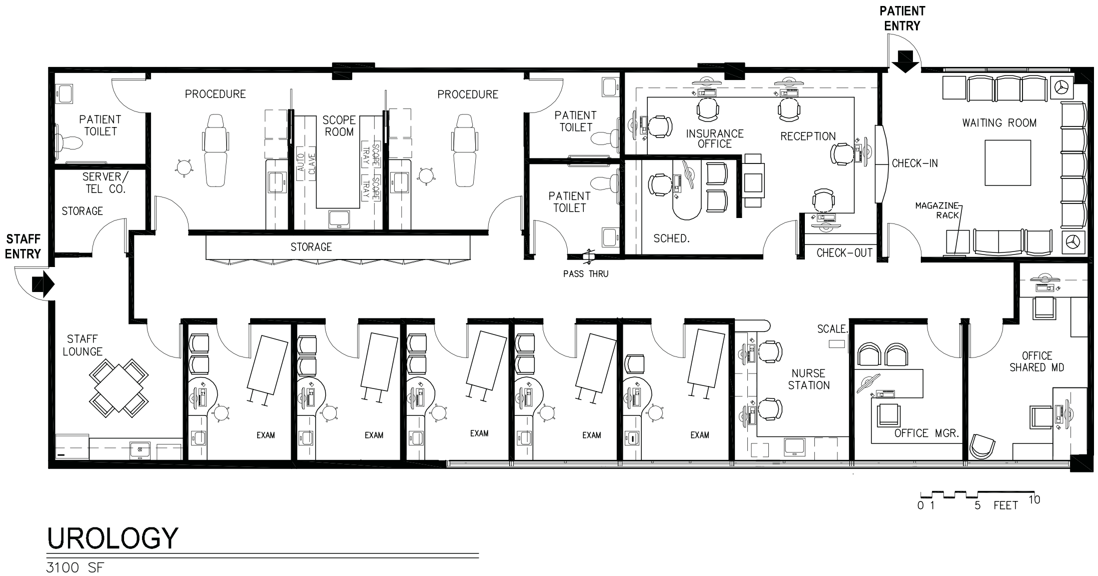


Figure 5-132. Space plan of urology suite, 3,320 square feet. *(Design: Jain Malkin Inc.)*

Lab

The lab is used for semen examination and for simple dipstick tests such as urinalysis to measure sugar or blood in urine, or to measure pH. A centrifuge on the counter would be used to spin-down blood. An undercounter refrigerator and a sink are required. A specimen pass-through in the wall between the lab and toilet prevents patients from having to carry a urine specimen through the corridor. The lab will have a monitor and printer for running off labels for urine or blood specimens. Do not underestimate the amount of countertop space that is necessary for the various equipment, monitors, and supplies.

Figure 5-133. Manual scope cleaning trays in urology lab. *(Photo: Jain Malkin)*

Figure 5-134. Lab in urology suite. *(Photo: Jain Malkin)*

Nurse Station

The nurse station is typical in this specialty. It will have a wet area with sink and an autoclave for sterilizing instruments (many of which are reusable) and a “dry” area for charting and making phone calls. Storage for frequently used forms and for instruments, a monitor for receiving lab results, and an undercounter refrigerator are also required. A locked drug cabinet is needed. Depending upon the practice, the flow and adjacencies to the procedure rooms, the lab and nurse station may be combined or separate. The nurse station needs to be accessible to exam rooms. One of these rooms may have a microscope.

Interior Design

Because this is a surgical specialty, physicians may run late, necessitating a larger than average waiting room. In addition, many elderly patients are accompanied by a spouse or escort. There are no special requirements in this specialty in terms of interior design. However, there are some urologists who have built a large practice in a subspecialty, namely, male sexual dysfunction. If this is the case, one may want to design the suite in a more masculine style, perhaps using artwork with a Western or sports theme.

As regards finishes, the walls and floors of cysto rooms must be easily cleanable. Exam rooms should not have carpet. A wood-look sheet vinyl is functional as well as aesthetically appealing. Note that the recovery area should have hard-surface flooring, as the urge to urinate frequently is strong after cysto procedures. A toilet room should be nearby.

CHAPTER 6

Diagnostic Medicine

Author's Comment: Much has changed since I researched and wrote this chapter for the third edition of the book 12 years ago. At that time, it wasn't known just how quickly the conversion from film to digital modalities in diagnostic imaging would occur; therefore, both film and digital were covered in the book. The reliability of the interface—called DICOM compatibility—between equipment by different manufacturers was a big issue. Today, of course, film cassettes, cassette pass boxes, darkrooms, and viewbox illuminators seem like ancient history, so total has been the shift to digital imaging. That doesn't mean that private practice physicians here and there do not still have a film-based machine but, if they do, it is likely they are using a computed radiography (CR) reader or a digital radiography (DR) upgrade to convert the images to digital.

My goal was to present photos of equipment by all major vendors for each modality but, in the end, there were space limitations. I regret having to make some difficult choices, but with the ease of Internet access to vendor websites, the full panoply of choices is available. In previous editions of this book, typical equipment room layouts were presented for MRI, CT, and nuclear medicine. Fortunately, these planning guides are now readily available with open access on most vendor websites.

DIAGNOSTIC IMAGING

Today, there is seamless transfer of images throughout the enterprise—total connectivity among physicians, radiologists, and hospitals. Referring physicians and specialists who previously had to wait many hours to several days for a film to be retrieved and delivered now have instant access to patient information: no misplaced or lost films, no need to carry films from one location to another, elimination of X-ray retakes (exposing the patient to more radiation) to compensate for errors in technique, and elimination of the cost of film. Instead, digital images go directly to a picture archiving communication system (PACS) where they can be reviewed, distributed, and ultimately, stored on a secure network. *GE's Centricity*™ is an example of a PACS data management system (Figure 6-1). Several manufacturers offer PACS, such as

Figure 6-1. Advantage PACS workstation. *(Courtesy of GE Healthcare)*

Philips, Sectra, and Novarad, each having distinctive proprietary features to give them a marketing advantage.

Goal: Acquiring Better Diagnostic Information in Less Time and with a Lower Dose

The new diagnostic imaging equipment showcased at the Radiological Society of North America (RSNA) exhibit each November is often stunning in its innovation. For those who may not be familiar with it, RSNA is "Mecca" for anyone associated with any aspect of diagnostic imaging. Held each November or December at McCormick Place in Chicago, it attracts over 65,000 attendees worldwide. Online magazines like *Diagnostic Imaging, Medical Imaging*, and *AuntMinnie.com* publish a preview issue prior to the event and a new product review afterward, both of which are very informative.

A review of trends from the 2012 RSNA reveals a focus on low-dose radiation solutions for CT (*Toshiba Aquilion RXL*, *Hitachi Scenaria* 128-slice) and mammography (*Siemens' Mammomat Inspiration Prime Edition*) by several vendors, reduction in size of mobile devices, more compact design of devices that are already portable, such as a mobile X-ray unit, and numerous enhancements of ultrasound. In addition, MRI machines that eliminate acoustic noise during 3D image acquisition and reconstruction were shown but are pending approval for sale in the U.S. market. Many other innovative products were on display for use in acute care settings and academic medical centers such as interventional radiology and surgical suites incorporating MRI, but these are outside the scope of this book.

Following is a glimpse at specific modality innovations:

Ultrasound elastography imaging—measures of tissue stiffness may be able to show if breast tissue is benign or malignant. The benefit is to reduce breast biopsies.

Portable ultrasound (*Siemens' Acuson Freestyle*) with the first wireless transducer to enhance infection control because it is fully immersible in liquid for disinfection.

Ultrasound by *Philips (iU22 xMatrix)* offers 2D and 3D images and has an enhanced transducer capable of advanced scanning to see vascular plaque, details of dense breast tissue, and for fetal heart navigation and more. A built-in database of anatomical structural models and intelligence tools simplify exams.

The Philips combination PET/MRI (*Ingenuity TF PET/MR*) scanner combines molecular data and MR with integrated software. This is especially useful in neurology, oncology, and cardiology cases.

The *Carestream DRX-Revolution* is a mobile X-ray system with a collapsible column, badge-swipe login, wireless digital detector, and an in-cart battery charger, all in a compact unit that is easier to maneuver than most C-arms.

Various workflow solutions were introduced for diagnostic workstations, making it easier for radiologists to view, annotate, and manipulate images and send them to referring physicians (optimized image distribution).

The Philips *IntelliSpace Portal* enables thin-client computing solutions for advanced image review with the flexibility to diagnose from any location that has broadband access.

PACS

Picture archiving communication systems manage digital data and images. Each vendor offers somewhat different system design, user-friendly interface, and certain proprietary features. PACS is a generic term for these data acquisition and image management systems, which generally have the following four components: image acquisition, image storage, image transfer (over a network), and image retrieval. PACS refers, in a generic sense, to any electronic substitute for film, but PACS can be based on direct ray (DR) transfer of images or computerized radiography (CR), which is explained below. (*Note that "DR," as a term*, *is interchangeably used to refer to direct ray, digital*

radiography, and direct radiography.) PACS may further be defined as:

- Mini-PACS—connecting single or multiple imaging modalities using viewing stations with or without soft reading and/or digital storage archiving.
- Full PACS—connecting all modalities, viewing/reading soft copy/enlarged digital storage. It is integrated with both the hospital and the radiology information systems and distributes data and images throughout the healthcare network.
- Teleradiology—connecting the radiology service to the radiologist's home, emergency department, intensive-care unit, or rural clinics.

Computed Radiography

Computed radiography (CR) is an older radiography technology that uses electronic media instead of film. It is used to retrofit analog machines to digital output but requires both a hardware and software upgrade. The film receptor has to be changed to a digital CR receptor. The cassettes typically look like standard film cassettes, but they don't have film in them; they have a phosphor plate that records the image and gets reused. The tech takes the plate out of the unit and puts it into the cassette holder to take the exposure then puts it into a plate reader, which reads the image and simultaneously erases the plate for reuse. This has several additional workflow steps associated with it compared with a more direct method of recording the image. The image that has been read is stored on an internal hard drive, which can then send the image to a PACS or print it on paper or film. The plates are heavy and expose technologists to back injuries so it is not ideal from an ergonomic or efficiency/throughput standpoint.

Direct Radiography

Direct radiography (DR) bypasses the phosphor plate; it is a direct transfer of the image to a PACS. One can do many more procedures per room because the tech has fewer workflow steps. Flat panel detector plates, 14 $\times$ 17 inches, fit into standard bucky trays and holders. The Fujifilm *FDR D-EVO* system includes detector plates, an FDX console, a control box, and a power supply. Synchronization of the detector activation requires connection to the existing X-ray generator system.

Converting Film to Digital Images

There are several ways of transitioning from film to a digital system. The major radiographic equipment manufacturers have recognized the need for a transitional strategy to help make this conversion by developing systems that achieve filmless imaging in phases, over a period of time, working with existing diagnostic equipment.

In addition, film can be converted to digital images by digitizing the X-ray whereas images from modalities that cannot output digitally can be converted into digital images by video capture systems (multi-frequency video capture boards installed in PC controllers equipped with barcode readers to facilitate quick entry of patient details and identification data).

DICOM Compatibility

All manufacturers are currently making products that are DICOM compatible, which facilitates interconnectivity among pieces of equipment purchased from different vendors and ensures that all images will reach the server without degradation or loss. Digital Imaging and Communications in Medicine (DICOM) is the standard for compliance developed by the American College of Radiology and the National Electrical Manufacturers Association. DICOM provides a format for how files are created to make it possible to move information from one system to another. The goal is total interface among the equipment of various manufacturers.

Image Storage

It is a challenge to keep pace with the vast amounts of graphical data (radiographic images) and the need for short-term and long-term storage, as well as quick retrieval of old files to compare with new imaging studies for a specific patient. There has been an exponential increase in the amount of data produced. Common is a three-tier storage strategy described as *Online, Nearline*, and *Offline*, that refers to the immediacy of access to data. Data may be stored in a main server with storage capacity enhanced by redundant arrays of inexpensive disks (RAID), which provides immediate-access "online" data. Online storage of images—perhaps six months of studies—would be on the RAID (although it is possible to configure a RAID-centric PACS model to accommodate more than a year's studies available online). From there, they will likely go to *nearline* storage, which may constitute a 6- to 12-month period, and this storage may be on an ultra-high-capacity magnetic tape and optical "jukebox." After that, images would go to *offline* storage for long-term archiving on magnetic tapes and optical discs. Realizing the size of these graphical files, which must handle large images, the demand for large memory configurations and vast storage capacity is staggering. To be able to store and retrieve such large amounts of data in a matter of seconds requires high-speed, broadband networks and high-resolution displays.

A rack located in a secure IT room can hold the uninterrupted power source (UPS), RAID, server, and long-term archive library. (Rorke Data is a leading manufacturer of mass storage units.) Multiple archival libraries can be connected. Images move from online (the server) to nearline (the jukebox or archival library), and then offline, which may be in a remote location or even cloud-based. Redundancies are built into all of these archiving systems to account for power failures, loss of data, fire, and so forth. Some PACS are designed to automatically route data, at certain pre-established intervals, to three to five redundant storage locations. Of course, the cost of storage media is a large contributor to total costs. Optical storage, also known as MOD, Magneto Optical Storage, is a disk read by laser and considered the most reliable for long-term storage.

Jukeboxes or archive libraries must be placed in a secure, restricted-access IT room, which may be within the facility or located remotely. The storage "racks" often have internal cooling fans, but good air circulation and constant temperature (cool) is important. Some are accessed only from the front, others from the rear, but none should be placed too close to a wall as there is considerable cabling and one must have access to it for maintenance. Once a library archive or jukebox is operational, it cannot easily be moved.

For hybrid suites, there will still be a need for conventional film filing. As conversion to digital occurs, there is often a need to store film files for a period of time. For a fully digital operation, film filing is replaced by a room for the server and archives (jukebox) although, theoretically, the jukeboxes (and even the server) may be at a remote location. Film files used to require a tremendous commitment of space, whereas now perhaps a room 8 × 10 feet may store 10 years of data.

Application Service Provider

PACS can be outsourced to an application service provider (ASP). This represents a way of financing the endeavor, which, much like lease payments, comes out of an operating budget rather than capital investment. And, much as with a lease, as equipment becomes obsolete it is replaced because the equipment is owned by the ASP. This option is often priced on a per-patient (procedure) basis.

ASPs grew out of the recognition that financing the conversion to digital imaging out of capital budgets constituted a big hurdle for many organizations. There is great variety in what ASPs offer. Basically, they buy software and hardware from a variety of vendors and customize a system to meet an individual enterprise's needs. Some of these are proprietary models that use Web-based architecture to enable a number of data and image management tasks to be executed: scheduling and registering patients, processing and interpreting diagnostic studies, archiving images, and distributing these data to referring physicians.

Getting from Here to There

The challenge in writing this chapter is that it needs to reflect the hybrid nature of what designers will encounter whether designing a one-room radiology suite for an orthopedist or general practitioner or a diagnostic radiology suite in a medical office building. The focus of the discussion, and the market for this book, is the non-hospital-based facility, which, in this case, means a radiology suite that serves tenants in a medical office building or that may be freestanding. An exception to this is the plan in Figure 6-21, which is hospital-based but also serves ambulatory patients. It is included because it exhibits good planning concepts that are relevant to an MOB setting as well. As previously stated, the editorial assumption is that film is gone (except possibly for the need by a physician practice to physically store aged films for a period of time) and that any film-based machine will have a software upgrade to enable it to communicate with a CR plate reader or DR and thereby result in digital output.

Principles of Radiography

General principles are commonly understood. A limb is exposed to X-rays, which penetrate body tissues, and produce a 2D image. Since body tissues absorb different amounts of radiation, bones, fat, gas, and so on make different exposures compared with surrounding tissues, which allows the observation of internal organs and structural anatomy without pain and with small exposures to radiation.

In addition to examination of limbs, diagnostic imaging is used to diagnose the presence of gallstones and kidney stones, tuberculosis, arthritis, and bone tumors; to discover foreign bodies in soft tissue; to detect enlarged or malfunctioning glands; to scan the brain; to reduce tumors (radiation oncology); to monitor a child in the womb (ultrasound); and to diagnose scores of other diseases. Some forms of diagnostic imaging, such as ultrasound, do not involve radiation.

Making an X-ray film of a leg or the chest requires no special preparation, but filming organs such as the gallbladder or the gastrointestinal tract requires that the patient fast before the procedure and then drink a special liquid or receive an injection that makes the organs visible to the radiologist. Since the designer must understand these procedures in order to plan an efficient suite, a brief outline of diagnostic radiology modalities follows.

Diagnostic Imaging Modalities

Fluoroscopy

Fluoroscopy enables the radiologist to watch internal organs at work. Gastrointestinal studies are common. The patient swallows or receives an injection of a contrast medium—air, barium sulfate, or organic iodine compounds—which causes the soft-tissue systems of the body to be outlined. X-rays passed through the body strike the input phosphor of an image intensifier tube, and that image is intensified electronically and can be viewed on a video monitor. (Monitors may be ceiling or wall mounted, or portable, on the floor.) With a video camera, screen images can be converted into real-time studies for future reference.

A contrast medium injected into a blood vessel (angiography) travels with the blood supply to a specific organ and allows the radiologist to examine that organ. For a study of the large intestine, a patient is given a barium enema. The radiologist makes sequential spot film (or digital) radiographs while the barium travels through the large intestine. To study the digestive system, a patient drinks barium and the radiologist films it traveling down the esophagus into the stomach, following it through the small intestine. Of course, endoscopy has greatly reduced the number of gastrointestinal barium studies.

Digital fluoroscopy is the technique for converting X-rays into visible images without film. Photographic film is replaced by an electronic image tube that produces a direct image of a broken bone, lung, brain, or other body organ being studied. This eliminates photographic processing. The Siemens *Luminos dRF* is a 2-in-1 radiography and fluoroscopy system with *Human*

Touch Technology: one touch and the machine moves where it is needed (Figure 6-2). The table drops down to the height of a standard chair for ease of access. Fluoroscopy rooms require a high ceiling because the tables tilt (Figure 6-3).

Ultrasound

Ultrasound does not involve radiation. A high-frequency sound, much like sonar, bounces off internal body structures. Ultrasound is particularly useful in examining soft pelvic tissue masses, gallbladders, or a fetus in the

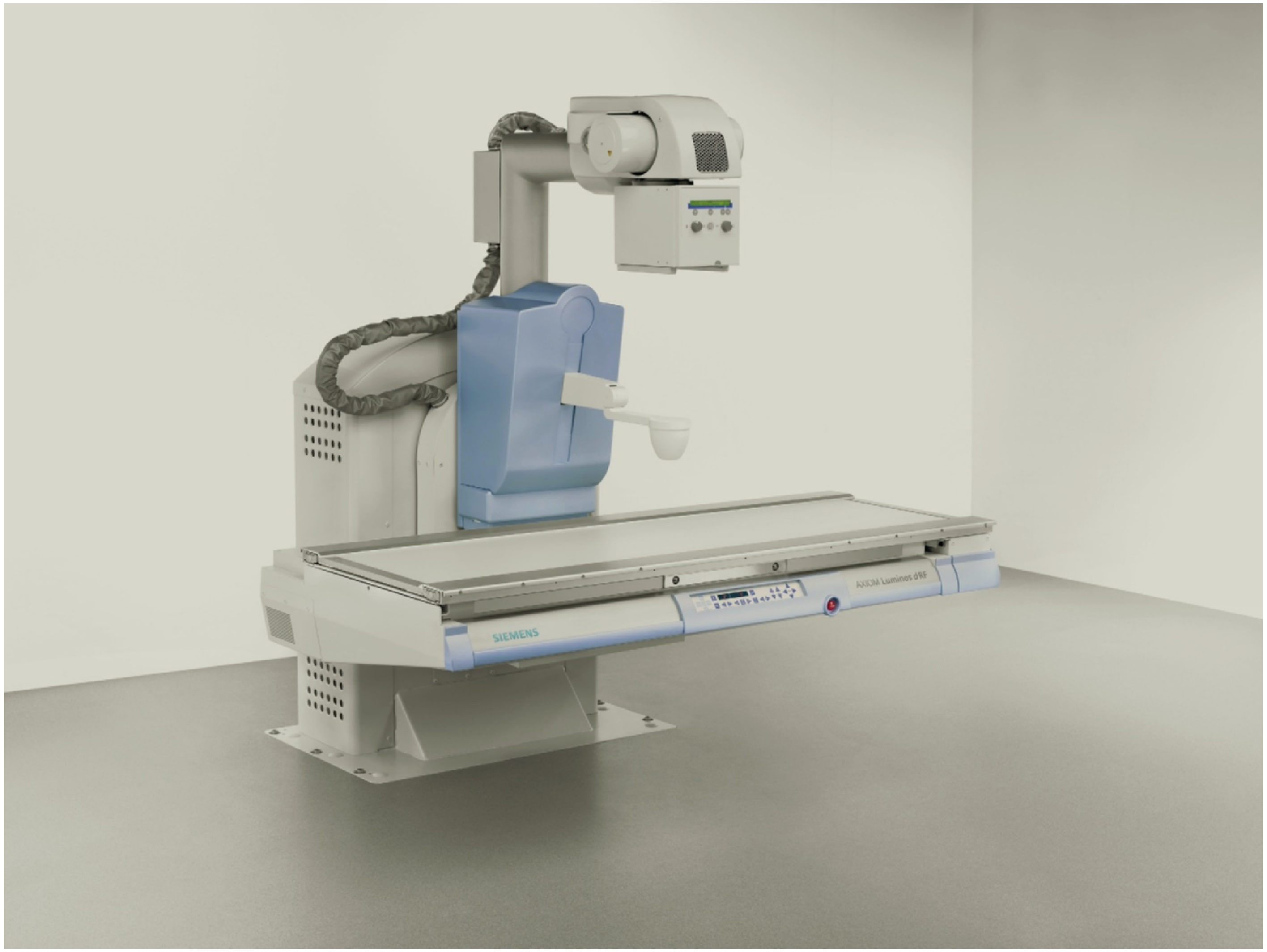


Figure 6-2. Digital radiography and fluoroscopy. AXIOM Luminos dRF with Human Touch Technology. *(Copyright © Siemens Healthcare 2013)*

Figure 6-3. Radiography and fluoro machine with table in tilted position. Precision 500D*. *(Courtesy of GE Healthcare)*

womb—procedures where even low doses of radiation might be dangerous. Ultrasound is also commonly used to image the heart (echocardiography) and for studies of blood flow in arteries and blood vessels. It is commonly used to analyze suspicious breast lesions, and tissue can also be biopsied using ultrasound. Physicians who do in-vitro fertilization use ultrasound routinely during a variety of procedures. Ultrasound machines can be found in Chapter 5 (see Figure 5-7) and in Chapter 3 (see Figures 3-79, 3-80, and 3-84).

Nuclear Medicine

Nuclear medicine deals with the diagnosis and treatment of disease with radioactive isotopes—chemicals that are unstable and break down, giving off radioactivity. The isotope may be given to the patient orally or by intravenous injection. The substance is specific to a particular gland or organ (e.g., iodine travels to the thyroid gland). The amount of the isotope absorbed by the gland permits the radiologist to determine the function of the organ and to trace its outline. Nuclear scans are useful for diagnosing brain

tumors and malfunctioning of the kidneys, pancreas, and thyroid. Positron emission tomography (PET) scanners are considered one of the best modalities for detecting cancer lesions. A combination CT/PET scanner (Figure 6-4) represents a fusion of CT's ability to render anatomy with PET's imaging of critical metabolic processes.

Computed Tomography

Computed tomography (CT) allows physicians to see cross sections of internal body structures, enabling the radiologist to discover tumors embedded in soft tissue or organs that formerly could not be seen by radiographic procedures. Thus, CT scans have eliminated much exploratory surgery and offer the patient greater safety by reducing the need for more dangerous, often painful, tests.

The patient lies on a table that slides through a rotating doughnut-like enclosure called the gantry (Figures 6-5 and 6-6). X-rays scan narrow cross sections of the body in a painless, noninvasive procedure. For example, 180 scans just 1 degree apart may be taken of an area. The numerous

Figure 6-4. Discovery* PET-CT scanner. *(Courtesy of GE Healthcare)*

Figure 6-5. Computerized tomography, Discovery* CT750. *(Courtesy of GE Healthcare)*

images are collected by a detector and reconstructed by a computer into a composite scan of the organ or tissue. CT scanners represented a major breakthrough in diagnostic imaging technology when they were introduced in 1977 and the technology has continued to advance with the current focus on lower levels of radiation and better image acquisition. During the scan, 3D images are built in real time and are completely constructed by the time the scan ends.

Mammography

Low-dose mammography, an X-ray of the breast, is considered to be the most accurate and safe means of detecting breast cancer at an early, usually curable stage. According to the American Cancer Society, one in three women in the United States will get breast cancer at some point in her life. Therefore, screening mammograms are recommended on a regular basis for women over the age of 40 and perhaps even earlier for those who have a family history of breast cancer. Refer to Figures 5-25 and 5-26 for mammography machines.

Radiation Oncology

Through use of a linear accelerator, tumors are bombarded by very narrowly focused, high doses of radiation in an attempt to kill cancer cells. The course of treatment is carefully plotted and monitored by a radiation physicist and the radiology team. The normal course of treatment runs six weeks, during which time the patient typically reports five times per week. Both facilities in Color Plate 18, Figures 6-7 and 6-8 offer patients calming views of nature and an aesthetically appealing environment.

Magnetic Resonance Imaging

Magnetic resonance imaging (MRI) has been heralded as a major innovation in diagnostic imaging and, today, it represents 20 percent of the medical imaging market. It provides

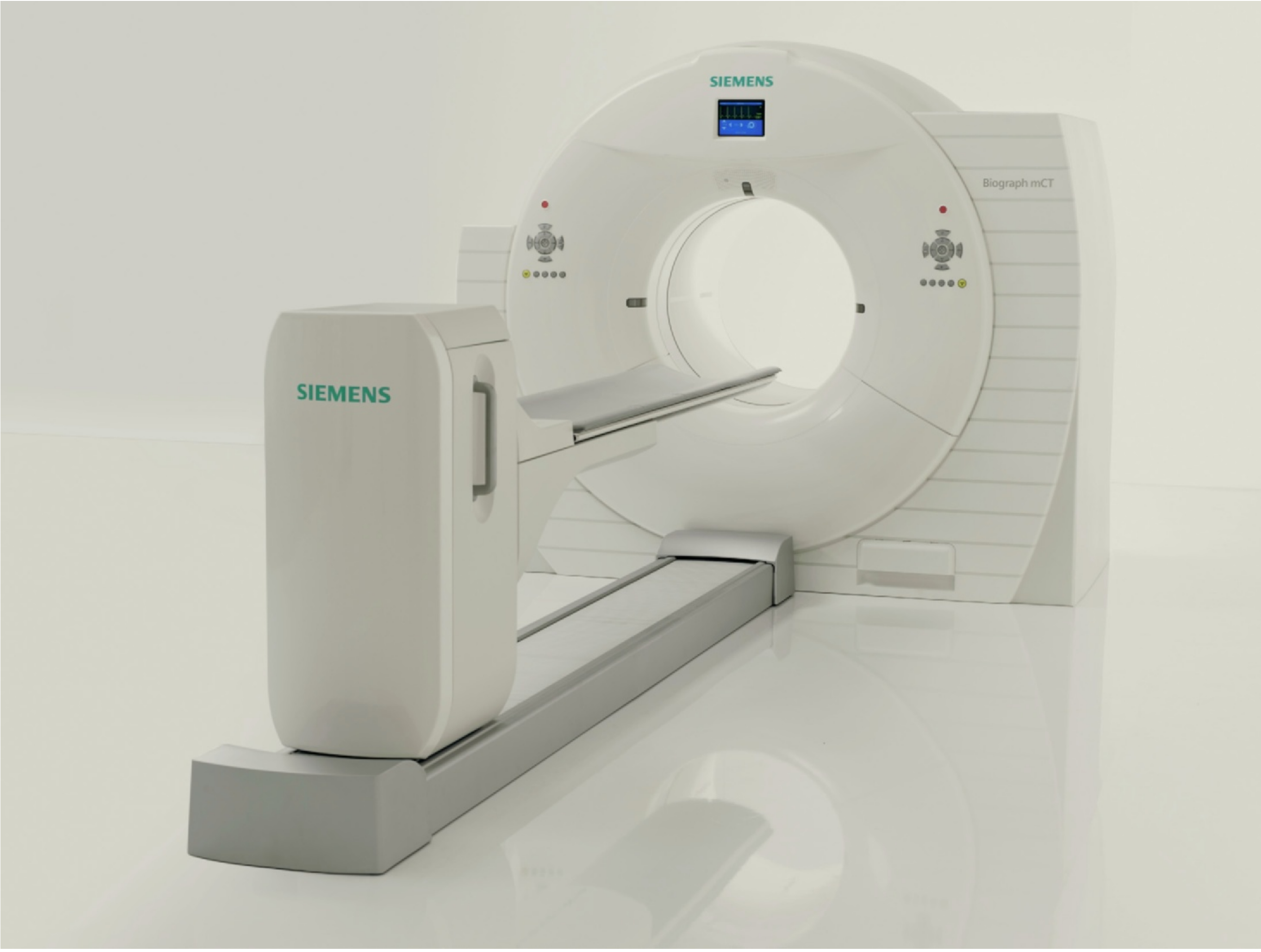


Figure 6-6. Computerized tomography Siemens Biograph™ TruePoint™ PET CT. *(Copyright © Siemens Healthcare 2013)*

exceptional soft-tissue contrast and is especially good for imaging the central nervous system and, in particular, the brain. It permits early and accurate diagnosis of a wide variety of conditions, including brain tumors, strokes, hemorrhage, and multiple sclerosis. Spinal cord compression is more effectively shown by MRI than by other imaging techniques. A pinched nerve or the effects of arthritis can be graphically demonstrated and may prevent the need for a myelogram or CT study. MRI is also effective for diagnosing knee injuries and cancers of the musculoskeletal system.

Figure 6-7. Radiation oncology linear accelerator with water feature wall at entry. *(Courtesy of Boulder Associates; Photographer: Copyright © Ed LaCasse Photography)*

Figure 6-8. Radiation oncology linear accelerator with backlit images of nature in wall and ceiling. *(Courtesy of Boulder Associates; Photographer: Copyright © Ed LaCasse Photography)*

MRI does not use X-rays, but depends instead on the interaction of radio waves and small particles within the body, called protons, in the presence of a strong magnetic field generated by the MRI equipment. A simplified explanation of a very complex process follows.

Inside the body, protons absorb energy from incoming radio waves of various frequencies and, in turn, give off energy in the form of radio waves. These outgoing signals are recorded by a highly sophisticated computer and reconstructed into an image similar to that produced by CT, but generally with higher resolution, showing more detail and an enhanced view of diseased tissues.

Advantages to the patient are that no special preparations are required before the procedure, no injections of contrast media are generally required, and it does not use radiation. Currently MRI examinations are expensive and take longer than a similar CT procedure. Other applications of MRI include in vivo spectroscopy and study of living tissues, providing information on processes occurring inside the cell. A single example of the derived benefit of this is diagnosing a tumor without resorting to biopsy, based on the fact that tumors are known to affect cell metabolism. There are many applications of MRI continually in development. The MRI by Toshiba in Color Plate 19, Figure 6-10 offers patients a "spa" theme and is one of the quietest machines available. The facility in Color Plate 19, Figure 6-9 connects patients to nature with a luminous sky and treetops spreading across the length of the room.

Table 6-1.
Analysis of Program
Diagnostic Imaging

No. of Radiologists On site		1–2		2–3
Waiting Room		16 × 24 = 384		18 × 24 = 432
Business Office		14 × 18 = 252		16 × 20 = 320
Dressing Room	6 @	4 × 4 = 96	10 @	4 × 4 = 160
Handicapped		6 × 8 = 48	2 @	6 × 8 = 96
General Radiography		16 × 20 = 320		16 × 20 = 320
Radiography/ Fluoroscopy		16 × 20 = 320	2 @	16 × 20 = 640
Toilet		8 × 8 = 64	2 @	8 × 8 = 128
Ultrasound	2 @	10 × 12 = 240	2 @	10 × 12 = 240
Toilet		8 × 8 = 64		8 × 8 = 64
Nuclear Medicine		—		—
Hot Lab		—		8 × 8 = 64
Procedure Room		—		16 × 20 = 320
Patient Prep		—		10 × 10 = 100
Subwaiting		—		10 × 12 = 120
Toilet		—		8 × 8 = 64
CT Scanner Suite[a]		16 × 29 = 464		16 × 29 = 464
MRI Suite[b]		—		23 × 51 = 1173
Toilets	3 @	8 × 8 = 192	4 @	8 × 8 = 256
Tech Work Area		Varies 120		Varies 150
Private Office (Radiologist)	2 @	10 × 12 = 240	3 @	10 × 12 = 360
Administrator		10 × 12 = 120		10 × 12 = 120
Radiologists' Reading Room		12 × 12 = 144		12 × 16 = 192
Storage		8 × 10 = 80		10 × 12 = 120
Staff Lounge		12 × 16 = 192		14 × 16 = 224
Breast Center		—		
Waiting Area				14 × 18 = 252
Toilets			2 @	8 × 8 = 128
Dressing Room			8 @	4 × 4 = 384
Handicapped Dressing Rm.			2 @	6 × 8 = 96
Mammography			3 @	10 × 12 = 360
Stereotactic Room				16 × 18 = 288
Tomosynthesis				10 × 12 = 120
Breast-Specific Gamma Imaging (BSGI)				12 × 12 = 144
Ultrasound				10 × 12 = 120
Toilet				8 × 8 = 64
Radiologist's Reading Room				10 × 10 = 100
Consultation				10 × 10 = 100
DEXA				10 × 14 = 140
Tel. Equip Room		4 × 5 = 20		4 × 5 = 20
Server /IT Closet/ PACS		6× 8 = 48		6 × 8 = 48
Janitor's Closet		4 × 4 = 16		4 × 4 = 16
Biohazard Storage		5 × 6 = 30		5 × 6 = 30
Subtotal		3,474 SF		8,513 SF
25% Circulation		868		2,128
Total		4,342 SF		10,641 SF

[a]Includes procedure room and control room.
[b]Includes procedure room, control, and electronic equipment room; layouts and room sizes vary per manufacturer and model/type of magnet.

Note: The above sizes are an approximation, since radiography rooms must also have control areas, which may be inside or outside the room. Many radiologists will have both a private office and a reading room, while others may share a private office. There are many variables, depending on whether the radiologists rotate among several locations or remain at one. Tech work areas will also vary, whether it is a room or a workstation within a staff-only hallway running along one side of procedure rooms.

Planning Considerations

The purpose of this chapter is to introduce the reader to the most common diagnostic imaging modalities and to explain the general parameters of designing rooms to accommodate this equipment. Clearly, one could write an entire chapter on each of the modalities if one wanted to cover thoroughly all aspects of design and construction. The focus of this discussion is the *outpatient radiology*

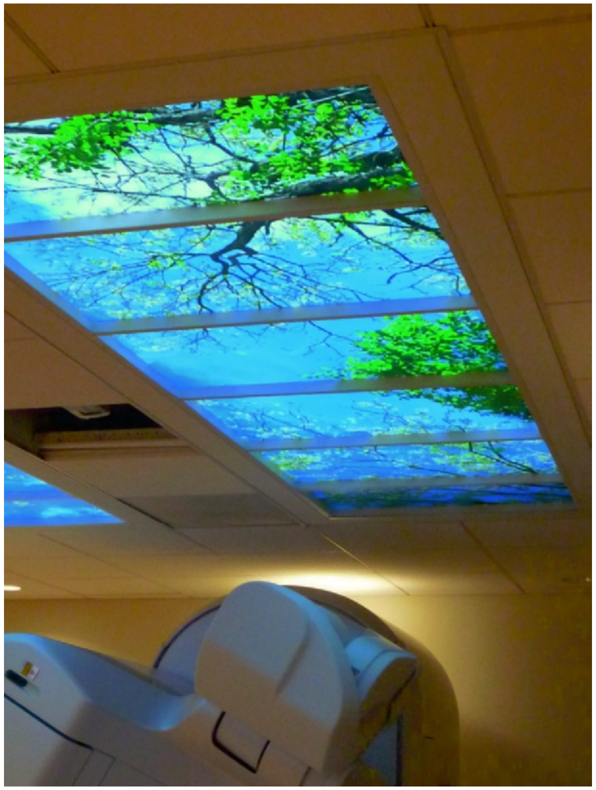


Figure 6-9. Linear accelerator with luminous ceiling providing a positive distraction for patients. *(Photo: Jain Malkin)*

Figure 6-10. Toshiba MRI with spa design features. *(Design: Jain Malkin Inc.)*

facility that would commonly be found in a medical office building, as opposed to one located within a hospital. Refer to Table 6-1 for a space program.

Before a space planner can begin to plan the suite, a program must be developed. There is a difference in how this is accomplished when the client is an independent radiology group developing a tenant space in an MOB (see Figure 6-19) versus a client that represents a radiology department that will serve a 250,000-square-foot ambulatory care center affiliated with a hospital (see Figure 6-14). In the former case, the radiology group will generally detail for the space planner the number and type of diagnostic imaging rooms that will comprise the suite. There is no way a space planner can second-guess this, as it depends on a number of considerations. First, if the radiology group has CT at another office not too far away, it's unlikely they will duplicate this equipment. Second, the number of physician tenants in the building and their respective specialties will influence the type of equipment the radiologists buy. Third, the medical building's proximity to a hospital and the type of imaging modalities available at the hospital may influence the selection of equipment for the facility, especially if the same radiology group staffs the department at the hospital.

In the other example (the radiology department serving a large ambulatory center), the programming will be done by the architect or planner, who will do workload analysis to determine the number and types of procedure rooms required. This must be done in collaboration with the radiologists because throughput (volume on each imaging modality) will be influenced by decisions to purchase new equipment and the extent of overall digital integration

in the enterprise. If the medical center with which the ambulatory facility is affiliated has a high-profile cardiology, oncology, or neurosciences center, a high enough volume of patients in one of these areas may warrant the purchase of specialized imaging equipment. All of these issues must be considered and factored into the workload analysis and ultimate program that is developed.

These are the six basic planning considerations:

1. Equipment
2. Patient flow
3. Staff flow
4. Information flow
5. Function
6. Flexibility

Equipment

A number of manufacturers offer equipment for each imaging modality. Room size and critical dimensions vary considerably, as do utility requirements. There are numerous accessory or ancillary items that may be added to each major piece of equipment. The space planner, therefore, may be faced with a number of possible combinations of equipment for an individual room. The radiologist will make these selections, but the space planner must obtain from each manufacturer a planning guide and specifications for each unit. Fortunately, this type of information is available online at each vendor's website (see Figure 6-37). Clearly, equipment dictates the size of each room, with function and future requirements being the two important considerations. Manufacturers usually offer planning services to plan a department and often produce almost a full set of construction documents. One must remember, however, that their goal is to sell equipment and to make sure it fits in the room. These services should be relied on only to provide technical assistance to the space planner or architect, who is much more likely to produce a functional layout that considers overall patient flow, business office activities, and the relationship of each room to the whole.

When equipment is placed in the room, function is achieved when proper clearances are preserved for items that swivel, extend, or tilt and for travel of the tabletop. Other aspects of function are patient access and staff ability to move around the room (e.g., if a patient needs to be transferred from a stretcher or gurney alongside the X-ray tabletop). Finally, each procedure room must have an area within it, or outside of it, for controls. Within the room, the control area is a lead-lined partition with a window in it. The tech stands behind it to operate the generator that controls the equipment in a film-based set-up. Note that the window must have a minimum 18 inches of wall on the leading or open end to protect the tech. The control unit is not very large for a standard digital radiography machine. It will have a stand-up (see Figure 3-72) or sit-down-height countertop approximately 4 feet wide for the operator's control console in addition to a quality-control computer. Figure 6-11 shows a control workstation for a PET/CT and Figure 6-12 shows one for an MRI.

It is optimal, when designing major radiography or radiography/fluoroscopy rooms (abbreviated R&F or R/F), to size them generously in order to accommodate future technology and anticipation of more interventional procedures requiring more staff. Radiographic rooms are very expensive to remodel due to lead shielding and other construction features.

Patient Flow

The overall layout of the radiology suite is driven by a desire to separate patient circulation from the staff work area (Figure 6-13). In Figure 6-14, patient dressing rooms are toward the front of the suite but also near procedure rooms. In the Breast Center (see Figures 5-12 and 5-13), patient circulation is on one side of the procedure rooms, while staff enter from a work corridor on the other side of those rooms. In Figure 6-21, a tech work core provides staff access to four exam rooms while patients enter from a different door. In Figure 6-15, a tech work area provides staff access to three exam rooms, with patients entering from a dressing and subwaiting area. However, it is not always possible to do this (Figure 6-16).

Figure 6-11. Operator's console looking into PET/CT room with chambered nautilus shell ceiling design. *(Design: Jain Malkin Inc.; Photographer: Michael Campos)*

In the plans referenced above, the staff area includes a workstation with monitors where technologists can check image quality and prepare the presentation to be passed via the PACS system to the radiologist or, perhaps, the orthopedist. If it is an orthopedic office, as an example, the medical assistant will often make sure the images are on the monitor prior to the physician entering the exam room. Access to the radiologists' reading room, break room, restrooms, and private offices may be adjacent to the tech work corridor. Plans with a separate staff work hallway prevent patients from overhearing staff conversations and from casually seeing X-ray studies on monitors. It is desirable to protect the patient from overhearing or seeing anything that might cause anxiety or discomfort or constitute a breach of privacy.

One often finds a women's center within a radiology suite. For marketing purposes, this area is often located near the front of the suite and may even have a private entrance (see Figures 6-15 and 6-16). In Figure 6-14, the women's center is a separate suite. In Figure 6-16, the sub-waiting areas are dedicated to the breast center. This unit functions independently from the rest of the suite, however, staff may travel easily between the breast center and the diagnostic imaging suite.

Staff Flow

Staff flow must be planned carefully with the radiologic technologists who will work in the clinic. Certain imaging modalities such as CT, ultrasound, and nuclear medicine have dedicated technologists. There must be ample space for all of these technologists to pass one another in corridors without bumping into one another and also have adequate monitors and workspace.

Figure 6-13 presents a schematic layout for a radiology suite, indicating separate entries to procedure rooms for patients and for techs as well as other functional adjacencies. It is desirable to provide a separate staff bathroom because patient bathrooms are often in use, and those serving the R/F rooms can get messy. Front office staff function as they would in any medical practice, although the high volume of patients in a radiology suite may necessitate a larger waiting room.

Figure 6-12. MRI control area. *(Courtesy of AECOM; Photographer: Philip Prowse)*

Information Flow

Information flow is dictated by PACS and network system design rather than by space planning. Individual system configurations will be as varied and unique as the enterprises they serve. The locations and number of monitors does not differ appreciably from any contemporary office setting except these happen to be specialized for diagnostic imaging. In the technologists' work area, there is a need for a document scanner, a CD burner (patients are sometimes given a record of their studies to carry to consulting physicians), and a laser film printer (such as the *Carestream*

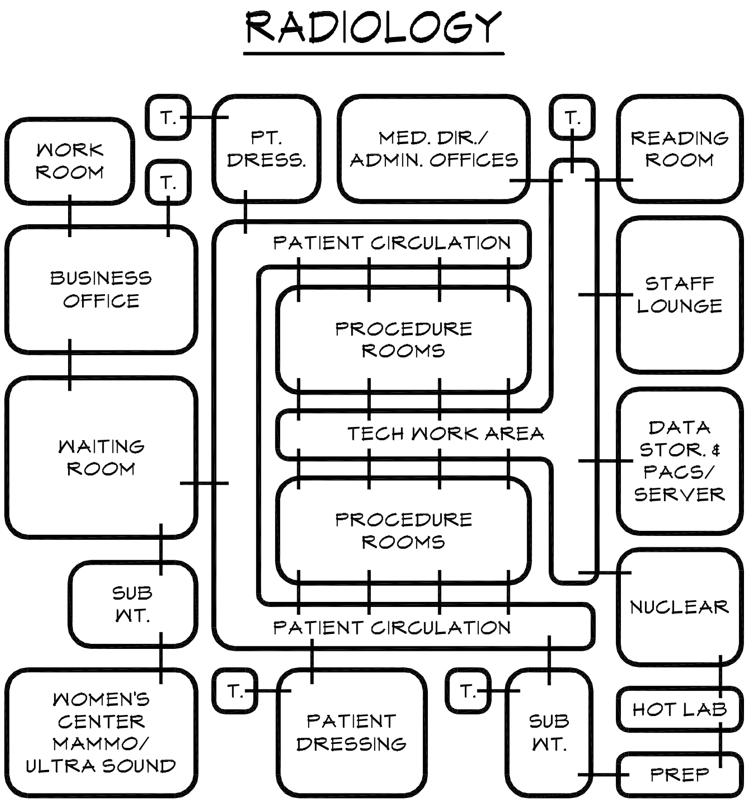


Figure 6-13. Schematic diagram of radiology suite.

DryView 5950 laser imager) to create an analog film version of a digital image. The one area in which there is a huge saving of space, when comparing film-based and digital settings, occurs in storage. With film, large storage capacity is required (as well as structural accommodation to support the weight), whereas an enormous amount of imaging data can be stored digitally in components placed in a small room.

What differentiates one PACS from another is (as with any software) the way it's configured to meet specific needs in the most user-friendly manner. Intranet access serves referring physicians or radiologists, who are able to log on from remote sites using a password, which then enables them to view images on a PC. They can be located in a remote office and access the system via a local-area network (LAN) or wide-area network (WAN). Each PACS offers different features with the overall goal of enterprise-wide connectivity, eliminating the need to redundantly enter data. Radiology information systems (RIS) such as the McKesson *Radiology Manager*™ manage workflow, track patients, exams and charges. Another, the *NovaRIS*™, from Novarad, is a top-ranked integrated PACS/RIS system. A feature of some systems allows for prefetching of pertinent previous studies and reports, bringing them to short-term online storage for quick access.

Some reading this chapter may be designing a radiography suite of two or three exam rooms in an orthopedic group practice. Orthopedists read their own films prior to examining a patient; therefore, a radiologist's reading room is not required. On the other hand, a multimodality radiology suite of perhaps 10,000 square feet serving a medical office building will have a reading room and a more sophisticated information management system.

Function

A functional layout is one that separates patient and staff flow, as discussed above, and one that has a logical placement of rooms based on patient volume and other considerations. For example, the patient dressing area should be near the procedure (exam) rooms.

The general radiography room for chest films is best located near the front of the suite as these are short examinations, but can be high volume, necessitating a number of dressing rooms nearby. The radiologist's private office and reading room, on the other hand, should be located in the most remote and quietest part of the suite.

A functional construction issue relates to the size of studs around procedure rooms. Six-inch studs are a wise choice to accommodate the conduit for cabling. Since imaging is such a technologically driven space, 6-inch studs should be considered for other areas, as appropriate.

Flexibility

Flexibility is desirable in any healthcare facility because technology is advancing so quickly that it is hard to forecast space needs 5 or 10 years in the future. As diagnostic imaging rooms are very costly to construct, planning for future expansion is critical, knowing that optimal patient and staff flow can be maintained and the addition of new procedure rooms will not create awkward adjacencies. Flexibility can also be achieved by making rooms larger than the manufacturer's minimum requirements.

Components of a Diagnostic Imaging Suite

These are the basic components of a radiology suite, and each will be discussed in detail:

1. Waiting room
2. Business office
3. Patient dressing
4. Tech work area
5. Reading and consultation
6. IT room (for server and archives—may be remote)
7. Tech work core
8. Imaging exam rooms for various modalities

Waiting Room

Allow three waiting room seats per examination room and provide a suitable space out of the traffic lane for a patient in a wheelchair. At times, a patient may be brought in on a stretcher or gurney. This should be taken into account when laying out the space, but it is desirable for the stretcher to be brought through a private staff entrance (rather than the waiting room), through the corridor, and into an examination room, without causing damage to walls or needlessly jostling the patient. A number of patients may be on crutches or use assistive ambulation devices like walkers

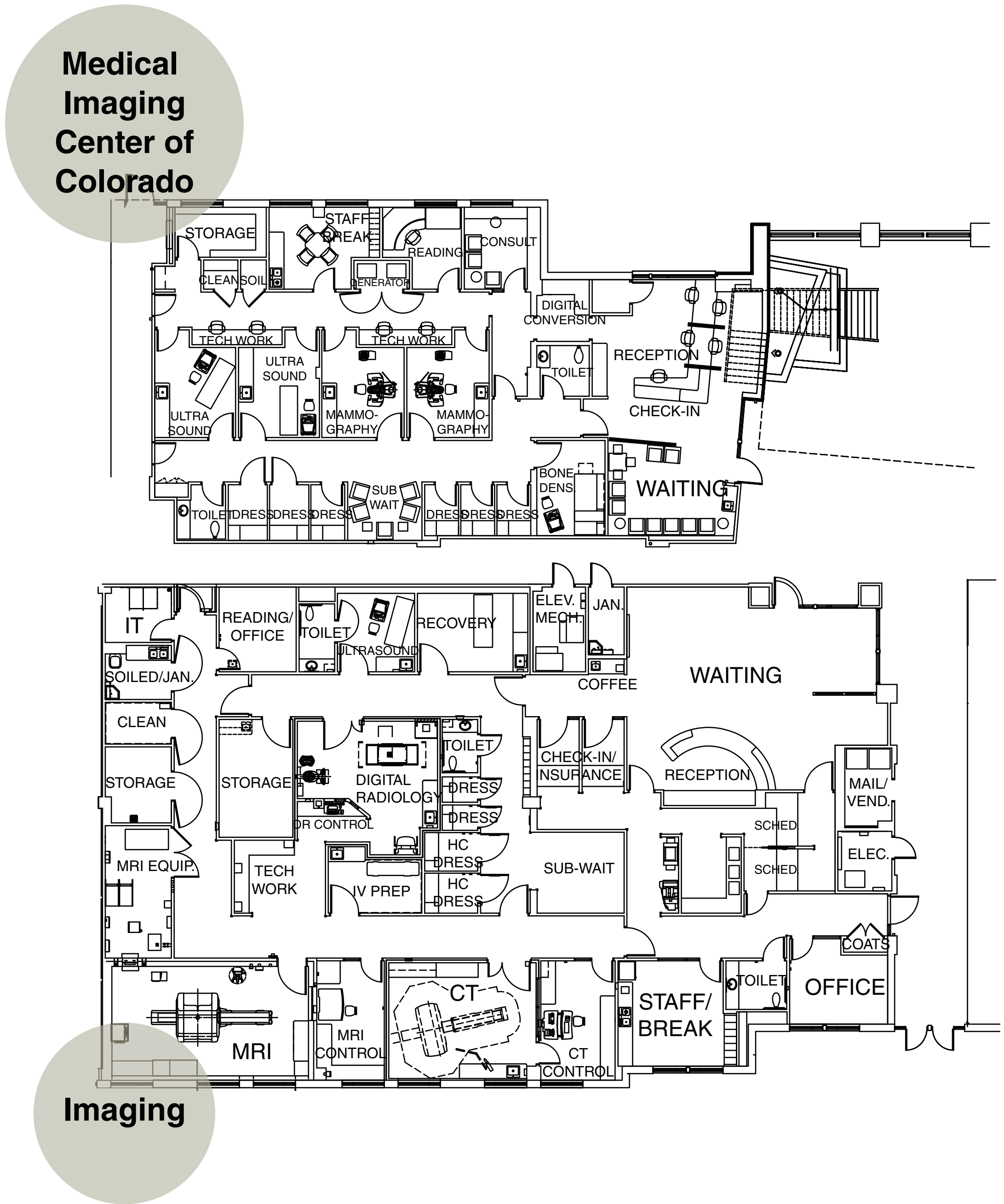


Figure 6-14. Space plan of diagnostic imaging, including breast center. *(Courtesy of Boulder Associates)*

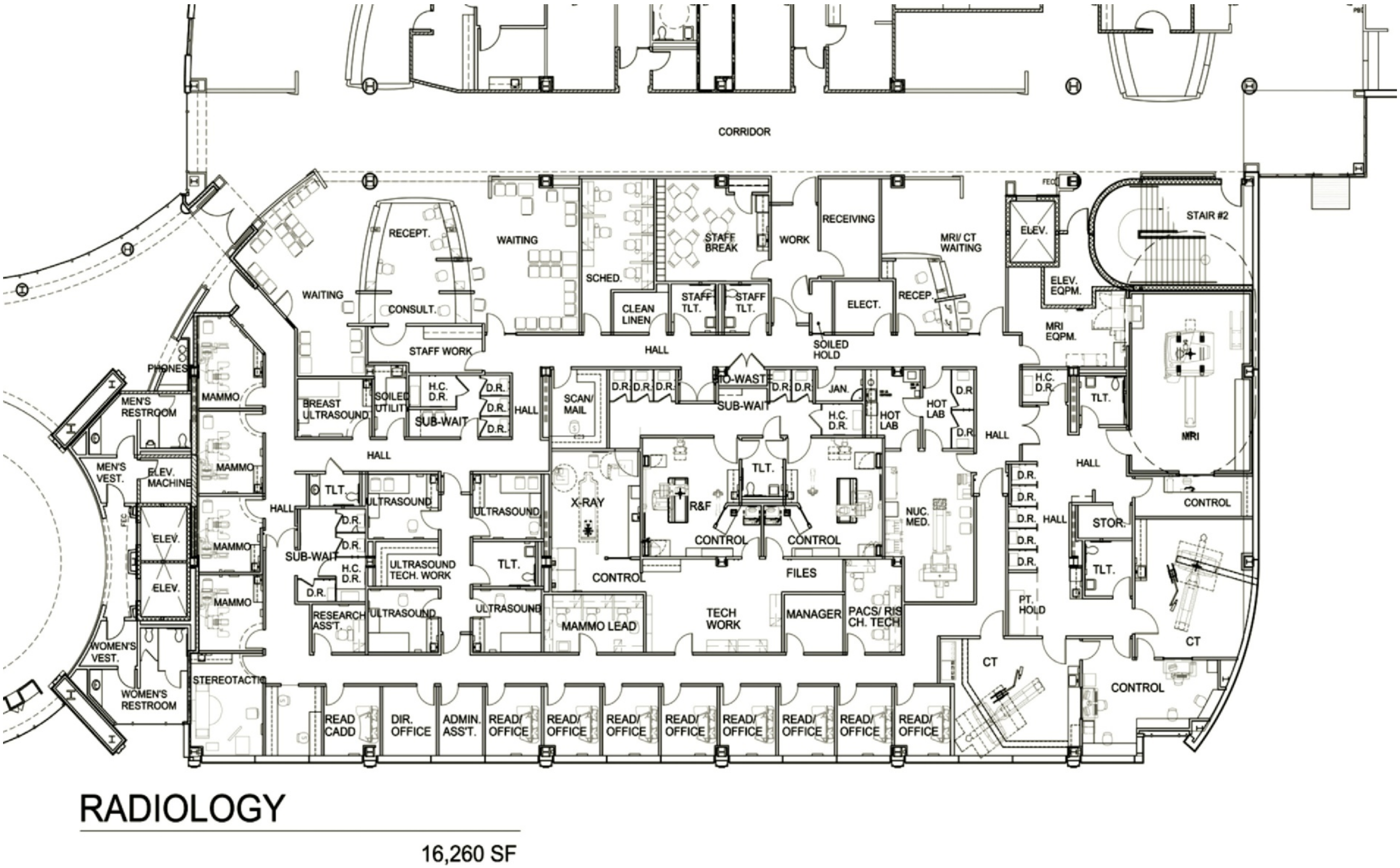


Figure 6-15. Space plan of diagnostic imaging, 16,260 square feet. *(Architecture and Interior Design: Hawley Peterson Snyder)*

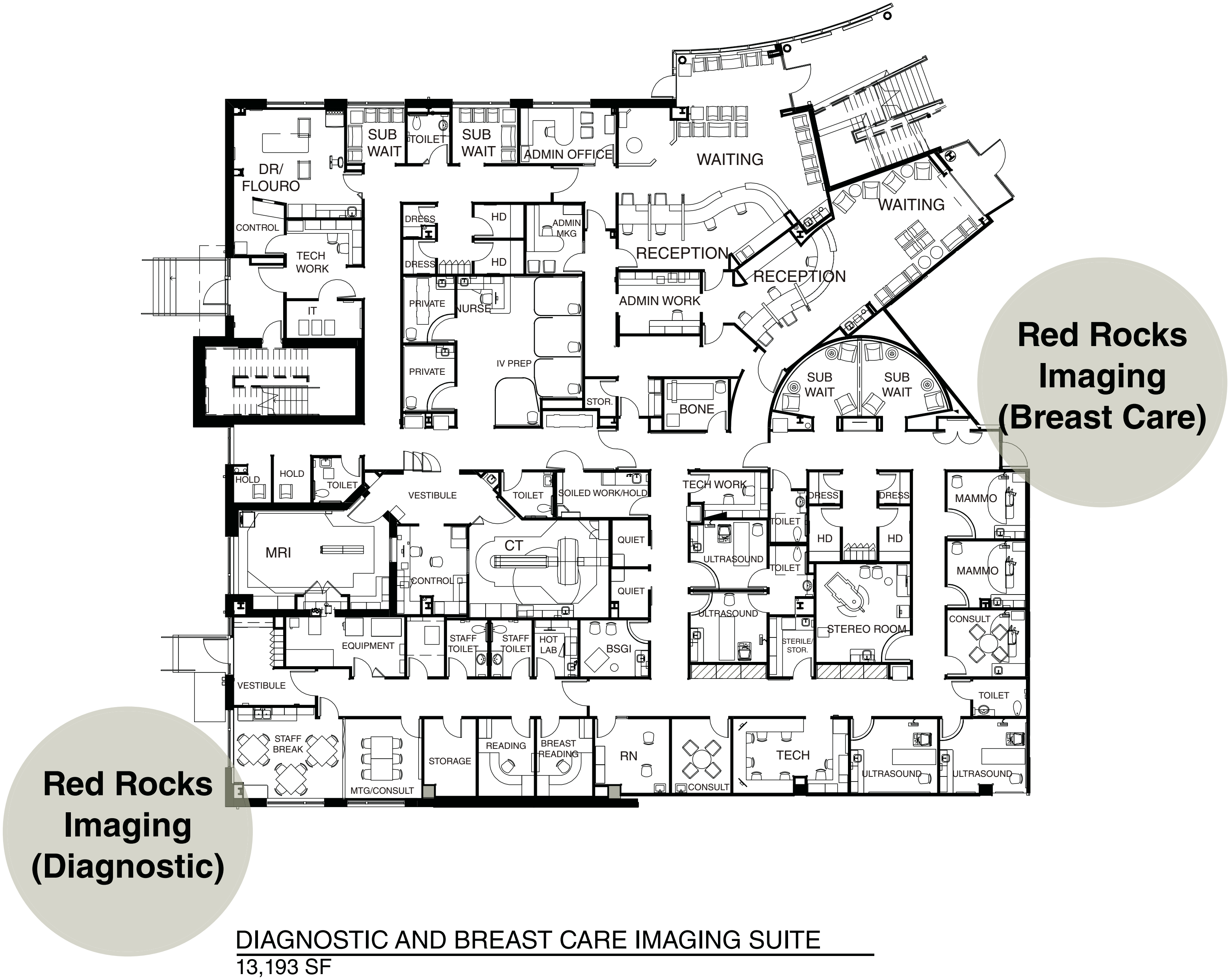


Figure 6-16. Space plan of diagnostic imaging, 13,193 square feet. *(Courtesy of Boulder Associates)*

and scooters, which means there should be more than the usual circulation space.

In a large radiology facility, the number of chairs in the waiting room can make it look like a bus station. It is preferable to divide the seating into privacy groupings, providing several styles of seating to accommodate individual comfort. Color Plate 20, Figures 6-17 and 6-18 present a beautifully designed reception/waiting area with a glass enclosure around registration that provides privacy as well as the ability of staff to monitor the room. Ceiling design and lighting offer variation and interest. Although this is a 27,000-square-foot facility located in a hospital, it also serves outpatients; the design is so outstanding that it merits inclusion in our discussion. It would be hard to find a more attractive diagnostic imaging environment; this should be celebrated as diagnostic imaging is an area that rarely gets any design attention beyond functional equipment layout. Because the St. Joseph's facility is primarily below-grade, the design concept creates the illusion of nature to surround the patient with design features carried into procedure rooms and prep areas (see Color Plate 21, Figures 6-32a and b). In the lobby, textures of black river rock and a large wall of dark charcoal stone are offset by a glass wall etched with trees and emerald green accent walls. Landscape murals of flower fields create a psychological escape into nature for patients in the holding bays. Throughout, careful lighting design is used to highlight textures.

Figure 6-17. Radiology check-in. *(Courtesy of Perkins + Will; Photographer: Peter A. Sellar, www.photoklik.com)*

Business Office

The business office is generally not large in a radiology suite, because this is a referral practice (Figure 6-19). The radiologist electronically archives only the X-ray images and a brief report on each patient as well as whatever records the referring physician may have sent. Billing and bookkeeping may be done within the suite or at another location. In a fully digital setting, an integrated data management system handles billing and insurance claims, inventory of supplies, and reports to referral physicians, as well as manages all the radiographic digital images. Radiographic images for the recent weeks or months would, of course, be online, accessible from the PACS server for the radiologist in preparing reports. A workroom may be needed for machines like a copier, fax, shredder, document scanner, printer, and possibly a postage machine. This equipment requires quite a bit of countertop space. Storage for business supplies and some paper goods is also needed. Even paperless offices need note pads, envelopes, and so forth.

It is common for radiology groups to sign contracts with hospitals to staff their radiology departments. It is not unusual for one large radiology group to staff three hospitals in a city, in addition to staffing and owning a number of outpatient radiology clinics in various medical buildings throughout the city. If such is the case, bookkeeping and billing might be done offsite at a centralized location for all of the clinics. Likewise, archiving of nearline and offline images may also be at a central location.

Patient Dressing

Allow two dressing rooms for each exam room. Each needs a chair or built-in bench, mirror, shelf for disposable gowns, and one or two hooks for clothing (see Figure 6-16). A proportional number of dressing rooms must be handicapped accessible. According to the Americans with Disabilities Act 2010 Guidelines, 5 percent of dressing rooms (but no fewer than one) must be accessible. Taking into account the clear area in front of the bench to enable a wheelchair to turn around, the room dimensions would be close to 6×8 feet in size. There are numerous specific details such as mirror placement, critical heights, and so forth that need to be followed. Regulations change, making it imperative to consult codes prior to design. Widespread differences exist in ADA interpretation between states and even municipality enforcement within a state.

Sometimes dressing rooms have an emergency buzzer for summoning staff. In a clinic with a sufficient number of dressing rooms, patients may leave their personal effects in the dressing room, which should have a lockable compartment for handbags, briefcases, or jewelry if the room cannot be locked. It is actually preferable to have lockers outside dressing rooms so that others may use the room as in Figure 6-14, which also serves as a subwaiting area. The dressing area should be carpeted, since patients may be walking barefoot.

Gowned Waiting. Certain procedures require disrobing and gowning. Typically, these are cloth gowns that need to be collected after use in a soiled linen bin that needs to be conveniently located. Men and women may sit in a unisex subwait room (see Figures 6-14 and 6-16) or they may enjoy more privacy by waiting in a private dressing room located close to the procedure room until called (Figures 6-20 a and b). These dressing/consult rooms offer a degree of privacy, amenities, and design that far exceed what is often found in diagnostic imaging facilities.

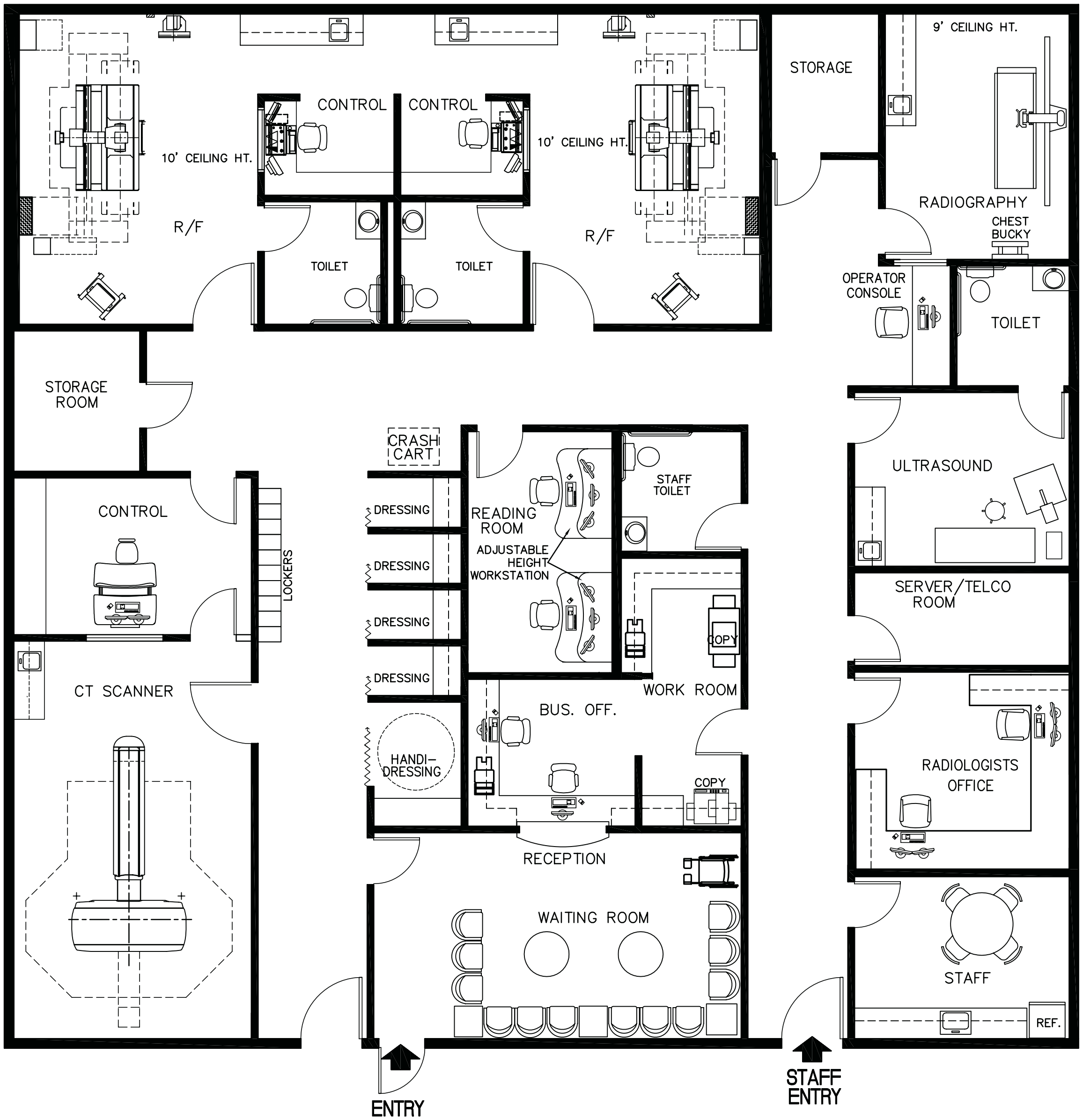
Tech Work Area

A discussion of the technologist's workspace must begin with a clarification of terms. Although often used interchangeably, there is a difference between *technician* and *technologist* initiated by the change in name of the American Registry of X-ray Technicians to the American Registry of Radiologic Technologists. The term "technologist" recognizes the evolution of education and skills: the X-ray technician became, quite a while ago, a radiologic technologist. Today, a technician is one who repairs equipment.

Many diagnostic procedures are performed entirely by the X-ray technologist, without the radiologist being present. The tech greets the patient, gives instructions for the examination, sets up the equipment, positions the patient, makes the exposure, manipulates the digital images as necessary, and sends the studies to the network PACS to be viewed and interpreted by the radiologist.

A quality assurance workstation is used by the tech to locate prior diagnostic studies to route them, along with

Figure 6-18. Radiology waiting area. *(Courtesy of Perkins + Will; Photographer: Peter A. Sellar, www.photoklik.com)*



RADIOLOGY

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Figure 6-19a. Space plan of radiology suite, 4,422 square feet. *(Design: Jain Malkin Inc.)*

Figure 6-19b. Digital radiography room, Ysio. *(Copyright © Siemens Healthcare 2013)*

the new images, for comparison and interpretation by the radiologist. In a digital setting, patient identification is barcoded and executed by the PACS software.

In a fully digital environment, the tech work area includes a viewing station/tech work area (see Figure 6-16), at either sit-down or stand-up height, with one or more printers. Hard copies of diagnostic studies may be printed on paper or film and sent to the referring physician along with a report. X-ray films carried in by patients are generally scanned and digitized on an as-needed basis. The type and placement of lighting is critical in any area where radiographic studies are viewed on monitors to avoid glare on the screen. This must be carefully analyzed.

Control Area. Note that, when laying out radiographic fluoroscopy rooms, the *tables tilt so that the right side*

Figure 6-20a. Diagnostic imaging private consult/exam rooms with storage units for personal belongings surrounding the subwait central nurse station. *(Architecture and Interior Design: Hawley Peterson Snyder; Photographs by David Wakely)*

goes down, and the left up, when one is standing on the working side (see Figure 6-3), although some tables tilt in *both* directions. The control area, therefore, should be on the right end so that the technologist can see the patient at all times. General radiography tables do not tilt, making this issue less critical, but it is still optimal for the technologist to have the patient in view. It is surprising how often this planning error occurs.

Figure 6-15 shows a frequently used layout with a control area that runs between two radiography rooms. The problem with this, although it is convenient, is that a right-handed and a left-handed room have been created. And this condition does not differ in a digital setting. The R/F room on the left puts the control area behind the patient's head, whereas the R/F room on the right keeps the patient in full view of the tech, especially when the table is tilted. In the room on the left, when the table is tilted, it seems that the patient would be totally out of view of the tech. (As a point of information, all R/F tables tilt.) Note that in Figures 6-16 and 6-19 the control area for the R/F room

is located so that the tech has a good view of the patient when the table is tilted.

The control area may be outside the radiography room as in Figure 6-19 (the operator or technologist looks through a lead-shielded window at the patient), or it may be in the radiography room (see Figures 3-74, 6-14, and 6-15), provided the control partition and window are lead shielded. Prefabricated, lead-lined control partitions and lead-shielded windows may be purchased from X-ray supply dealers.

If the control area is outside the room, a method of verbally communicating instructions to the patient may be required. As a safety precaution, the control console is wired to a warning light outside each radiographic room to prevent entry when the machine is in use.

Reading and Consultation

This room should be located at the rear of the suite where it is quiet. It should not be in the front of the suite or in the hectic patient circulation area. It can also be in a remote location since techs no longer have to deliver and hang films for the radiologist. The location depends also on what modalities are in the suite. If the radiographic modalities require the participation of radiologists, such as radiography & fluoroscopy (R/F), breast center, certain ultrasound procedures, the radiologist will need a reading room onsite not far from the procedure rooms. There are numerous variables here.

Reading Room. A reading room in a totally digital setting can be smaller than one used for reading films, but there are numerous environmental issues that must be addressed. The following information is based on articles written by noted diagnostic imaging planning specialist Bill Rostenberg, FAIA. Reading workstations for radiologists must be designed with great care, working closely with the individuals who will work there. Issues of privacy if more than one radiologist will use the room simultaneously loom large because distraction must be avoided; as voice recognition systems become more common, extraneous noise can be a problem. PACS workstations may be configured differently reflecting individual preferences, which includes the number of monitors, the depth

Figure 6-20b. Central nurse station in diagnostic imaging clinic. *(Architecture and Interior Design: Hawley Peterson Snyder; Photographs by David Wakely)*

of the countertop, and the location of the keyboard tray (if any). In addition to reading and interpreting radiologic images, the radiologist may dictate, talk on the phone, do handwritten paperwork, or bar-code entry. The ergonomically designed workstation in Figure 6-22, specifically for radiologists, provides a work surface that adjusts from sit-down to stand-up heights and has a place for a phone as well as foot rests.

Lighting. Ideal room lighting would be a perimeter valance (with dimmer control) running along two or three walls of the room. This provides glare-free indirect illumination. Lighting in a reading room should be indirect, able to be dimmed, and divided into several zones so that one workstation can be controlled or dimmed independently of others.

Ambient lighting for computer workstations should minimize contrast between the monitor and surrounding surfaces in order to avoid eyestrain, yet the room must be sufficiently dark—and without glare—for the image on the screen to be readable. A relationship of 1:1 between ambient light and that of the display terminal is recommended. Task lighting can be used to supplement ambient lighting where more light is required for handwriting or illuminating a keyboard. If task lighting is to be used, consider electrical outlet locations so that they are convenient and electrical cords are not running to distant outlets.

Anyone who works at a computer terminal knows the problems caused by glare from overhead lighting, white walls parallel to the screen, windows, and other monitors on a parallel wall. In the reading room, glare on a screen is far more than an annoyance and a cause of eyestrain: It can make it difficult to interpret an image. To minimize reflection on the screen, walls should be a medium to dark color, never white. Plastic laminate countertops should be dark as should any shelves or other casework in the room that might reflect on the screen.

Task lighting is likely to be LED which is cooler than other sources. Room lights may alternately be controlled on a panel at the radiologist's workstation, so that lights may be turned on or off in various zones without leaving one's chair.

Ergonomics. As in any computer workstation, it is desirable to be able to adjust the height of the work surface to accommodate tall or short individuals, and, of course, the chair should be a quality ergonomic design that provides adjustment of arm height, rake of the back, and seat height. Fixed countertops do not afford flexibility; however, a number of manufacturers offer freestanding workstations with maximum ergonomic adjustment (Figure 6-21).

HVAC. Thought should be given to zoning the film reading room independently as PACS workstations and numerous monitors give off considerable heat. The radiologist should be able to control the temperature from a thermostat in the reading room.

Electrical. The key to any high-functioning digital system is an uninterrupted power supply. Disturbances from other equipment, inadequate system capacity, and inadequate grounding can cause fluctuations that are devastating to electronic instruments. Newer electronic instruments are far more sensitive to power line disturbances than their predecessors. Even minimal amounts of electrical noise can affect the dense digital circuitry of these advanced microprocessors. UPS units can be attached to each electronic instrument or be built into the infrastructure of the facility.

Radiologist's Office/Consultation. The radiologist does not consult with patients, but does consult with referring physicians. This would likely occur by phone with each looking at the images online. Alternatively, this may take place face-to-face in a private office if the radiologist has one. A PACS workstation or possibly a passive viewing station could meet this need.

IT Room—Digital Data Storage

This was explained under the PACS section at the beginning of this chapter. A facility may or may not have a storage room to accommodate a large server and jukebox tower for archival storage. A facility that is part of a larger building may have telecommunications equipment rooms disbursed throughout it. An independent radiology suite, as in Figure 6-19 located in a medical office building, does need a room for data storage equipment.

Figure 6-21. Space plan, radiology suite, 16,155 square feet. *(Courtesy of Bostwick Design Partnership)*

Figure 6-22. Ergonomically adjustable radiologist read station, Carl's Table® CT12. *(Courtesy of Anthro Corporation, copyright © 2013)*

Tech Work Core

The tech work core in a fully digital environment can be large (see Figure 6-15, 6-16, and 6-21), if centralized, depending on the volume of studies and the number of procedure rooms served. For example, (if it exists) the plate reader (for phosphor plates) may be in this area and there may be other peripheral pieces of equipment such as laser printers and a PACS viewing station that enable techs to access images. Note that a plate reader is only needed to support a film-based analog machine and will not be found in a setting with all direct capture machines.

General Radiography Rooms and Radiography and Fluoroscopy Rooms

Not all radiography rooms are equipped for fluoroscopy. A diagnostic imaging facility may have two general radiography rooms plus one radiography and fluoroscopy (R/F) room or perhaps one general radiography room and two R/F rooms. The R/F rooms should be a minimum of 16 × 18 feet in size just for the machine and may even be larger depending upon the position of the toilet room and the control station.

The size of the radiography room will vary in accordance with the size of the X-ray unit and the ancillary equipment. As the room is equipped for taking radiographs of all parts of the body in standing, sitting, or angled positions, the room will have freestanding, wall-mounted, and ceiling-suspended equipment. Because there are a certain number of variables from one manufacturer to another, the space planner must obtain suggested room layouts that note critical distances between various components, along with specifications of required utility connections from each manufacturer. Technical planning guides should be accessed from their websites.

To begin with, cables connect the electronic control console to the X-ray tube stand and the transformer. These cables are high-voltage, low-voltage, and signal cables. (The control console may also be wireless.) The most unobtrusive way of handling this is to trench the floor and bury them under a cover plate. The transformer and/or power distribution unit is generally located in one corner of the radiography room.

An R/F room must have a toilet attached to it as in Figure 6-19 or it may be nearby as in Figure 6-21. Occasionally, the toilet has one door to the R/F room and another to the corridor or one toilet may serve two rooms as in Figure 6-15. Remember, the patient needs to immediately discharge the barium enema after the lower GI (gastrointestinal) procedure.

If the toilet has access to the corridor, the patient exits the bathroom via the corridor door, adjacent to the dressing area. If he or she needs to use the bathroom again, the patient may enter from the corridor side, as the next patient would not be using it immediately. (A certain amount of cleanup time and prep is required before examining the next patient.)

The fluoroscopy room is the workroom for the radiologist. He or she will watch the TV monitor as the patient is turned in different positions, and the contrast medium moves through the organs. The size of the fluoroscopy room is largely determined by the amount of ceiling equipment. The ceiling tube mount moves on ceiling-mounted tracks, supported by a Unistrut® system above the finished ceiling. When a room has a table that tilts and a ceiling-mounted tube stand, a 10-foot ceiling height may be required. Of course, the weight of the equipment must also be considered which, for fluoro, is about 3,000 pounds for the table.

Radiography Room without Fluoroscopy

A radiography room without fluoroscopy may be as compact as 14 × 20 feet to as large as 15 × 24 feet, including the control area or room. Occasionally, an orthopedist may have a smaller table that can be placed in a somewhat smaller room. Always err on the side of a larger, rather than a smaller, room. In these compact units, the X-ray tube column may be mounted directly to the table, negating the additional space required for ceiling mounting. If a radiography room is used by a technologist only (as is often the case), the room may be smaller than if it is used by the radiologist, who may be doing special procedures requiring more than one person to be in the room and perhaps the use of additional portable equipment.

Chest films would typically be done in a general radiography room. A wall-mounted film holder, called a *bucky*, would be located generally at the "head" end of the X-ray table but it may be placed to the side of the table as well (see Figure 6-20a). The direct ray sensor panels are inside the bucky. Another common procedure, an intravenous pyelogram (IVP), used to study the kidneys, uterus, and bladder is performed in a general radiographic room that has tomographic capabilities, but these are more commonly done with CT. For these studies, a bathroom must be nearby but need not be attached to the room.

Radiography rooms without fluoroscopy need not have sinks but do require a cabinet and shelves for storage of patient positioning devices such as sandbags and foam wedges and for disposable items needed for procedures.

The door to a radiography room must be large enough to move equipment in and out. It should be noted that a lead-lined door is very heavy and will require a heavy-duty closer. Figure 6-19 shows a 42-inch-wide door on the R/F rooms, but movement of equipment can also be accommodated by a 3-foot-wide door placed in a 4-foot-wide frame with a 1-foot dead panel (lead lined) that can be removed as needed.

An additional piece of equipment may be found in a radiographic room with an analog X-ray machine. This is a plate reader for converting data to digital in order to view them on a PACS. This may be located in the tech control area and can be shared between two general radiography rooms.

Lead Shielding. Once a radiology suite is designed, a radiation physicist must be consulted to prepare a study of lead-shielding requirements. In order to do this, the physicist will need to know full specifications on the equipment for each room, the anticipated volume of studies, the location of a specific radiology room with respect to adjacent rooms in the suite, and the location of the suite itself within the medical office building.

For example, if a radiography room is on the third floor of a building and has two exterior walls, the lead-shielding requirements would be considerably different than if the room were contiguous with an office where someone sits at a desk all day. If the suite is located on the ground floor of a building and the radiography room is on an exterior wall, with passersby walking to a parking lot, the physicist evaluates the volume of foot traffic and the amount of exposure in order to "protect the genes of future populations." Of course, placement of equipment in the room will determine the direction of radiation scatter.

The lead-lined control partition in Figure 3-72 is viewed from the control side. The leading edge must have at

least 18 inches of wall to the side of the window to protect the tech.

Emergency Precautions. When laying out a radiology suite, thought must be given to the possible evacuation of a patient on a stretcher. Since most radiology suites are located on the ground floor, this may be accomplished by a secondary exit that leads directly to the parking lot, enabling an ambulance to pick up a patient without the patient having to be carried through the waiting room or the building lobby. Resuscitation equipment on a crash cart should be readily available to the procedure or examination rooms. Radiologists sometimes request emergency call buzzers for procedure rooms, patient dressing rooms, and toilet rooms. The annunciator panel would be located at the reception desk.

Lighting. There should be two types of lighting in a general radiography or R/F room: overhead fluorescents and indirect perimeter lighting, switched separately. Perimeter lighting should be able to be dimmed, as fluoroscopy procedures are done in a dimly lit room. Designers may wish to consider upgrading the acoustic ceiling tile to one of many having an interesting design or pattern or one that "hides" the 2 × 4 foot grid.

ULTRASOUND

Since ultrasound does not use radiation, there is no need for lead shielding. The room should not be smaller than 10 × 12 feet in size or may be the size of a standard medical procedure room, 12 × 12 feet. The patient lies on an examination table and the technologist works on the patient's right side. The equipment is portable (see Figures 3-79, 3-80, and 5-7, but varies in size with many compact models available (see Figure 3-84). A "full size" unit may be as large as 27 inches wide by 34 inches deep by 54 inches high. Images may be sent to a PACS or a laser camera or a video recorder. Enhanced ultrasound units provide instantaneous 3D images of anatomical structures, including the liver, kidneys, thyroid, breast, and fetuses. Ultrasound equipment has no special electrical requirements, except for a dedicated circuit. However, the room is darkened for the procedure, and an ideal type of lighting would be indirect perimeter lighting that can be dimmed or overhead lighting that can be turned off with wall sconces as secondary lighting on dimmers.

An ultrasound room must have a toilet immediately adjacent to accommodate voiding studies of the bladder. A cabinet with sink should be provided in the ultrasound room.

NUCLEAR MEDICINE

Historically, nuclear imaging equipment was found primarily in hospitals, rather than in the outpatient setting, because of its availability to both inpatients and outpatients and due to environmental issues of safely handling and disposing of radioactive materials. Statistics indicate that the majority of nuclear medicine imaging is hospital based; however, it is increasingly appearing in outpatient settings. Nuclear imaging also includes positron emission tomography (PET) scanners that image metabolic and biological functions of the body. A hybrid CT/PET scanner combines the best of both modalities in one unit, revealing images of internal anatomy (CT) and images of metabolic (molecular) processes (PET).

Although there are numerous variables in equipment, these are the basic components:

1. Operator's console/workstation
2. Detector gantry (single, dual, or triple head)
3. Collimator
4. Patient bed (may be part of detector stand)

A nuclear imaging room does not require lead shielding, as the gamma camera emits no radiation; it picks up the small amount of radioactivity released by the organ being imaged. The patient ingests or is intravenously injected with a small amount of a radiopharmaceutical that travels through the bloodstream to the specific organ being studied. The patient prep room should be close to the hot lab where the radioactive material is prepared so that the tech

never has to walk through patient circulation corridors carrying radioactive material. Having a nuclear scan can be an all-day process for a patient as explained below. In the interim, while they are radioactive, they should not mix with other patients in the waiting room as there is a risk, for example, of birth defects should this patient sit next to a pregnant woman in the first trimester who is waiting for an ultrasound. Sometimes patients leave the facility for a couple of hours and then return. A subwaiting area near the nuclear imaging procedure rooms is practical, as is a dedicated toilet since human waste discharged from patients who have ingested radioactive materials could splash on the floor or toilet seat. Because the type (and amount) of radioisotopes used in *diagnostic studies* (as opposed to *treatment*) is minimal and decays quickly, the toilet waste can generally be discharged into the sewer system without being diverted to a holding tank; however, local codes should be consulted. The radioactive material dissipates quickly in the patient after the examination has been completed.

There are many types of nuclear medicine scans, including bone, liver, thyroid, lung, and gallbladder, to name a few. The time between administering the radioactive compound and taking the scan may vary, depending on the compound used and how long it takes to accumulate in the part of the body being studied. Some scans are performed a few hours after the injection, while others may be performed immediately. The scan itself may take anywhere from 30 minutes to two hours, again depending on the part of the body being studied. Gamma cameras may have single, dual, or triple detectors. A dual (Figure 6-23) or triple head cuts the scan time because scanning is done from several locations at the same time. Collecting the data is vastly increased. Because layout options for nuclear imaging equipment can vary considerably in shape and size, manufacturers should be contacted for suggested room layouts. As with any radiographic equipment, weights that exceed 3,000 pounds require careful structural analysis, as does the path of travel into the room and through doors.

The space planner may encounter the terminology *SPECT* in regard to nuclear imaging procedures. It refers to *single-photon emission computed tomography* capability.

Nuclear Stress Test

This is used in conjunction with a dynamic ECG. The room may have a nuclear cardiology scanner (or a "general purpose" gamma camera), a workstation for the tech, and possibly a treadmill, although cardiac stress can also be imposed pharmacologically. This equipment may be accommodated in a dedicated room or it may be performed in a larger multipurpose nuclear imaging room.

Positron Emission Tomography

Positron emission tomography (PET) is a nuclear technology that offers intimate glimpses of molecular functioning (see Figures 6-4 and 6-11). PET/CT is often used for cancer staging (a method of evaluating tumor growth), based on a number of clinical studies demonstrating that PET/CT is considerably more accurate than conventional imaging for patients with certain types of cancers, and it is expected to constitute the state of the art for cancer diagnosis and management. In some regions, entrepreneurial radiologists have joined together in a business venture to purchase a PET scanner and contract with hospitals. Sometimes these are dedicated PET centers with no other imaging modalities. As of 2010 there were 2,000 PET scanners in the United States versus close to 11,000 CT scanners.

It should be noted that PET scan rooms do require lead shielding and that PET involves higher levels of radioactivity than with the standard nuclear gamma camera. The techs are in a separate room, similar to the layout for an operator's console in CT or MRI (see Figure 6-11).

Tech Shielding

When tech shielding is required, the nuclear medicine mobile barrier in Figure 6-24, featuring lead-impregnated acrylic, may be used. The oversized window permits unobstructed viewing of the patient. This barrier (which comes in many sizes) may be positioned close to the patient table, and it shields the tech from patient-emitted radiation.

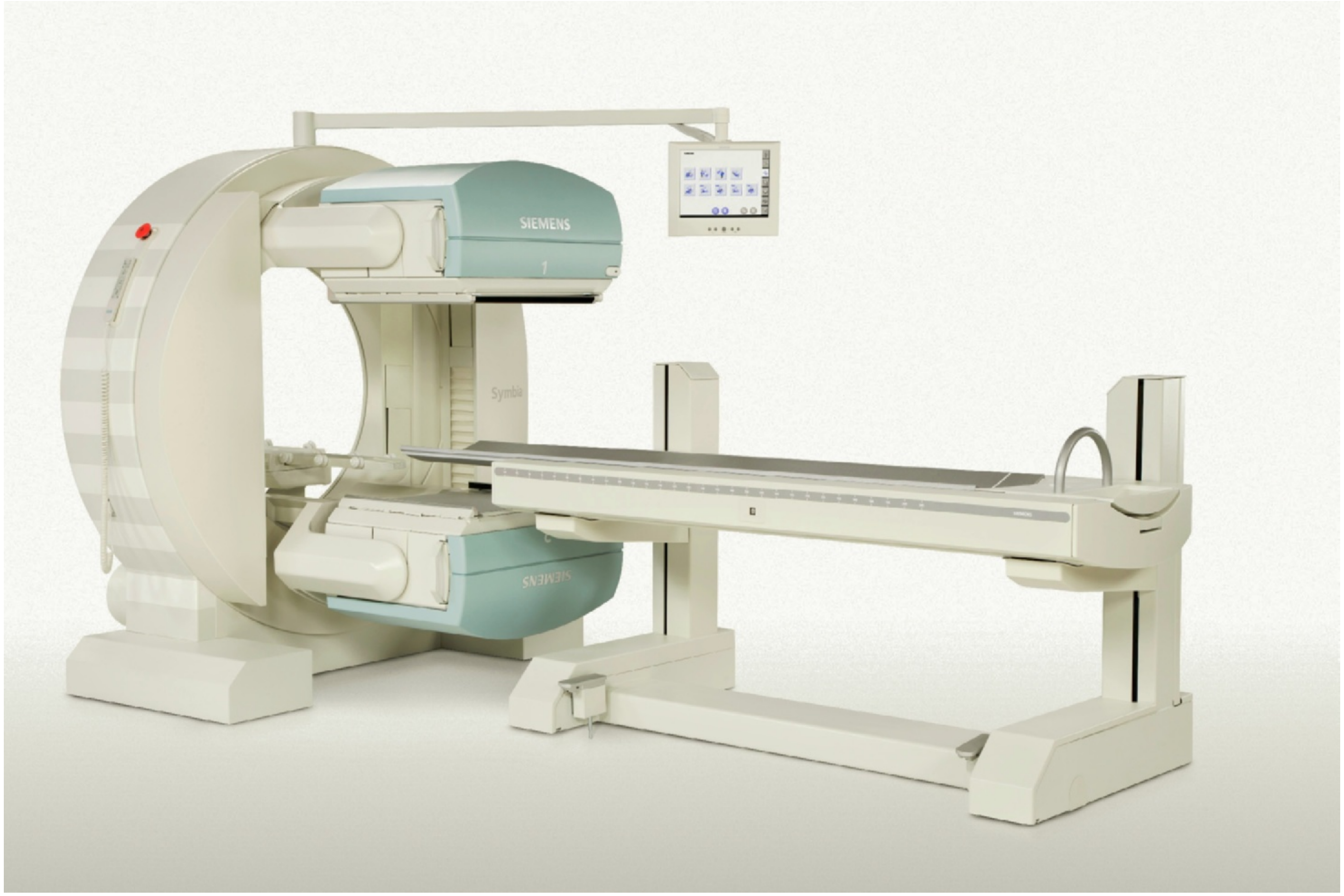


Figure 6-23. Dual detector scanner, Symbia® E Nuclear Medicine. *(Copyright © Siemens Healthcare 2013)*

Hot Lab

This is a room, perhaps no larger than 6 × 8 feet, where radiopharmaceuticals are prepared. This is best located in a part of the suite where there is not a lot of traffic. Unit-dose, freeze-dried "kits" specific to each study (e.g., lung kits, bone kits, and the like) have greatly reduced the amount of prep required and the amount and type of storage needed. With unit dose, a refrigerator and the various bins depicted in Figure 6-25 are not required, but as the use of unit dose is not universal, these items are pictured. The room would have 34-inch-high countertops with a single-compartment sink, and may have a lead-lined undercounter refrigerator with some open shelves

Figure 6-24. Radiation shield. *(Courtesy of Biodex Medical Systems, Inc.)*

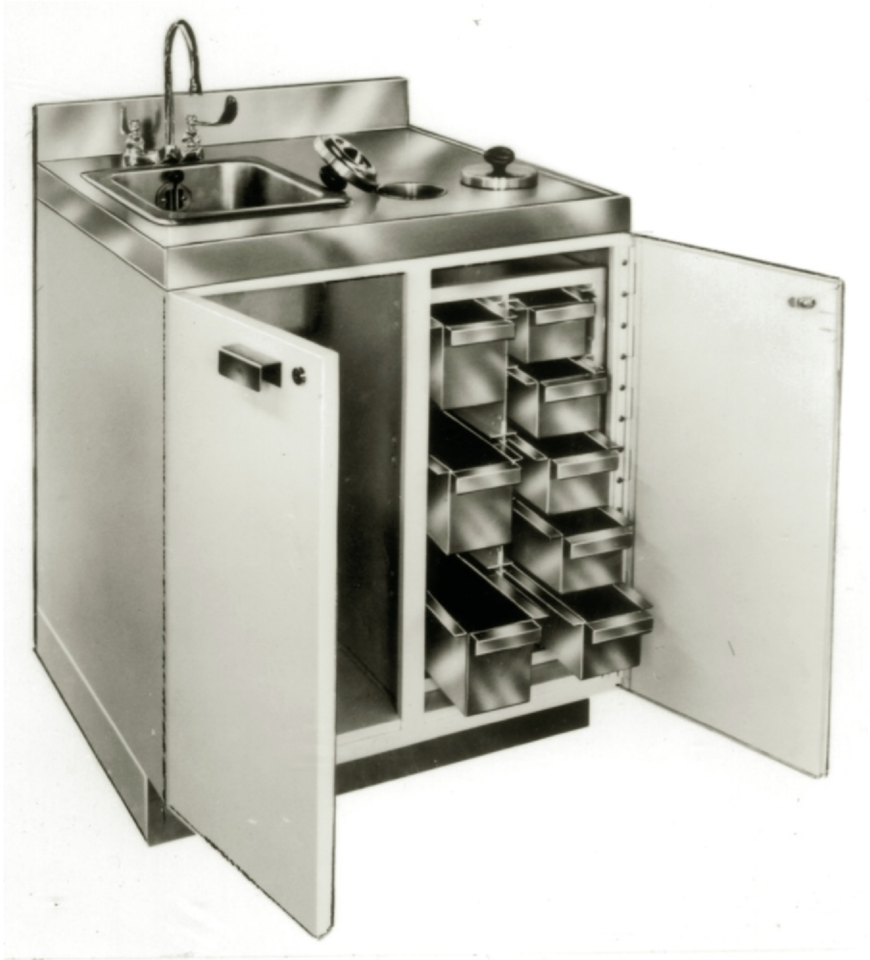


Figure 6-25. Workbench for handling radioactive materials. *(Photo courtesy of Nuclear Associates, Carle Place, New York)*

Figure 6-26. Interlocking lead bricks. *(Photo courtesy of Nuclear Associates, Carle Place, New York)*

and hinged-door storage under the countertop. Note that the countertop must be steel reinforced in order to support the interlocking lead bricks (Figure 6-26) that will be placed on it. These may total as much as 1,000 pounds. Suffice to say the floor must be structurally reinforced. It may be more practical to buy a prefabricated workbench designed specifically for handling, storing, and disposing

of radioactive materials (Figure 6-27). The modules of these workbenches are lead lined on six sides with solid sheet lead and encased in steel. Stainless steel countertops allow for easy cleaning and decontamination.

Figure 6-27. Biodex Germfree portable shielded isolator for preparing radiopharmaceuticals. *(Courtesy of Biodex Medical Systems, Inc.)*

Radioisotopes are stored in *vial shields* (Figure 6-28) from which the contents are dispensed. Vial shields of radiopharmaceuticals are stored in a small *safe* made up of interlocking lead bricks or in a lead container (Figure 6-29). These containers may be placed on the countertop or on a shelf under it—one with enough space to lift the lid and access the contents of the safe. Remember that safes range from 125 to 200 pounds in weight. Figure 6-30 shows a clear *benchtop shield* that provides a protective lead barrier from radiation exposure when working with radionuclides. PET unit doses are very high energy and are shielded in 1 to 2 inches of lead for shipment in “pigs,” which are tungsten shipping containers. The tech opens it behind an “L” block in the hot lab. Safe handling in mixing and compounding is dictated by the United States Pharmacopeia Chapter 797 for PET drugs, although an individual state pharmacy board may not have adopted this standard. An International Organization for Standardization (ISO) Class 5 clean room environment must be maintained which can be accomplished with the *Biodex Germfree Portable Shielded Isolator* (see Figure 6-27). Two lead-lined

Figure 6-28. Vial shields for radiopharmaceuticals. *(Courtesy of Biodex Medical Systems, Inc.)*

waste receptacles are needed and also a sharps container. Once the material has decayed, a specialized service will pick up the containers.

A compact alternative for preparation of PET drugs is the Biodex lead-lined PET Unit Dose Cabinet (biodex.com) that can be placed in a hot lab. It has an L-block, built-in dose calibrator shield, sharps container shield, lead brick cave, and storage for various devices, tools, and accessories.

Electrical outlets are required over the countertop for radioisotope dose calibrator, the wipe test counter, and other accessory items. The dose calibrator (touch screen) and wipe test are available combined in one unit, the *Atomlab™ 500Plus* Dose Calibrator (Figure 6-31). There is a need for storage of items used to mix agents such as vials and syringes, for gloves, and for gripping tools.

The floor of a hot lab must be a durable seamless product that can be coved up walls for a baseboard. Air conditioning is required in this room.

Figure 6-29. Lead storage container (safe) for storing radioactive materials. *(Photo courtesy of Nuclear Associates, Carle Place, New York)*

Figure 6-30. Tabletop shield. *(Courtesy of Biodex Medical Systems, Inc.)*

Figure 6-31. Atomlab 500Plus Dose Calibrators. *(Courtesy of Biodex Medical Systems, Inc.)*

COMPUTED TOMOGRAPHY

The CT suite consists of a scanner room and a room with an operator's console for the technologist (see Figure 6-11, 6-15, and 6-16). Manufacturers will supply engineering data sheets with alternative suggested layouts, critical dimensions, floor loading, and utility requirements.

Although there are slight differences between different models of CT scanners, generally a procedure room 20 feet long by 16 feet wide plus an adjoining room for the operator's console 9 ×16 feet will suffice (see Figures 6-15 and 6-16). Remember that for patient safety, sufficient access around the scanning unit must be maintained in case a patient becomes ill to allow the resuscitation team unobstructed access.

The procedure room is where the scanner gantry is located. The patient is positioned on a table that slides back and forth under a rotating doughnut-like enclosure; some units have a gantry that tilts. The room needs a built-in cabinet and sink plus storage for clean linen, patient positioning devices, contrast media, and IV materials. A cart for soiled linen is also required. An 8-foot-long base cabinet with a wall cabinet or shelves above would be adequate. A couple of drawers might be partitioned for storage of alcohol preps, disposable syringes, injectables, contrast media, tubes, tape, and emesis (vomit) basin.

The ceiling of the room is normally 9 feet or 9 feet 6 inches high, and the door should be at least 48 inches wide, with a heavy-duty closer. The walls and door will have to be lead shielded according to recommendations of a radiation physicist.

Room lighting must be controlled by a dimmer. Indirect lighting around the perimeter of the room will keep glare out of the patient's eyes. The control room also requires dimmer-controlled indirect lighting. The massive size of this equipment can be frightening to patients, even though it does not have exposed cables and is quite streamlined in appearance (see Figures 6-5 and 6-6). A room with cheerful colors and a mural or backlit film images of nature on the walls and/or ceiling can be quite effective in relaxing patients (see Color Plate 21, Figure 6-32a. Occasionally facilities will have an area for prep and recovery as in Figure 6-16 and Color Plate 21, Figure 6-32b. It is known that the anticipation phase of procedures creates maximum anxiety; therefore, backlit images of nature should be considered as a positive distraction. The PET/CT room at the Scripps Center for Integrative Medicine Early Detection Center (see Figure 6-11) has a ceiling shaped like a chambered nautilus shell, created of gypsum board, with individual sections "outlined" by concealed fiber-optic lights that sequence through the colors of the rainbow. After the patient has been situated on the table, the tech dims the room lights to focus attention on the ceiling, creating a soothing, relaxing ambience. This is known as a positive distraction and is likely to reduce anxiety in this type of setting. The design theme correlates with the "sacred geometry" concept for the clinic, using the Golden Mean as a design guide in space planning, ceiling design, and elsewhere. Other photos of this facility can be seen in Color Plate 6, Figures 3-122 and 3-123, and Figures 3-124a and b, and 3-125.

The room with the operator's console is where the technologist sits during the procedure. It must have a lead-shielded window facing the procedure room so that the patient is always in view. The dimmer control for procedure room lighting should be accessible from this room; however, this room also benefits from dimmer control to eliminate glare on computer monitors. A wall-mounted injector control is wired to the ceiling-mounted IV injector in the procedure room that allows the tech to manually time injections of contrast medium to alter the appearance of vascular structures so that they can be imaged.

Digital images are constructed during the scan (the multi-slice concept was explained previously) and images go to the network PACS where they can be accessed by the radiologist for interpretation.

Refer to the MRI section for a discussion of the innovative Philips *Ambient Environment*, available for CT and MRI. For children, the GE *CT Adventure Series* is a consideration, although it is likely to be found in children's hospitals since young children do not usually receive these types of examinations in outpatient settings.

Figure 6-32a. Prep and recovery area, with backlit views of nature in line of sight and above. Note curved HVAC diffuser. *(Courtesy of Perkins + Will; Photographer: Peter A. Sellar, www.photoklik.com)*

Figure 6-32b. Computed tomography with backlit image of nature as a positive diversion. *(Courtesy of Perkins + Will; Photographer: Peter A. Sellar, www.photoklik .com)*

MAMMOGRAPHY

A room 10 × 12 or 12 × 12 feet is adequate for a mammography room. Most manufacturers' equipment is approximately the same size. A hand-washing sink should be provided in the room or just outside it to serve several rooms. Mammography examinations are often performed in a women's center or breast center, and the reader is referred to a detailed discussion under these headings in Chapter 5.

Mammography equipment incorporates an attached leaded-glass protective screen behind which the operator stands (see Figures 5-25 and 5-26). It would be rare today to find a machine that is not digital. There are no unusual utility requirements for this equipment, and sometimes the walls may not need to be lead shielded. As with any diagnostic imaging equipment, however, a radiation physicist must be consulted.

An imaging suite having two or more mammography rooms may have equipment from more than one manufacturer, which may alter somewhat the orientation of the equipment in the room.

Indirect lighting is optimal for this type of room, and decorative wallpaper, carpeting, and attractive artwork make the patient's experience more pleasant. Refer to Chapter 5, Breast Centers, for more information.

RADIATION ONCOLOGY

Also known as radiation therapy, radiation oncology is designed to bombard tumors with high doses of radiation. This is usually an outpatient-based modality found in large ambulatory care centers and sometimes in a medical office building. It is mandatory that this tenant be identified while the building shell is being planned. Often, because of the expense of construction and also equipment, a hospital system will build a freestanding facility in a convenient location to serve patients from throughout their network. Such is the case with the facility in Figure 6-33.

The room containing the linear accelerator (see Color Plate 18, Figures 6-7 and 6-8 and Color Plate 19, Figure 6-9) will have concrete walls of varying thickness anywhere from 24 to 60 inches. The amount of concrete can sometimes be reduced by the addition of steel or other materials. Sometimes this room can be situated on the site where the ground slopes (or below grade), to enable the room to be either partially or totally underground, reducing somewhat the radiation shielding requirements.

The radiation therapy space plan in Figure 6-34 illustrates the required ancillary rooms. Patients arriving for therapy may be ambulatory or may arrive on a gurney; therefore, both types of traffic must be accommodated. If the radiation therapy suite is part of a diagnostic imaging center, it is desirable to have a dedicated subwaiting area for radiation therapy so that those patients need not wait with diagnostic radiology patients (Figure 6-35).

The design of a radiation oncology facility is worthy of an entire chapter as there are so many psychological issues associated with the treatment as well as planning issues and innovative design solutions. In addition, there are variations in equipment such as high dose used for certain types of tumors, linear accelerators with intensity-modulated radiation therapy (IMRT), image-guided radiation therapy (IGRT), brachytherapy (radioactive material placed inside the body near tumor cells), and proton beam therapy. The overall goal is to vary the shape and intensity of the radiation beam to precisely target the tumor and damage as little healthy tissue as possible. Different types of tumors respond better to one type of therapy than another.

Often radiation therapy and chemotherapy are both part of the treatment plan. An excellent discussion of all these modalities as well as the process of cancer staging using a simulator CT or MRI can be found on the website of the National Cancer Institute (cancer.gov/cancertopics/factsheet/therapy/radiation). A detailed review of such information goes beyond the scope of this book but there is benefit in studying the space plans presented because they have good functional flow and the photos of the linear accelerator treatment rooms may provide inspiration for creating more aesthetically interesting environments. It is truly hard to understand the notion of spending upward of $2 million on a machine that will have such a long life and then not invest an additional $20,000 to provide a suitable

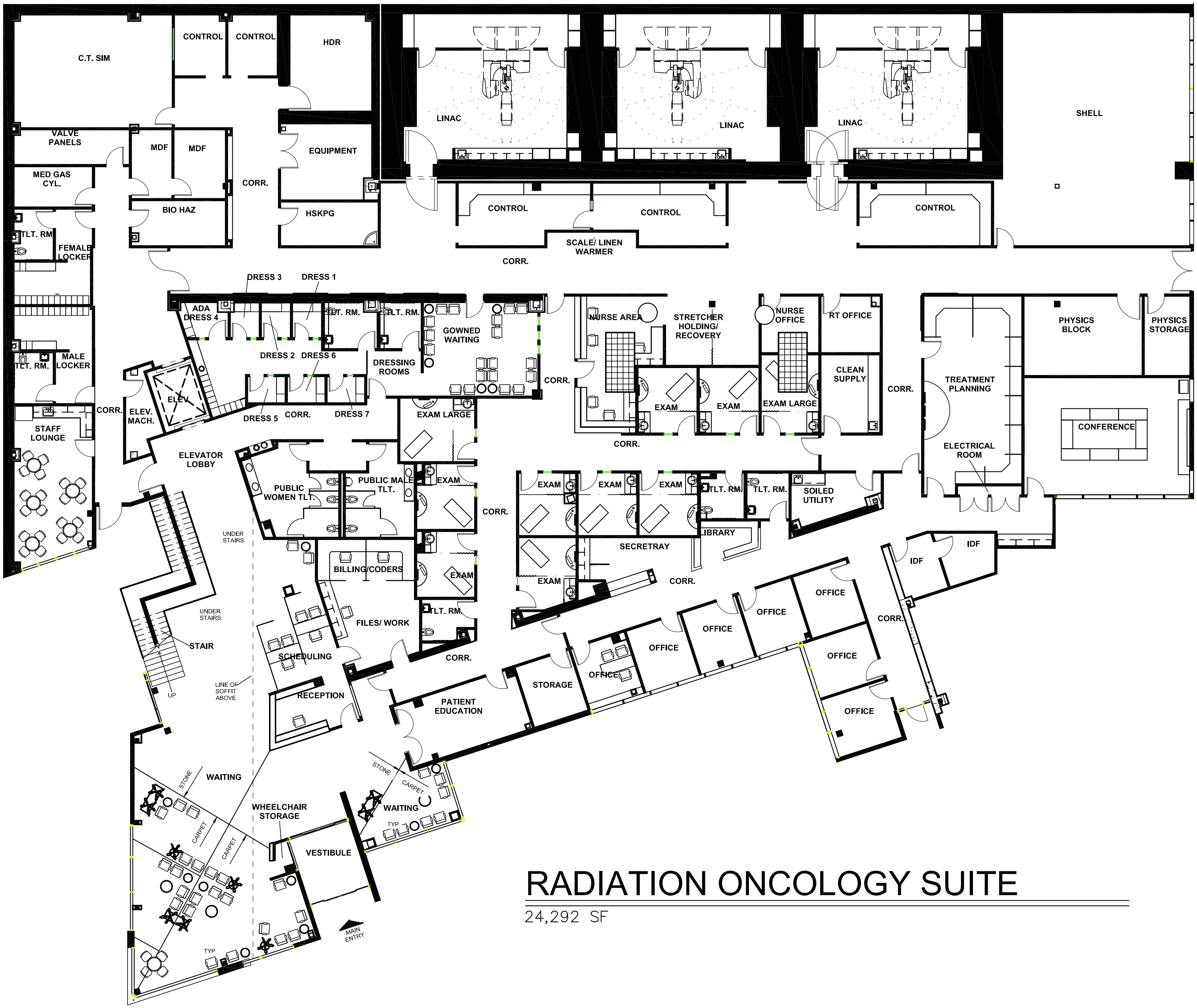
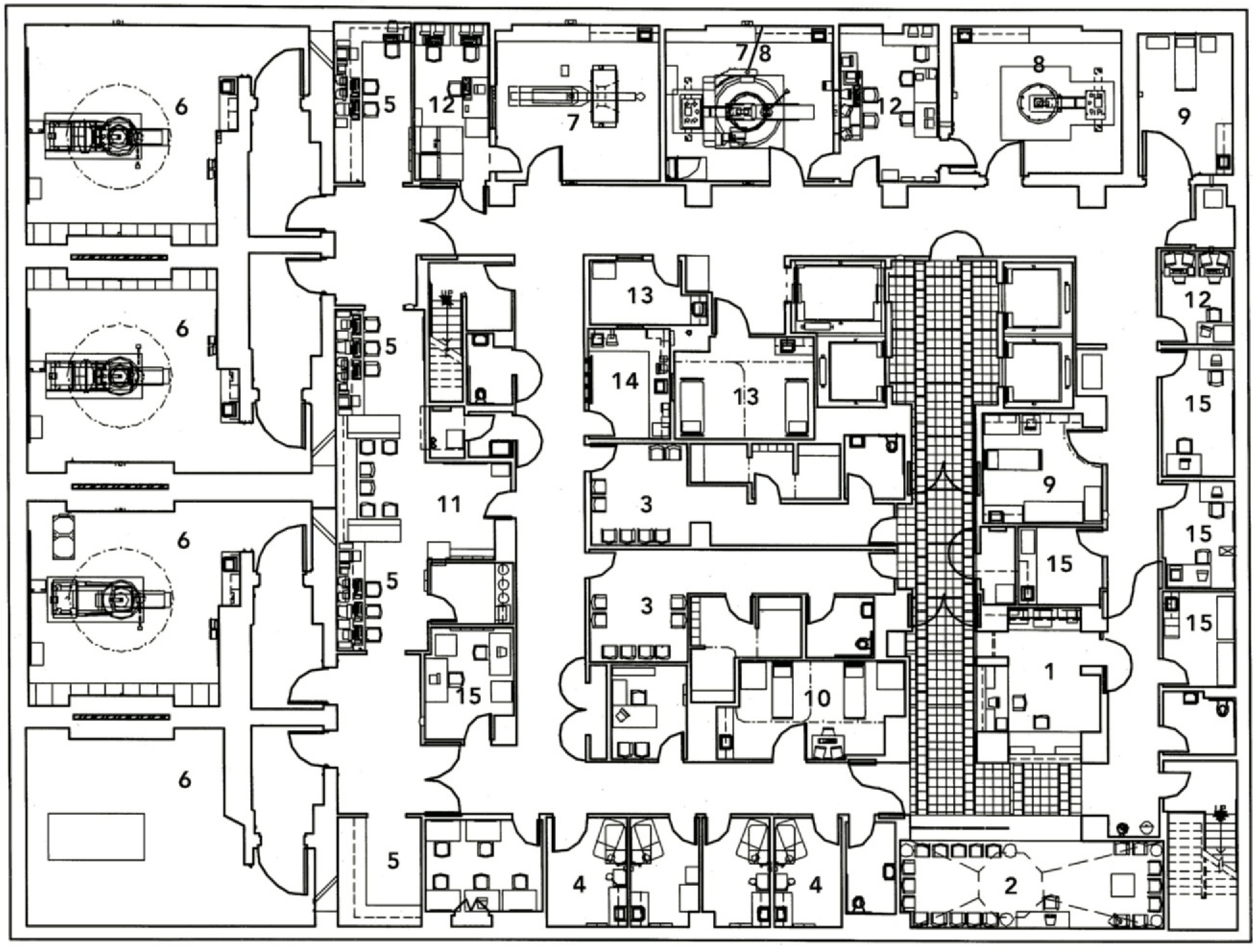


Figure 6-33. Floor plan of radiation oncology suite, 24,292-square-foot, freestanding building. *(Courtesy of TAYLOR)*

Sub-Basement



MOUNT ZION COMPREHENSIVE CANCER CENTER

RADIATION ONCOLOGY

1. Reception
2. Family Waiting
3. Gowned Waiting
4. Exam
5. Linear Accelerator Control
6. Linear Accelerator
7. CT Simulation
8. HDR Imaging
9. HDR Procedure
10. Hyperthermia
11. Image Review
12. Control
13. Patient Holding
14. Nurse Station
15. Work Area / Support

Figure 6-34. Space plan for radiation oncology suite, University of California San Francisco, Mount Zion Comprehensive Cancer Center. *(Architecture and Design: SmithGroup, San Francisco, California; Photographer: Michael O'Callahan)*

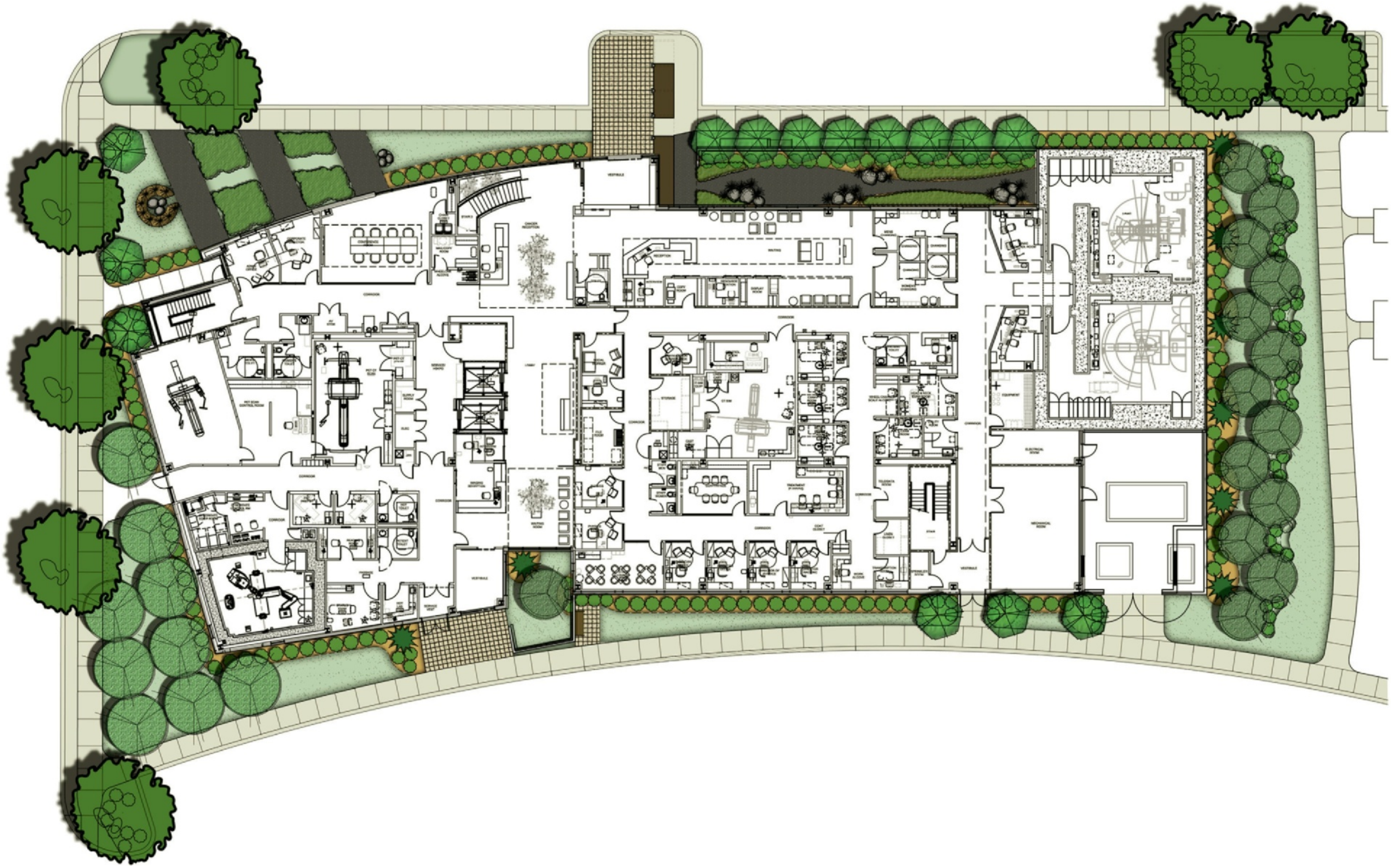


Figure 6-35. Floor plan for radiation oncology suite. *(Courtesy of Ewing Cole)*

aesthetic environment. While some facilities do have an uplifting ambience, many are "plain vanilla" without proper storage for equipment and accessory items that creates a cluttered visual appearance not unlike walking into a friend's garage.

Color Plate 18, Figure 6-7 features a floor that has the warmth and appearance of wood and suggests—in what is truly a concrete bunker or tomb—that there is a skylight with views of nature overhead. The mosaic tile wall is a water wall. In Color Plate 19, Figure 6-9, a sky with treetops is visible. These backlit film images are extraordinarily beautiful and provide much needed diversion for patients undergoing radiation therapy. Linear accelerators with multi-leaf collimators have software that programs the setting, thereby performing the function of what lead blocks and molds would have done. This has changed the design of linear accelerator rooms because it reduces or eliminates the need for shelves or racks for lead molds and the requirement for a room where molds are poured.

In the Mount Zion installation (see Figure 6-34) a PermaGrain real-wood floor (has a clear acrylic coating and meets all fire codes) is complemented by a wall of wood casework that conceals the positioning light, plumbing, and electronic equipment. As patients enter the room, their eye is drawn to back-lit panels of fabric that have the feeling of a shoji screen. There are five different lighting settings that change the color at the patient's request. Although this is an older facility that was included in the third edition of the book, it is worthy of discussion in this edition because of its planning concepts.

The layout of the vault is innovative in that it addresses psychological issues of the patient as well as functional issues to reduce the weight of the shielded door which, in turn, affects the time it takes for the door to open and close. There is a double-door entry so that the patient walks through a wooden architectural door that has a "soft" appearance. The gigantic, thick, shielded door is out of view and, by the time a patient encounters it, it is in the fully open position and the eye is drawn to the beauty of the ceiling. Typically, linear accelerator vaults have a maze design to deflect the radiation. The layout of this department is notable for excellent space planning: the separation of male and female gowned waiting areas, functional adjacencies of rooms, and corridors without jogs to make wayfinding easy.

Other components of a radiation therapy facility include dressing rooms and examination rooms, along with the radiation physicist's office, which has a large computerized workstation, and a tech work area with TV monitors that allow techs to view patients in the therapy room. A large conference room is needed to enable the entire treatment team to meet to plan treatment for each patient. The physicians who work in this specialty are called radiation oncologists.

Most rooms of this suite, including the linear accelerator room, may be carpeted.

BONE DENSITY SCANNING (DEXA)

A DEXA bone densitometry scan is used to measure bone loss and to diagnose osteoporosis. A small amount of ionizing radiation creates the image with measurements taken usually in two locations: the hip and the spine. A diagram is printed showing the results and comparing them with others in a specific age range. The room need not be shielded for this machine and the tech is able to sit in the room with the patient during the exam. A long narrow room works well for this as the machine can be placed along the long wall with the tech sitting at the "head" end of the table operating the control device and looking at a monitor (Figure 6-36).

MAGNETIC RESONANCE IMAGING

Magnetic resonance imaging (MRI) is considered by many to be the most revolutionary imaging technology of the century. Manufacturers of radiology equipment have committed large sums of money to engineering, research, and product development to continually expand the capabilities of MRI. For example, advances in magnet technology have continually reduced the area of magnetic field influence (the Gauss field) surrounding the equipment to the point where it is, for the most part, contained within the

room itself. An MRI suite consists of the magnet room plus an equipment room and a control room that, depending upon the specific machine selected, will be approximately 19 feet wide by 39 feet long.

This discussion will acquaint readers with the basic principles of MRI facility planning and design. Each manufacturer's equipment will vary somewhat in terms of room layout, depending on magnet weight and strength. Manufacturers will supply technical manuals to aid the architect or designer in planning the space (Figure 6-37).

MRI uses computers and magnetic fields to provide noninvasive images of human anatomy. It does not involve radiation but, rather, uses powerful superconducting

Figure 6-36. Lunar iDXA* bone density scanner. *(Courtesy of GE Healthcare)*

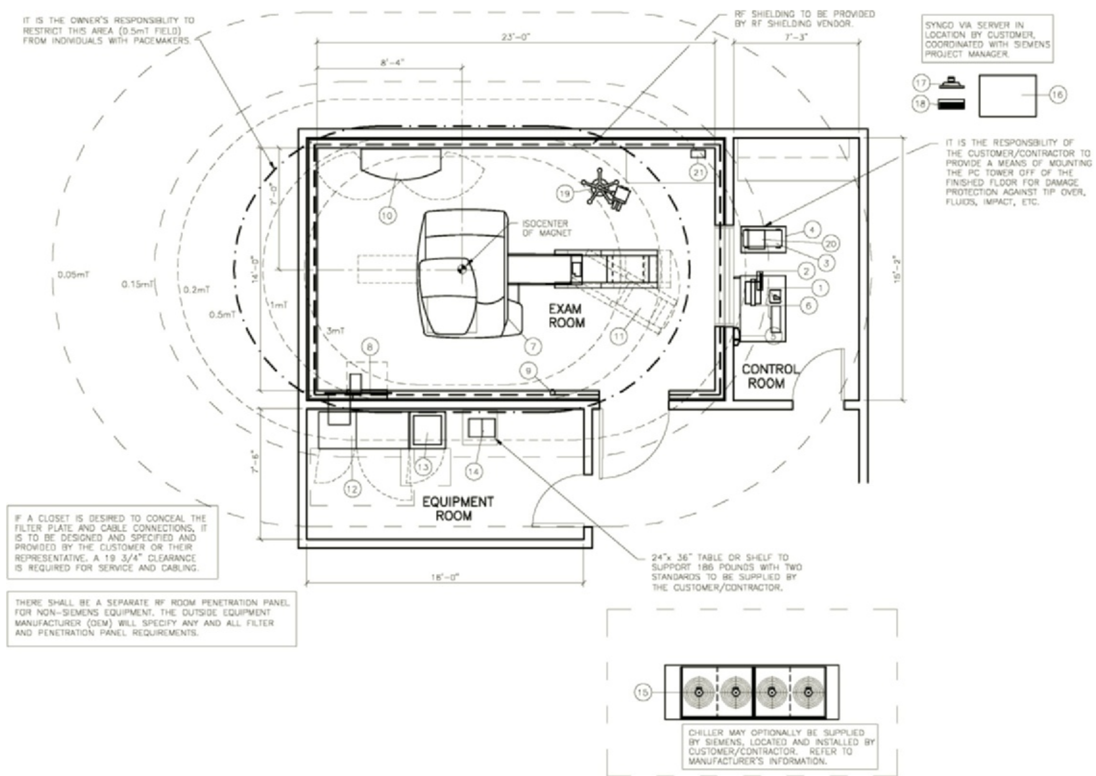


Figure 6-37. Planning diagram for MRI room, Siemens MAGNETOM® Avanto. *(Copyright © Siemens Healthcare 2013)*

magnets to generate magnetic fields 8,000 times stronger than that of the Earth.

High-strength magnets constitute a problem for those who are claustrophobic. The magnet—essentially a cube 8 feet in size—has a fairly narrow channel (the bore) in the center through which the patient's body travels. The "bed" that the patient lays on slides through the bore. As the typical scan may last 45 minutes and one is instructed to lie perfectly still with arms and hands folded across one's chest, it can be a torturous experience that occasionally results in panic attacks, causing the study to be aborted and the patient sedated. Manufacturers have worked hard to solve this problem by developing open MRIs that are lower in strength, and although they cannot be used in lieu of the superconducting magnets for some patients, they are very popular with consumers and frequently marketed to the public in local newspaper and TV ads. Initially, when first introduced, open MRIs were weak, required longer scanning times, and could not perform certain applications. But this is no longer true. It seems the market for open bore machines has expanded because they are also easier for the elderly, for overweight or obese individuals, and for those who have limited mobility. The compact *MAGNETOM® C!* 0.35T by Siemens has a small footprint, a C-shaped magnet, and offers excellent image quality despite being open (Figure 6-38). In addition, it has a sleek contemporary design although it weighs 35,000 pounds. The Philips *Panorama HFO* is another open bore MRI with a sleek design that can be sited on any floor without the need for additional reinforcement, according to the manufacturer, despite the weight of 15,500 pounds (Figure 6-39). Although this has a 1.0 tesla (T) field strength, according to the manufacturer, it is equivalent to a 1.5 T cylindrical magnet yet offers the comfort of being open. Open magnets are used for imaging the knee, shoulder, ankle, spine, and brain, and they can also be used to monitor stroke therapy. The *GE Optima MR430* (Figure 6-40) is a 1.5 T extremity magnet especially useful for athletes and dancers, among others, to diagnose injuries without having to be confined in a cylindrical magnet.

The unit in Figure 6-41 is a 1.5 tesla, superconducting high field magnet (*GE Optima MRT450w with GEM Suite*), with a wide bore and other patient-pleasing features such as acoustic noise reduction and feet-first imaging for all anatomies. This MRI gets high performance reviews in radiology magazines.

The trend is toward superconducting magnets with shorter bores such as the 3.0-tesla magnet (GE *Discovery MR750*) in Figure 6-42. The reduced size also results in reduced weight. However, many of the older MRI units (with deep bores) will still be in service as there are no moving parts and the software can often be upgraded. How the data are processed is the important issue. A dedicated phone line into the system allows the software to be upgraded (or, occasionally, remote diagnostic troubleshooting to be carried out) during the night without disruption of patient scheduling during the day.

Enhancing the Patient's Experience

In recent years, there has been a focus on the patient experience, which for MRI, means reducing the noise and vibration during image acquisition and reconstruction. It has been likened to a jackhammer and causes an additional layer of stress for a frightened patient. GE has introduced *Silent Scan* that reduces the noise to 77 decibels, which is close to the ambient environment with just the humming of the machine in "idle" mode. Toshiba boasts of the quietest scanner on the market with its *Pianissimo* technology and also addresses the claustrophobia issue by having both the shortest bore and the widest bore opening as well as offering feet-first imaging. The Siemens 1.5 T *Magnetom® Avanto* with *Tim®* (Total Imaging Matrix) integrated coil technology and *Dot®* workflow solution system achieves a dramatic reduction in acoustic noise as well as short scan times (Figure 6-43). This machine has a comprehensive application range up to whole-body imaging. As for industrial design, it is sleek and elegant, remarkable for a machine of this scale and bulk. A shorter scan time is another feature of a number of new technology machines.

Feelings of claustrophobia can be lessened in long bore magnets through the use of virtual reality. A patient can wear a visor that delivers 3D video at very high resolution. Some patients are comforted by listening to music

Figure 6-38. Open MRI, MAGNETOM C!™. *(Copyright © Siemens Healthcare 2013)*

from headphones, and this helps to block out the noise of the machine. Soothing images and sounds of nature are another strategy. The Philips *Ingenia Ambient Experience*, based on research garnered from a collaboration with The Center for Health Design, is the result of several years of pilot studies and experimentation to create a multisensory environment that transforms the patient's experience in the most positive ways (Figure 6-44). It offers both adults and children a variety of options and choices to suit individual preferences for music, color, and visual imagery projected on the wall. Imagine how soothing it would be to see a large video projection of dolphins swimming while

Figure 6-39. Philips' Panorama HFO open MRI. *(Courtesy of Philips Healthcare)*

listening to the sound of waves, and being enveloped in blue light. A YouTube video produced by Philips displays the "layers" of environmental options available to reduce stress. To begin with, the clutter of equipment and accessories that make MRI rooms so intimidating is concealed behind walls; corners of the room are rounded; integrated cabinets for coils conceal accessories. A control panel allows patients to select the color of LED to wash the walls and to select the video they would like to see as well as the audio (sounds of the seashore perhaps or music) to create a truly personalized multisensory immersive environment. Topping it off, literally, is a large oval halo of colored light encircling the machine. Truly soothing, truly amazing. Much of the Philips research for this project was done in pediatric hospitals for obvious reasons. Children usually have to be sedated for MRI examinations to calm them and keep them still. This has been a tremendous advance that is so much healthier and comfortable for pediatric patients and their parents, as well as helping to relieve the anxiety of staff. Economically, it increases throughput and results in fewer restarts and aborted procedures due to patients' discomfort and anxiety. Philips Ambient Experience is also available for CT examination rooms. Philips, in developing this product, became a Pebble research partner with The Center for Health Design (healthdesign.org) to develop studies to measure the effectiveness of specific images and the strength of the stress-reduction effects.

GE has also developed a patient-centered environment called *Caring MR Suite* in collaboration with PDC of Hartland, Wisconsin, a company that provides radiofrequency screening and ambient lighting for their MR rooms. This seemed a natural extension of their expertise to "wrap" the room with walls and panels to conceal clutter. Upon entering, patients are given an iPad to set up the theme of the room, selecting music, lighting, and visuals on the ceiling that consist of high-resolution nature images. A docking station makes it possible to hear music, from one's own iPad or iPhone, yet another option to provide a sense of control and mastery over the environment that is known to reduce stress. If a physician has to do a procedure, a tap on the iPad changes the room to white light and another tap restores it to the former theme.

Another offering by GE is the *Adventure Series*, available for all modalities. In this case, the room is wrapped with colorful cartoon-like graphics that transform it into any number of make-believe settings that are so complex that the machine, as large as it is, gets lost. The graphics even cover some of the machines. There is an MR Camp Adventure in which the scanner is the "tent" and the loading table is the sleeping platform; a CT Pirate Island Adventure; and a Nuc Med Jungle Adventure in which the loading table is a canoe and the child's imagination is focused on a jungle safari down a river. These can be viewed on the GE Adventure website.

Acoustic wall treatments help to provide a quieter environment when the patient enters the room, which may lessen the patient's anxiety. Once the study is underway,

the noise increases, and the acoustic attenuation in the room may not lessen the noise for the patient inside the bore. If this is frightening to many adults, imagine how traumatic it can be for children, although parents can be in the room for comfort, and diversions such as the virtual-reality video with cartoons may help.

Innovation in MRI is continually advancing as digital technology enables ever higher levels of sophistication in imaging. For example, interactive software allows radiologists to pan around the patient's anatomy in real time to find the most appropriate locations to image. It can also measure how long it takes for a contrast agent to travel from the point of injection to the blood vessel being studied—physicians can do studies in real time as patients breathe and move.

Planning Considerations

Large superconductive magnets (see Figures 6-42 and 6-43) are 1.5 tesla and higher in strength. A number of issues must be evaluated before choosing the site for an MRI facility.

1. Magnet's effect on the surrounding environment
2. Environment's effect on the magnet
3. Corridor/door sizes for transport of magnet during installation
4. Convenient access for delivery of dewars for magnet cryogen replenishment and for servicing the equipment
5. Area of magnetic field influence
6. Radiofrequency interference (RFI) shielding
7. HVAC
8. Power requirements
9. Floor loading
10. Storage of accessory items
11. Interior design

Figure 6-40. MR430 MSK* extremity magnet, 1.5T. *(Courtesy of GE Healthcare)*

Magnet's Effect on Environment

The influence of a strong magnetic field upon the surrounding environment must be considered, although today's magnets are internally shielded and the 5-Gauss field is contained principally within the room as illustrated in Figure 6-37, which depicts the layout for the open MRI in Figure 6-43. In this diagram, the fringe fields are falling outside the room. The 5-Gauss field is the FDA

Figure 6-41. Optima* MRT450w with GEM Suite MR system, 1.5 T. *(Courtesy of GE Healthcare)*

recommendation for safety with respect to individuals who have pacemakers. The Gauss field is measured from the center of the magnet in all directions. If the 5-Gauss line extends outside the room, the area must be secured and a sign posted notifying passersby of the high magnetic field. If the area extends outdoors, it must be secured with a chain-link fence. When the magnet is up and running, the 5-Gauss field must be measured and a report filled out and filed with regulators.

Magnetic fields are three dimensional, extending outward on all sides, above and below, measured from the exact center of the magnet. Related to the magnet's maximum operating field strength, the fringe magnetic field (the measurable stray field around the magnet) decreases in strength the farther one is from the center of the magnet.

People with heart pacemakers are especially vulnerable, as are any sort of electronic or electromagnetic systems. Information on credit cards or magnetic tapes may

Figure 6-42. The Discovery* MR750, 3.0 T magnet. *(Courtesy of GE Healthcare)*

be erased. Even more sensitive are cathode ray tubes, image intensifiers, or other types of electronic equipment commonly found in diagnostic imaging systems. These must be kept out of the 1-Gauss line. (As a point of information, gauss and tesla are units of measurement of magnetic field strength. 1 tesla = 10 kilogauss.) An assessment of all adjacent areas within the influence of the magnet is required to carefully identify the presence of equipment, people, or materials that may be sensitive to the magnetic field.

Environment's Effect on Magnet

The presence of ferrous material within the vicinity of the magnet can adversely affect the equipment's performance. Ferromagnetic material may be either stationary or moving. Moving objects may include an elevator in the vicinity of the magnet, a passing automobile, or a piece of garden maintenance equipment. Structural steel beams and reinforced concrete in floors, ceilings, or walls are examples of stationary materials that may interfere with a distortion-free image.

The negative effects of stationary material can sometimes be minimized by positioning the magnet symmetrically between and/or parallel to the ferromagnetic objects. *Shims* (energized coils that provide a magnetic field opposite to the one causing the disturbance) are another method of compensating for stationary ferrous objects. The most critical area is the floor immediately under the magnet. Each manufacturer has a specification on the allowable number

Figure 6-43. MAGNETOM® Avanto, A Tim+Dot System, 1.5 T. *(Copyright © Siemens Healthcare 2013)*

of pounds of steel in a 10-foot-square area under the magnet. The next area of concern is immediately above the magnet, namely, the direction of the I-beams running overhead. If diagonal, it constitutes a problem. The magnet should be parallel and perpendicular to the steel in order not to disturb the magnetic field. High-tension power lines can also affect the magnet. However, one can evaluate the site with a Gauss meter to read the magnetic fields in the vicinity to see how best to site the unit. All metals have a maximum saturation, which means there is a limit as to how magnetized they can become. Stainless steel, for example, is at the low end with little potential to affect a magnet. An elevator in a corridor outside the MRI unit constitutes a large magnetic field that can interfere with the magnet, especially since it is a moving object.

It is critically important to estimate, by taking physical measurements of the site, the influence of moving ferrous objects that may produce an image artifact. Each

manufacturer supplies an overlay grid that indicates, in concentric circles, the Gauss field and indicates the distance, in feet, moving away from the center of the magnet.

There are a number of other issues that should be considered. Light fixtures within the 5-Gauss field must be of nonmagnetic material. Fluorescent lighting must not be used within the R/F shielded room containing the magnet. LED lighting is a good choice but fixtures must be developed for MRI use. Resources include Kenall Lighting, Everbrite Lighting, and PDC Co. Both Kenall and Everbrite also offer LED lightboxes for back-lit images of nature used either in the ceiling or walls of MRI rooms to relieve anxiety. Both websites have suggested lighting designs for MR installations. Appropriate type dimmers may be used within the magnet room. Commonly used medical accessory items such as oxygen cylinders, IV poles, and gurneys may not be used within the 5-Gauss line. Framework for suspended ceilings must be of aluminum. Metal studs, however, may be used in walls.

Magnet Transport Access

Consideration must be given to the transport of a magnet during installation. Corridor and door sizes, as well as floor strength, must be adequate to handle a 15,000-pound superconducting magnet or 35,000-pound open magnet. This piece of equipment cannot be broken down into smaller components. One might wonder how it arrives at the room. It is often brought through the roof or the side of the building. An MRI site should be planned at the time the medical office building is designed so that issues of access can be considered. It's important not just to get it into the room initially, but to think about how one would remove it through a roof hatch or an access panel in the exterior wall. If traveling down a corridor, the load is spread on 2- × 12- × 16-foot-long planks of wood.

Cryogenic Replenishment

Superconducting magnets carry electrical current free of resistance only at cryogenic temperatures, necessitating cooling by liquid helium and nitrogen. Storage cylinders containing liquid helium and liquid nitrogen are called dewars. Facilities no longer store dewars onsite because newer units don't need to be replenished as frequently and the dewars are delivered by a service as needed. It should be noted that although they do not show in the manufacturers' marketing photos, there is a cryogen replenishment "chimney" or turret at the top of the magnet and some cabling. In some models, the cryogen tube folds and is recessed into the machine housing. There is also an electronic box for the gradient and shim coils on the side.

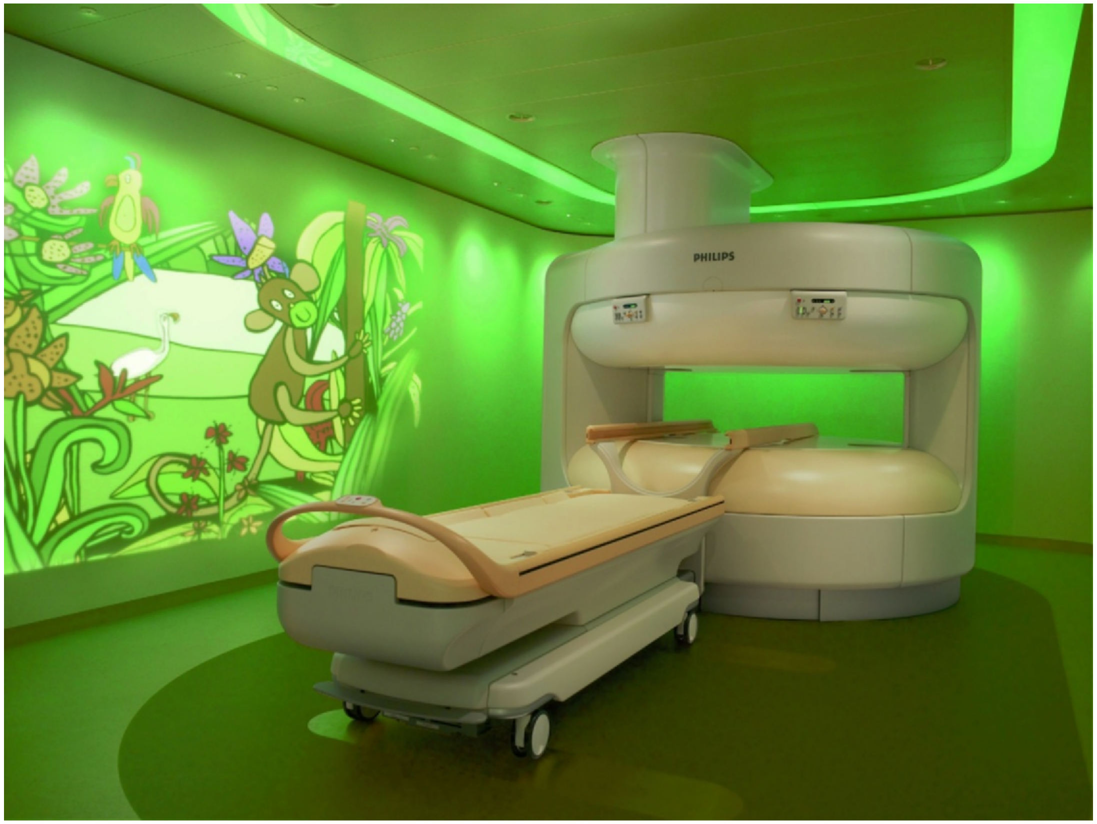


Figure 6-44. Ingenia Ambient Experience gives patients a sense of control with the ability to customize the environment. *(Courtesy of Philips Healthcare)*

Magnetic Field Influence

As discussed previously, the extent of the magnetic field of influence would be determined by the size of the magnet.

A superconducting magnet of 1.5 tesla has a larger field of influence than a less powerful one. Minimum safety distances for objects in the magnetic fringe field must be carefully assessed. Inside the facility, a strict protocol regarding patient screening, the use of metal detectors, and architectural barriers can be used to protect visitors, as well as protect the magnet. A ferrous object in a person's pocket can become a lethal projectile if too close to the magnet. For this reason, it's important to provide lockers for patients' valuables, as all jewelry, wristwatches, wallets, and so forth must be stowed.

Radiofrequency Interference Shielding

There are two types of shielding in an MRI facility. One is shielding to contain the magnetic field (however, machines are currently internally shielded); the other is shielding from radiofrequency interference (RFI). Noise generated by stray radiofrequencies distorts the image. Any penetrations in the room, such as doors, windows, light fixtures, or mechanical ductwork, must be filtered to prevent radiofrequency interference. Some brands of equipment are internally shielded from RFI, thereby eliminating the cost of shielding the room. There are many variables here; sometimes just half the room requires RFI shielding.

HVAC

A careful analysis of the heat output of the equipment must be made, and each area must be individually environmentally controlled so that the heat load in one room does not adversely affect the temperature and humidity of other rooms. An audible thermal alarm may be required in the computer room to alert the operator if the ambient temperature exceeds operating limits. An air filtration system may be required in the computer equipment room. Some units need chilled water for cooling the power supply, while others are air cooled, eliminating the need for water.

A vent system must be provided to exhaust helium and nitrogen to the outside of the building. Precautions must be taken to ensure that the exit end of the exhaust duct does not allow gases to be vented into a closed area or allow access to passersby within 10 feet of the duct in order to protect people from cold burns.

Power Requirements

A power conditioner unit is a component of most MRI systems to assure a clean, continuous power source with minimum fluctuation. A power management system or power conditioner controls electrical surges and spikes, which are the principal causes of computer malfunction.

Floor Loading

MRI magnets (superconducting) average 15,000 pounds, concentrated in a relatively small area. The floor space immediately under the magnet is of critical concern with respect to allowable amounts of ferrous material used in construction of the slab. Manufacturers' recommendations must be carefully followed in this regard.

Storage of Accessory Items

A 24-inch-deep closet should be considered in the procedure room for storage of the body coil calibration kit and for breast and head coils, which are heavy to carry around. If it is possible for this cabinet to be recessed into the wall, it provides a less cluttered appearance in the room.

Interior Design

When MRI was first introduced, it was thought that any ferrous substance would negatively affect image quality. Very expensive construction techniques using totally nonferrous materials were standard procedure. Wood beams, glued connections, stainless steel nails, fiberglass, copper, and aluminum were considered appropriate construction materials. Now, however, manufacturers generally agree that shimming of the magnet is able to compensate for *static* ferrous building materials. The use of conventional construction techniques and materials greatly reduces the expense of constructing an MRI facility.

Carpeting may be used in the examination (magnet) room, although it has the potential to create dust and contribute fiber particles to the air that may affect the equipment. If used, manufacturer's specifications must be checked to verify that the carpet has the proper amount

of static control. The computer room will generally have computer-access-type flooring, making this an optimum base for the installation of carpet tile. Many MR rooms will have wood flooring, whether acrylic-impregnated real wood or simulated wood resilient flooring because it is more functional and practical than carpeting.

The ceiling height of the magnet room will generally be 9 or 10 feet for a superconducting magnet. Ancillary areas will usually be 9 feet in height.

A view of the outdoors or a garden can occasionally be achieved in the siting of the unit. A simulated view of nature can be achieved with back-lit film transparencies overhead. Considering the cost of this equipment and the inherent fear and anxiety that many patients experience, it is tragic to find these units placed in rooms with no interior design amenities. A wallpaper border does not constitute interior design and does nothing to relax patients. Bland, clinical diagnostic imaging environments are created all too often. It is hoped that the photo images in this book will stimulate a desire to go beyond this. As an example, the spa design for the Toshiba MRI international marketing showroom in Tustin, California, was developed to demonstrate to potential customers an approach to reducing patients' anxiety (see Figure 6-10).

CLINICAL LABORATORY

Laboratory tests are a vital tool in diagnosing disease. A basic part of a thorough examination, a certain number of these studies may be performed in a small room within the physician's office, in a clinical laboratory located within a medical office building, in an adjacent hospital, or in a distant laboratory. A physician may take a blood or urine specimen from a patient but send it out for testing to a reference laboratory. Others will do simple tests in the office, but send out the more complicated ones. The *i-STAT*® handheld analyzer (see Figure 3-71) is an example of powerful small devices that make it possible to perform a variety of tests in physicians' offices without having to send a patient to a lab. It requires just a few drops of blood. The instrument performs the following "waived" tests: blood gases and electrolytes, glucose, hematocrit, hemoglobin, and other blood chemistry tests. The *i-STAT*® performs a variety of other tests that are not CLIA waived and therefore cannot be performed in a physician's office unless the lab has a CLIA Certificate of Compliance. Waived tests, according to CMS, are "simple laboratory examinations and procedures that have an insignificant risk." These include dip stick urinalysis and drug testing in addition to those tests listed above. Refer to Chapter 3, CLIA Compliance, for a discussion of waived and nonwaived tests and how CLIA has affected what tests physicians ordinarily do in their offices.

The designer of a medical office building will most often encounter small clinical labs. Large labs, employing a pathologist, will usually be designed by a lab specialist experienced in the planning of such facilities. It is unlikely that a large clinical lab will be included in a medical office building if that building is adjacent to a hospital. Sometimes a "drawing station" will be provided in an MOB with specimens processed and tested at another location (Figure 6-45). This discussion, then, is limited to introducing the reader to basic laboratory processes and space requirements—some of which will occur in a small laboratory facility.

CLIA AND OTHER REGULATIONS

The Clinical Laboratory Improvement Act (CLIA), reported in the *Federal Register*, imposes strict regulations on laboratories, some of which may affect design but mostly deal with processes and procedures, safety, billing, recordkeeping, and the like. At the outset of a project, it's important to understand the requirements for accreditation and licensing by a potential number of agencies. In addition, OSHA has many standards and regulations that assure the safety of laboratory personnel such as an eyewash device (Figure 6-64) which must be an OSHA-approved design.

Development of the Requirements

As with all medical suites, the success of a well-designed laboratory is dependent on a thorough understanding of

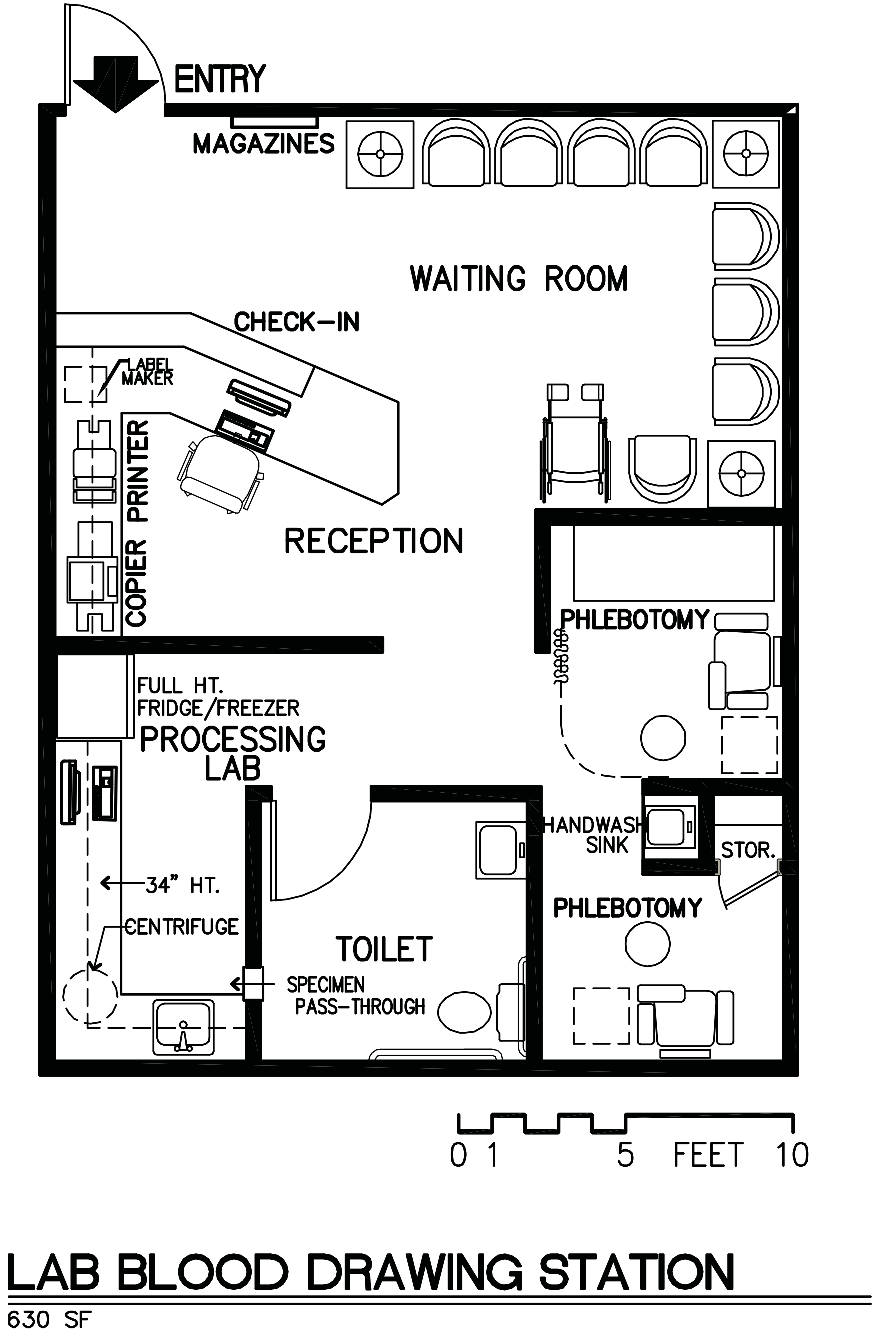


Figure 6-45. Space plan of a phlebotomy suite, 630 square feet. *(Design: Jain Malkin Inc.)*

needs—a written description of all requirements that must be incorporated into the design.

The following checklist will serve as a guide:

1. List the procedures that are to be performed. They will vary with the medical specialties of the building's tenants.
2. Analyze the space in terms of projected equipment and personnel in three areas:
   a. Administrative.
   b. Technical.
   c. Support (includes biohazardous waste storage, reagent and supply storage, computer hardware, clean and dirty lab coats, lockers, and laboratory records). Storage is required at workbenches for manuals, disposables, and constantly used items. Open shelves and closed storage are required.
3. Review sizes and specifications of major pieces of equipment. Tabulate the lineal feet of high and low countertop space required for each item or area and note required adjacencies. Determine if equipment will have special plumbing, electrical, and temperature requirements.
4. Determine which procedures may be combined in the same work area and which require separate areas.
5. Divide technical areas by functional units: hematology, chemistry, microbiology, urinalysis, serology, but (except for microbiology) do not enclose them with walls; an open area is more flexible (Figure 6-46).
6. Estimate the volume of tests in each functional unit in order to determine the number of tech workstations required.
7. Review desirable functional adjacencies (Figure 6-47). For example, urinalysis can be combined with either chemistry or hematology. Hematology can be located near the blood drawing area since those specimens do not require additional processing prior to analysis. The prevalence of disposables and premade reagents

has eliminated the need for glassware and sterilizers. Small laboratories have a limited staff; therefore, technical modules need to be clustered together so that staff working in each unit can support each other.

8. Allow for future expansion. If any units are expected to expand in terms of physical space, they would best be located in the area of the suite adjacent to the laboratory and where expansion may easily occur without infringing upon existing critical office functions.
9. Review utility requirements for all equipment carefully. Separate electrical circuits are required for many instruments in order to avoid fluctuating voltage, which adversely affects the accuracy of the instruments. During construction, it is a good idea to leave room in the panel for future power requirements and potential need for a 220-volt circuit. Of course, a UPS is critically important.
10. Determine which equipment and space, if any, will be shared. Depending on the size and volume of testing performed in the laboratory, either common-use or dedicated refrigerators, freezers, computer terminals, and clerical space will be needed. Based on workflow, in some space plans, the refrigerators and freezers may be banked together in a location convenient to all workstations. These will need to be anchored to the wall in earthquake-prone areas. The refrigerator is a wide, laboratory type with glazed doors, and the freezer an upright model.
11. Allot storage space for supplies used on a daily basis in each technical module. A storage room would be used for bulk purchase of supplies.
12. Consider environmental factors such as ventilation, light, and isolation of equipment that may be noisy or produce heat when used.

Technical Modules

The following descriptions of technical modules will familiarize readers with standard methods of processing

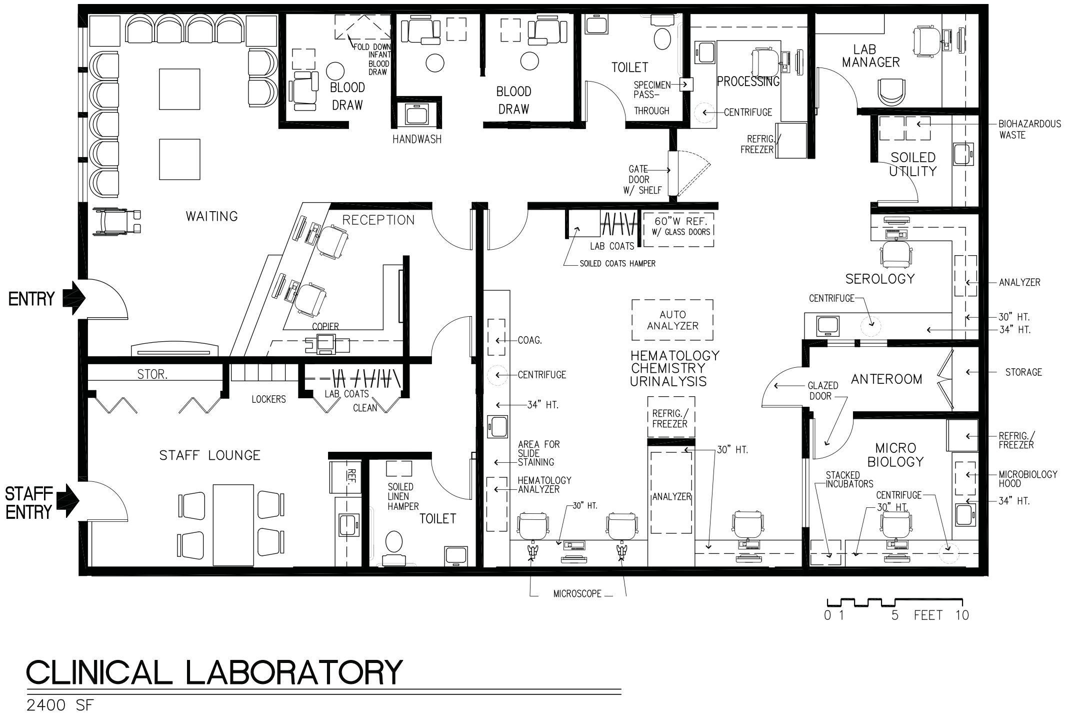


Figure 6-46. Space plan of clinical laboratory, 2,400 square feet. *(Design: Jain Malkin Inc.)*

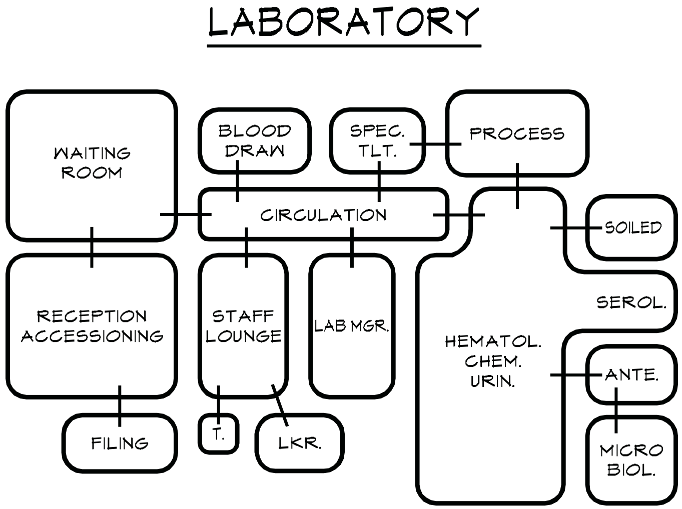


Figure 6-47. Schematic diagram of clinical laboratory.

samples. Electronic, automated clinical analyzers are the standard for all labs regardless of size.

Hematology. This is the study of the cellular components of blood. Procedures performed in this area are those most frequently ordered by a physician such as complete blood counts (CBCs); thus, this module should be located close to the phlebotomy (blood drawing) station for most efficient workflow (Figures 6-48 and 6-49).

One-half of the module should be set aside for procedures such as sedimentation rates (a level, stable work surface is needed), the hematology analyzer, and slide staining. Another portion of the work surface (at 30-inch height) should have kneespace for sit-down work at the microscope (Figure 6-50). If there is a centrifuge (Figures 6-51 and 6-52a and b), due to its noise and vibration when in use, it should be placed in an area where it will not disturb anyone or interfere with the microscopic examination of slides. In a small-volume lab, a refrigerator/freezer, desk, and computer should be centrally located for use by hematology, urinalysis, and chemistry. Critical adjacencies of equipment are dependent on staffing and whether one tech is doing a few tests in each area. If, because of the physician mix or the presence of an ambulatory surgical center, coagulation tests, such as prothrombin

Figure 6-48. COULTER® HmX hematology analyzer. *(Image courtesy of Beckman Coulter, Inc.)*

Figure 6-49. Hematology analyzer in blood draw lab. *(Photo: Jain Malkin)*

Figure 6-50. Microscope workstation in clinical laboratory. *(Photo: Jain Malkin)*

Figure 6-51. Centrifuges in clinical laboratory. *(Photo: Jain Malkin)*

Figure 6-52a and b. Microfuge® 20R. *(Image courtesy of Beckman Coulter, Inc.)*

time, are to be done, they would be performed in this unit. Additional benchtop space would be needed for a coagulation instrument and a high-speed centrifuge. The hematology analyzer is often a benchtop instrument (see Figures 6-48 and 6-53). The Siemens *Stratus*® *CS* analyzer is used for cardiac assays to determine myocardial ischemia (Figure 6-54).

Chemistry. A variety of chemical procedures are performed here. Most manual testing is done at a 34-inch-high countertop, but a lowered kneespace area should be provided for seated procedures or benchtop instruments. There should be floor space for larger multi-test instruments in laboratories supporting a large number of physicians (Figures 6-55 and 6-56). One countertop will have open shelves above for chemicals used during procedures, for disposables, and constantly used items. However, these shelves may have a protective barrier such as a 2-inch-high Plexiglas band at the edge to prevent items from falling in case of an earthquake or accident. A sink is required in the chemistry work area; built-in cabinetry would consist of drawers and hinged-door storage below the countertop. It is useful if the bottom drawers in a few locations are file drawers to keep frequently used references at hand. Ninety percent of specimens are blood; 10 percent are urine.

An instrument table or countertop should be available for small instruments or manual tests. The area will require countertop space for a centrifuge. Depending on the volume of work performed in the laboratory, this centrifuge could be shared by specimen processing, if adjacencies exist. In Figure 6-51, at the far left is a label maker for specimen test tubes, with centrifuges to the right side.

Urinalysis. This unit may be located in the hematology or the chemistry module. One-half of the urinalysis work counter is used for microscopic examinations and the other half for chemical procedures. The work surface

Figure 6-53. CELL-DYN Sapphire® multiparameter automated hematology analyzer. *(CELL-DYN, CELL-DYN Sapphire, and CELL-DYN Emerald are trademarks of Abbott Laboratories in various jurisdictions)*

Figure 6-54. Siemens Stratus® CS analyzer is used for cardiac assays. *(Photo: Jain Malkin)*

should be 30 inches high and have a sink or it may be at stand-up height.

Serology and Microbiology. Serology is the study of serum and the body's immunological response to disease; microbiology is the study of infectious organisms. These units may be combined. Parasitology, the study of parasites (normally performed on feces), is included in the microbiology module. Since most work is done in a seated position, the countertop should be 30 inches high with a kneespace for the technologist, space for a centrifuge, and open shelves above for reagents. Some may prefer to work standing up. A refrigerator is needed for the storage of purchased media and reagents. Floor or countertop space must be allocated for both a 37 degree Celsius incubator and a CO_2 incubator. A sink is needed for staining slides and for hand washing. As with other technical modules, drawers and undercounter cabinets are necessary.

Although few small labs will do microbiology, it should be noted that a microbiological hood is required to prevent the spread of infection during preparation of specimens for tuberculosis, fungi, viruses, bacteria, or parasite isolation and identification. This HEPA-filtered biological safety cabinet (hood) may or may not require venting to the outside, depending on the model and health regulations. If at all possible, separate the microbiology module from other modules by full-height partitions to reduce contamination of air and the chance of infection being transmitted to other lab personnel. A window in the door is a good idea to see if someone is working in the room and to prevent the occupant from feeling isolated while inside. This room should have negative air pressure.

Histology. This is the study of tissues. Thin slices of diseased specimens are examined by microscope. During surgery, for example, sections of tumors would be sent to a hospital for a pathologist's report on possible malignancy or other cellular deformities. Small labs in a medical office building would not have a histology unit or a pathologist. Normally, this work would be performed in a hospital or reference lab. Thus, the requirements in equipment and workspace will not be discussed here.

Figure 6-55. VITROS® 350 chemistry system. *(Courtesy of Ortho-Clinical Diagnostics, Inc.)*

Automated Analyzers

It is hard to imagine any laboratories that do not have microprocessor-based hematology and chemistry analyzers, which considerably reduce the number of technologists required and eliminate much of the equipment necessary for manual analysis. Automated analyzers vary considerably in their size and capabilities. All of them are aimed at speed and total automation, freeing the technologist to walk away while samples are being tested.

One may place a blood specimen into the machine, and in a few minutes, the analyzer will complete multiple tests

on the specimen and send the results directly to the laboratory computer. Large analyzers can process hundreds of tests per hour with little manual intervention. Many analyzers fit on a countertop (see Figure 6-49), whereas others require floor space (see Figures 5-55 and 6-56).

Figure 6-56. AU480 chemistry system for small to medium size laboratories. *(Image courtesy of Beckman Coulter, Inc.)*

Large analyzers (see Figures 6-55 and 6-56) cannot be placed close to a wall as they are serviced from behind and need to be 2 feet away from a wall; it is also a good idea to dissipate the heat that is built up. Often these are placed in the center of a room, as in Figure 6-57.

Specimen Processing Area

The lab should have an area designated for organizing of specimens and tests to be performed. Labels with the patient's name, physician's name, and other identification are generated by a computer and sent to a label printer to be applied to specimen vials. This is usually done at the front desk or a processing area (see Figures 6-45 and 6-46).

Generally, a laboratory will need an area for the processing of specimens that are to be tested later or sent to an outside laboratory. A countertop area large enough to accommodate a centrifuge, specimen containers, test tube racks, a computer, and clerical functions is necessary. This area is usually located where the specimens first arrive in the laboratory. A refrigerator and freezer are also needed for specimen storage awaiting pickup.

Central Communication Center

The laboratory is directly linked by computer to physicians' offices and to reference laboratories. Communication into and out of the laboratory is of critical importance. Results are sent electronically to physician offices on a secure portal. A personal computer may be used for laboratory recordkeeping. If the lab sends out a substantial amount of work to a reference laboratory, a dedicated computer, monitor, and printer allow quick access to specimen results from the reference laboratory. This is best located at a desk convenient to all of the technical modules. In Figure 6-46, it is located in the processing area.

Administrative Area

The administrative area consists of waiting room, business office/reception room, staff lounge and locker room and, in a medium to large laboratory, a private office for the director or manager of the lab. These areas should be separated from the clinical areas so that nonlab personnel need not enter the clinical workspace.

Dressing Area for Employees. A lab will often include lockers perhaps in the staff lounge (see Figure 6-46). A staff toilet room at this location is convenient. The dressing area may be combined with the staff lounge but a separation of clean versus dirty areas is important. Since food cannot be stored or eaten in the lab, it is important to provide a room to be used for breaks and lunch. This area should also contain an area for clean lab coats and a linen hamper. Lab coats should be left in the technical area when leaving to use the restroom or break room. A buttoned lab coat is required when working in the lab and scrubs or street clothes may be worn under it, according to the facility's dress policy. Once a lab coat is worn it is considered "dirty" and must be hung separately from the "clean" coats. Employees' personal clothing is considered clean and cannot be hung with "worn/dirty" lab coats.

Specimen Toilet

The toilet room for collection of urine specimens should have a recessed pass-through box in the wall that opens into the clinical area so that urine samples can be picked up by the technician without the patient having to carry the cup out of the bathroom. Stainless steel specimen pass-through units with a rotating turntable and other styles are available from Newton Distributing (newtondistributing.com). They are designed to maintain visual privacy inside the bathroom, regardless of how it is turned. This toilet room, as in any medical or dental suite, must be designed to accommodate the disabled (see Appendix for design options).

Figure 6-57. Hematology analyzer in clinical laboratory. *(Photo: Jain Malkin)*

Drug-Testing Toilet Design

If there is a need for the collection of "chain of custody" drugs of abuse, detected by urine specimens, a "dry" toilet needs to be created. The chain of custody form is a legal document. This requires a mechanism for shutting off the water to the sink and toilet and taping of sink faucets. A plumber can install shut-off valves that allow the handles to be removed so the patient cannot dilute the specimen with water. A colored dye is also added to the water remaining in the bowl so it cannot be used. This type of testing requires a specialized license and is rarely done in this type of lab due to the time required and legal issues.

Blood Drawing

Blood drawing (phlebotomy) can be performed in a small room or cubicle equipped with a straight chair and a

24 × 36-inch table or a prefabricated specialized blood drawing chair. Some prefer a pneumatic adjustable height chair (see Figure 3-67). Privacy is important. If individual rooms or enclosures are not possible, a screen or cubicle drape will protect those waiting from the view of blood being drawn and provide privacy if clothing needs to be removed to access the arm. If space allows, it is a good idea to have one private cubicle large enough to accommodate a built-in bed or bench for drawing blood of patients who may feel faint and for babies or small children. The private rooms in Figure 6-58 are among the nicest this author has seen with natural light, ample space, and good design. Also see Figure 3-68, a lab serving a large primary care group practice. A sink is needed in the area so phlebotomists can wash their hands between patients. This is a good location for a rack to hold glove boxes (see Figure 3-52).

A good rule of thumb is 35 patients per day per phlebotomist; CLIA requires at least three blood draw stations.

Figure 6-58. Phlebotomy draw room. *(Photo: Jain Malkin)*

Auxiliary (Support) Services

Disposal of Biohazardous Waste. Regulations for the disposal of biohazardous waste dictate that an area be allocated for the storage of laboratory specimens, disposable supplies, needles, syringes, and other items that may have come into contact with patient specimens until these contaminated items are collected by licensed disposal companies. Presently, OSHA standards require storage in sharps containers or red bags placed in leakproof secondary containers. A secured labeled area is required for storage until pickup. The soiled utility room can be used for this purpose.

The laboratory has the option, however, of autoclaving its infectious waste prior to its being picked up by the standard refuse collection agency. If the laboratory chooses this option, an additional space large enough to accommodate this equipment will be required in the sterilization room. Criteria for the handling of hazardous materials (i.e., potentially carcinogenic or infectious waste) must be reviewed before designing a laboratory that must meet certification and licensure requirements.

Glass Washing and Sterilization. Today, with the use of disposables and premade reagents, the need for a glass-washing and sterilization area has been almost eliminated. This area used to be larger when lab procedures were done manually. If this module is required, it should be located near microbiology or chemistry. Components of this unit are: deionized water equipment, sterilizer, drying oven, and pipette washer, depending on the laboratory's test volume and mix of procedures. Storage of glassware, chemicals, reagents, and paper supplies should be provided in cabinets. A ventilation hood over the sterilizers would exhaust heat and moisture generated by the equipment.

Record Storage. Most records will be electronically stored but there is a need for shelving for binders (make sure shelf spacing allows enough height so binders can be vertical) for instrument printouts, test protocols, equipment service records, and quality control reports (Figure 6-59).

Future Technology

As with any medical space, there should be some flexibility in the layout to allow for future space requirements as technology evolves.

Figure 6-59. Storage for binders in clinical laboratory. *(Photo: Jain Malkin)*

Utilities

A clinical lab may require gas tanks. External cylinders of CO_2 are needed for the incubator in microbiology. Acid-resistant material for plumbing drains and the U-joint is recommended for sinks that will be used for reagent disposal, which should have plaster traps. Depending on the volume, the substance, and local wastewater regulations, most laboratory waste can be discharged into the sewer but used stain (for staining slides) must be disposed of as red-bagged waste. Devices to prevent backflow are required. It is important to know local codes regarding requirements for waste disposal. Laboratory sinks should be of a noncorrosive material and countertop work surfaces may be chemical-resistant plastic laminate or special ceramic lab tops. Consider the best location for placement of an eyewash device (Figure 6-64). A deionized water supply is needed for the chemistry analyzer.

Air Conditioning and Ventilation

The need for a well-planned, functional air conditioning and ventilation system is critical in a laboratory. Chemical fumes, vapors, gases, heat from equipment, plus the impracticality of open windows, create a health hazard to those in adjacent medical suites as well as to the laboratory staff who suffer repeated exposure. It is not adequate simply to exhaust these vapors out of the roof of the building without considering the dispersion to nearby persons and buildings.

Ventilation requirements for each work unit must be studied so that airflow patterns can be regulated by proper location of supply and exhaust grilles. A competent mechanical engineer should be consulted to prepare this study. Exhaust air from fume hoods should be conducted through noncorrosive ducts to the roof of the building and not be recirculated. The microbiology module should have negative air pressure in relation to surrounding rooms. In addition, slightly negative air pressure between the lab and the medical building should be maintained in order to prevent odors and contaminants from spreading.

Figure 6-60. Clinical laboratory refrigerator. *(Photo: Jain Malkin)*

Something that is often overlooked is the aggregate heat load generated by the analyzers. Inadequate cooling not only makes it uncomfortable for the lab staff but it affects the functioning of the equipment, causing it to shut down.

Power Requirements

A laboratory demands maximum flexibility. Each work surface countertop should have a continuous plug-mold strip and a separate circuit every 8 to 10 feet. Because certain pieces of equipment may draw as much as 15 amperes when warming up, a careful inventory must be made of the power requirements of each major piece of equipment. Automated analyzers are sensitive to voltage fluctuations and may require a constant voltage regulator as well as a separate circuit.

Work areas need shadow-free light, requiring that a fluorescent "shelf" light be mounted below the upper cabinets. Otherwise, ambient light may be supplied totally by ceiling-mounted fluorescent or LED luminaires in sufficient quantity to assure a level of at least 100 footcandles for close work, and 50 footcandles for general illumination.

Consideration must be given, when designing and specifying lighting, to the elimination of glare from data management display monitors associated with clinical analyzers. This may necessitate indirect lighting that bounces off the ceiling for general illumination. The issue would be the same as that encountered in any office where computer monitors are in use.

Emergency backup power supplied by a generator is mandatory for the large analyzers and refrigerators (Figure 6-60). It should be separate from a generator serving other areas of the medical office building. In some labs, chemotherapy drugs are prepared daily for the oncologists in the building, which require refrigeration. If the power fails, these very expensive drugs would have to be discarded. An uninterrupted power source (UPS) is needed for each analyzer and refrigerator.

Interior Design

For years, laboratories have been designed in a neutral color palette because the reflection of colors made it difficult to match samples to a standard or to analyze colors. Today, with automated equipment, matching of specimens to a standard is no longer done visually, although some labs may do certain tests manually, in which case, color matching is an issue. Walls may be any pleasant color the technologist prefers but the overarching concern is that wall color and lighting must allow for accurate reading of color test reactions, pink to red, green to blue, across the spectrum. The floor might have an attractive design created with several colors of vinyl composition tile or it may be sheet vinyl with a confetti pattern. Busy patterns should be avoided.

In the laboratory area, there needs to be wall space for white boards and bulletin boards in the modules. These provide space for messages to other staff members, posting of quality control charts, and changes in test procedures.

In patient areas, provide a place where patients can hang their coats, handbags, and stow their packages or briefcases. This should be located principally in the blood-drawing area. The waiting room needs a secure place for hanging overcoats and umbrellas and for stowing boots.

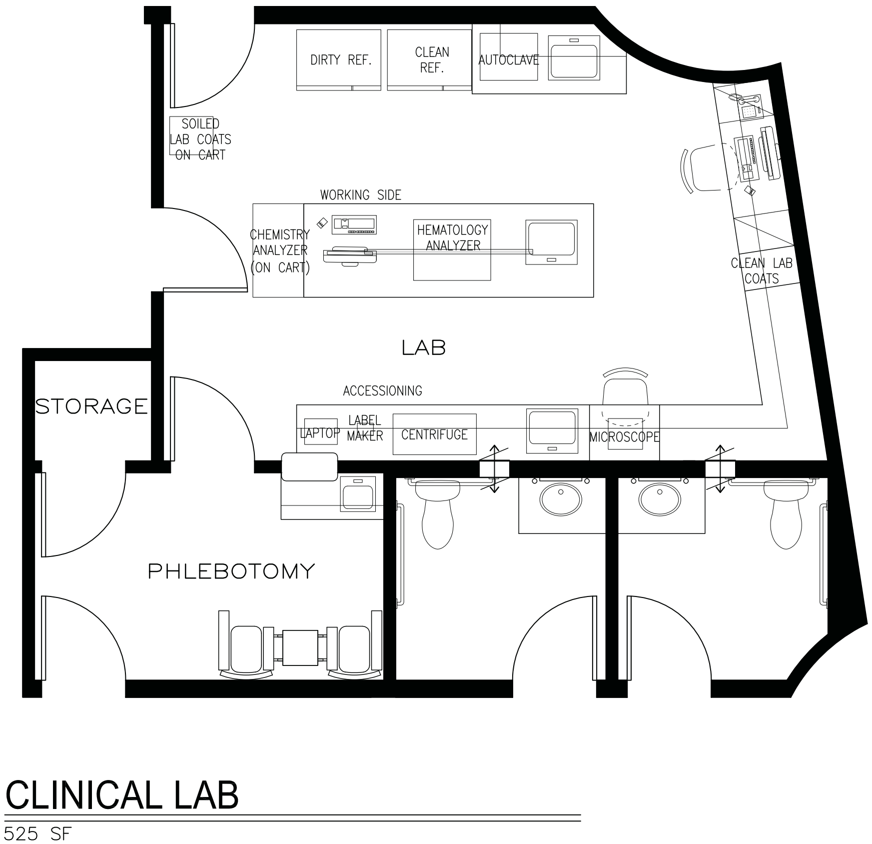


Figure 6-61. Space plan for clinical lab in primary care group practice, 525 square feet. *(Design: Jain Malkin Inc.)*

Small Laboratory

The small laboratory (CLIA licensed) that may be part of a group-practice suite performs the more common and simple laboratory tests (Figure 6-61). This is also known as a *stat* lab, because the tests are generally urgently required. Specimens requiring complex bacteriological or chemical procedures would probably be sent to an outside laboratory. Biopsied tissue specimens would be sent to a pathologist for diagnosis. Thus, the small lab (650 to 750 square feet) would have separate areas for hematology, chemistry, urinalysis, and possibly microbiology, allowing approximately 8 lineal feet of countertop for each, plus three blood draw cubicles, specimen toilet, small reception/waiting area and storage room. With the continuing development of small multipurpose analyzers and “waived” tests requiring minimal workspace, small laboratories may require less space in the future. The CLIA website (cliawaived.com) lists analyzers that do CLIA-waived tests. The small benchtop analyzer in Figure 6-62, the *CELL-DYN® Emerald*, does routine hematology tests such as CBCs. It is compact and weighs less than 20 pounds. The *Piccolo Xpress Chemistry® Analyzer* is even smaller (see Figure 3-70). The *i-STAT®* point-of-care handheld blood analyzer (see Figure 3-71) may also be used in a stat lab.

Figure 6-62. CELL-DYN Emerald small benchtop analyzer for routine hematology tests. *(CELL-DYN, CELL-DYN Sapphire, and CELL-DYN Emerald are trademarks of Abbott Laboratories in various jurisdictions)*

Other Considerations

Following are comments from laboratory managers collected from site visits. Other suggestions have already been incorporated into the above text.

1. There is never enough countertop space (see Figure 6-63). Just accommodating the analyzers and other equipment is not at all adequate. Room is needed for spreading out materials and preparing manual kits (for manual testing) such as pregnancy, mononucleosis, influenza, strep throat, and to make slides for hematology. A centrifuge is needed to spin down urine where these manual tests are done. From observation, 50 percent more countertop area is needed than the layout of equipment would seem to demand.
2. Consider, in planning the flow, where the courier will enter to drop off boxes and pick up specimens. A door is required into processing area.
3. More storage is needed for clean and dirty lab coats.
4. This was mentioned above but cannot be emphasized strongly enough: The heat load generated by the equipment will actually shut down the machines if cooling is inadequate. Also consider the heat generated by the number of occupants working in a small area as part of that calculation.
5. The dedicated emergency generator is hugely important. Imagine if there is a power failure and all the expensive reagents and blood products and patient specimens in the refrigerator are rendered unusable. During a power failure instruments may be processing several hundred specimens. Specimens in process on the instruments may have to be discarded, and patients would have to be contacted to come in for the recollecting of samples, causing a delay in getting important results and reports.
6. A rear door is needed to enable physicians' office staff to make deliveries. Sometimes nurses come down to ask questions.
7. More bookshelf space is required than can be imagined. There are manuals for the instruments, procedures, safety, and surveys that, for a medium size lab, total about 20 lineal feet. Be sure the height allows for a large binder to stand upright (Figure 6-59).
8. Drawers are preferred to cabinets (shelves behind doors).

Figure 6-63. Clinical laboratory countertop space is in short supply in many facilities. *(Photo: Jain Malkin)*

Figure 6-64. Eyewash device, AXION MSR™. *(Courtesy Haws Corporation)*

9. Undercounter refrigerators often do not fit under countertops. This sounds like a simple fix, but it is possible that the person who orders it does not realize that the one specified by the architect should be used because it is likely the design professional took this into account and *made sure* it was coordinated with the clear space under the countertop.

SUMMARY

While interviewing a number of laboratory technicians and managers, a common complaint was that the facility was designed without their input, resulting in some "workarounds" that could easily have been avoided by talking to the people who actually do the work and know it best. Sometimes these were hospital-based labs located in satellite medical office buildings and it is possible that the person meeting with the architect or planner was a system-wide head of pathology or a laboratory manager working more at an administrative level. As with any medical specialty, to design it well and achieve functional flow requires a good deal of onsite observation and speaking to the people in the trenches.

CHAPTER 7

Group Practice

The focus of this chapter is the small to medium-sized group practice—8 to 20 physicians. Large ambulatory-care networks, such as Mayo or Cleveland Clinic or the 100,000- to 150,000-square-feet hospital-based ambulatory facilities that have become so common in the past 10 years on medical center campuses, are far too complex to cover in one chapter. These facilities grow out of a context of politics (relationships between physicians and hospitals as to what departments will be included and how the revenue is to be divided); an analysis of market share; and a sophisticated master planning process that involves workload analysis using computer programs to model various scenarios, analyze revenue stream, allocate space by department, and estimate construction cost. Nevertheless, this book will be helpful at the micro level, as each department is planned, since the basic composition of each specialty suite and the layout of typical rooms, as well as the equipment used, will be relevant. In addition, the many patient-centered features and design ideas will be useful. The reader is reminded to read Chapters 3 and 5 as background for Chapter 7. These include a discussion of digital technology. As a point of information, a good resource for a variety of statistics and information is MGMA, the Medical Group Management Association.*

The point of origin for all group practices is the Mayo Clinic. Founded in 1897, it became the prototype for others that followed, including the prominent Menninger Clinic in Topeka. The Mayo Clinic is reputed to be the world's largest medical clinic. While few can attain this level of achievement, many of the principles upon which the Mayo Clinic was founded apply to smaller group practices as well. These include the sharing or pooling of knowledge, a division of labor that allows physicians to concentrate on their specialty, and a desire to stay on the cutting edge of new technology. It is a teamwork approach to the delivery of medicine. Now, many years later, with the Affordable Care Act (ACA) and patient-centered medical homes, a collaborative care model is gaining prominence across the nation.

There is an ever-increasing trend toward group practice. Economics and the threat of for-profit chains dominating the market have encouraged many solo practitioners to band together in groups to enhance their strength and presence. Moreover, group practice offers physicians more power when negotiating managed care contracts. Although some physicians do not feel psychologically geared to practice in a large organization, and some fear a loss of individual authority in medical matters, group practice does increase a physician's productivity and may lower the cost of healthcare.

In theory, each physician can be made more productive by eliminating the waste and inefficiencies inherent in a solo practice. A solo practitioner may work a 60- or 70-hour week, but perhaps 20 percent of his or her time is spent on office management. A group practice provides a division of labor with sufficient personnel to perform these nonmedical tasks, thereby enabling physicians to concentrate solely on practicing medicine.

Another advantage of group practice is the convenience of having a fully staffed radiology department and clinical lab in the physician's own office. Equipment that might be too costly or underutilized in the small medical office can easily be justified in a large group practice. Other benefits

*Note: Medical Group Management Association (Englewood, Colorado), known as MGMA, is the oldest and largest member organization for group practices, founded in 1926. MGMA represents 13,700 healthcare organizations and 275,000 practicing physicians who provide more than 40 percent of the nation's healthcare (mgma.com).

of a group practice are greater freedom with regard to leisure time. Partners can cover for one another with no lack of continuity in care for the patient. And physicians in a multispecialty group provide one another with immediate access to specialists in other fields. This pooling of resources provides patients more efficient and complete professional services than each physician could provide individually.

Of course, economics plays a prime role in motivating physicians to practice together. Eight physicians in private practice would require eight business offices, eight waiting rooms, possibly six to eight X-ray rooms, six to eight minor surgery rooms—a great duplication of space and personnel. Together, as a group, the eight might have two minor surgeries, two X-ray rooms, one large waiting room, and one centralized business office. More efficient use of space and personnel means more income for physicians and perhaps lower costs for patients. In addition, certain lab tests or X-rays that might otherwise be sent out could be done within a properly equipped suite, netting extra fees for the group practice to reduce office overhead, providing CLIA regulations are met. Refer to Chapter 3 for a discussion about why physicians currently do little lab work within their offices, and to the Introduction for information about HIPAA.

As healthcare approaches the status of a commodity, the pressure on group-practice physicians to meet revenue goals (with compensation often tied to productivity) has steadily increased. The big shift is from volume-based to value-based care, which is a new ball game. The group-practice model that once sheltered physicians from some of the minutiae of private practice has imposed its own sort of tyranny, which, as reimbursement steadily decreases, enslaves them to "beat the clock," seeing ever greater numbers of patients and enjoying it less. In past years, the billing of ancillary services helped to compensate for declining professional fees as managed care continued to dominate the marketplace. However, CLIA regulations and the Stark statute (relates to physician self-referral regulations) have made it difficult to vertically integrate ancillary services to enhance physicians' income without tripping over conflict-of-interest issues and ever more complex compliance requirements.

STARK STATUTE

Stark I

Named after California senator Pete Stark, this statute creates penalties for physicians who engage in self-referral of Medicare patients to clinical labs in which they have a financial interest. Known as Stark I, the legislation was enacted by Congress in 1989.

Stark II

Stark II, enacted by Congress in 1993, prohibits self-referrals for radiology, hospital inpatient/outpatient, and eight other services. Proposed regulations on Stark II, issued in 1998, were considered by many to be confusing and ambiguous, prompting the Health Care Financing Administration (HCFA—now CMA) to issue important changes in the Stark II final rule as a response to formal hearings and criticism. The definition of group practice has been broadened in terms of what qualifies as a "single legal entity," and productivity bonuses and profit-sharing rules have been revised. Significant changes were made to the "in-office ancillary services" exception to ownership and compensation arrangements. The final rule, divided into Phase I and Phase II, is reported in the January 4, 2001 *Federal Register*. Phase I became effective January 4, 2002.

Stark II, Phase III

On September 5, 2007, CMS completed the third installment of Stark which includes an in-office ancillary services exemption, meaning that group practices may have in-house, lab, radiology (except for CT, MRI, and PET), physical and occupational therapy and be able to bill for it without breaking Stark law. If the group has MRI, CT, or PET, it is obligated to post a sign where it is visible to tell patients the names of other local facilities available to them.

ACCREDITATION

At the start of programming, the space planner must determine the type of certification, accreditation, or licensing the group is seeking. Some regulatory agencies have requirements that affect space planning and design (Medicare certification, for example), while others deal with issues of governance, credentialing, quality management and improvement, and clinical records. Periodic onsite surveys and peer review occur. These agencies may include The Joint Commission, Accreditation Association for Ambulatory Health Care (AAAHC), and a number of organizations that accredit managed care enterprises. Refer also to Chapters 5 and 8 for additional discussion of these issues.

TYPES OF GROUP PRACTICES

There are four types of group practices in terms of space-planning considerations. The *single-specialty group* consists of physicians (rarely more than eight) who are all of the same medical specialty. This type of group permits a physician a great deal of freedom since patients usually will accept treatment from any member of the group. This allows for better utilization of all the doctors' time. The single-specialty group represents the majority of group practices and this includes family practice and internal medicine.

The *multispecialty group* might typically be a large clinic offering internal medicine, OB-GYN, urology, pediatrics, family practice, ENT, or any combination of medical specialties. A group such as this could potentially offer many of the outpatient services provided by a hospital: clinical lab studies, diagnostic radiology, physical therapy, chemotherapy infusion, endoscopy, and multiphasic medical screening. A multispecialty group might consist of 20 physicians to several hundred physicians, as in an HMO.

The *internal medicine group* might be a group of general internists plus those with various subspecialties: pulmonary medicine, cardiovascular disease, hematology, oncology, gastroenterology, or endocrinology. A large enough group could support its own clinical lab, radiology department, cardiovascular rehabilitation, and pulmonary function testing.

The *family practice group* enables primary care physicians to expand beyond their individual resources in purchasing equipment and staffing an office. Large family practice groups are often found in small towns, and sometimes they have one or more specialists on staff in an effort to offer the community a wider range of services.

Top Issues in Ambulatory Settings

1. Patient satisfaction issues	**Coming and going:**
	Wayfinding
	Parking and access
	Waiting times and space
	User experience:
	Accommodating the family
	Noise mitigation
	Accommodating users under high distress:
	Communication and information
	Positive distractions and choices
2. Accommodating change	Adopting medical technology
	Adopting and integrating technology
3. Place-centered issues	Entry, screening and waiting zones
	Diagnostic imaging
	Pre-op and operating rooms
	Exam rooms
4. Operational efficiency issues	**Workforce issues: Use of staff and human resources (with implications to the environment and the organization):**
	Aging staff issues
	Labor shortages, such as increased workload, risks, stress
	Direct care worker satisfaction
	Communication among all direct care providers

Source: *Critical Issues in Healthcare Environments*: U. Cohen, D. Allison, and J. Witte, 2009. Concord, California: The Center for Health Design Research Coalition.

PRIMARY CARE CLINICS

The primary care clinic is an extension of the family practice group, which, depending on the extent of ancillary services, can be quite large and self-sustaining. As an example, some may be developed to contract with insurance companies or large employers to provide total care for patients on a capitated (fixed amount per month) basis. There is every incentive to keep patients out of the emergency room (ED) and out of the hospital, since that cost comes out of the medical group's profit. Therefore, some clinics have an urgent care unit to observe and treat patients who might otherwise go to the ED. They also offer fairly extensive diagnostic imaging and lab services. Physicians in these clinics are salaried employees, a number of whom may have a financial interest in the enterprise.

In Figure 3-43, registration, ancillary services, and urgent care are on the first floor with direct gurney access from urgent care to the exterior. X-ray is part of the urgent care center. The primary care facilities in Figures 7-1 and 7-2 are associated with a nearby hospital system, which means that they are designed to be feeders to the ancillary services of the main campus. Therefore, they do not have X-ray or cardiopulmonary testing onsite. Figure 7-2, on the Internal Medicine side, has a lab. These two facilities are located in single-story retail/office complexes with convenient parking. The hybrid nature of primary care clinics can be illustrated by Figures 7-3 and 7-4, which, in addition to the expected components, feature, respectively, a medical oncology unit and a diagnostic breast center. Figure 7-4 has X-ray onsite but Figure 7-3 does not, even though it has an urgent care center. It is likely that it is a feeder to the hospital's ancillary services. This facility is an example of adaptive reuse; it was a 30-year-old former supermarket. (*Author's comment: Figures* 7-3 *and* 7-4 *were carried over from the third edition of this book because they have some good planning features although they predate electronic medical records, digital X-ray, and toilet rooms do not meet current ADA*.)

Centralized waiting and registration areas lead directly to four primary care pods and to diagnostic imaging in Figure 7-4, while the breast center has its own entry and well-appointed waiting room. The flow in this plan is excellent if the goal was to have four distinct primary care pods that don't connect. More recently, with the focus on flexibility, it is likely it would have been planned with a connecting corridor to enable staff to flow "seamlessly" from one pod to another, although this would have resulted in the loss of one exam room in each pod and would interrupt the centralized core services. The symmetry of this layout is appealing and is often difficult to achieve.

HEALTH MAINTENANCE ORGANIZATIONS

In theory, any of these groups can be organized as a health maintenance organization although, since the obligation of an HMO is to provide a full range of health services to its members, it would most likely be only the large multispecialty group that would be prepared to do this. Kaiser is the best-known HMO of this type. More commonly, HMOs contract with medical group practices, individual physicians, and other healthcare providers to provide services for their members who prepay a monthly fee in addition to a fee or copay at the time the service is rendered. For many individuals, this arrangement centralizes and simplifies their healthcare and eliminates debates with insurance companies over what is covered and not covered, and it eliminates the need to individually pay a number of physicians. Members may be issued an embossed identification card that is presented to the receptionist upon checking into the clinic or may enter a PIN number into a kiosk computer. Some healthcare organizations use an electronic handprint for identification. The identification card or PIN has the patient's billing code and other pertinent information coded into it. Thus, although an HMO may have more members than a similar-sized multispecialty group that charges a fee for service, billing procedures are often less complicated (there are no insurance claims to file) and are facilitated by sophisticated data-processing software.

Large multispecialty group HMOs like Kaiser have historically stressed health maintenance on the basis that it

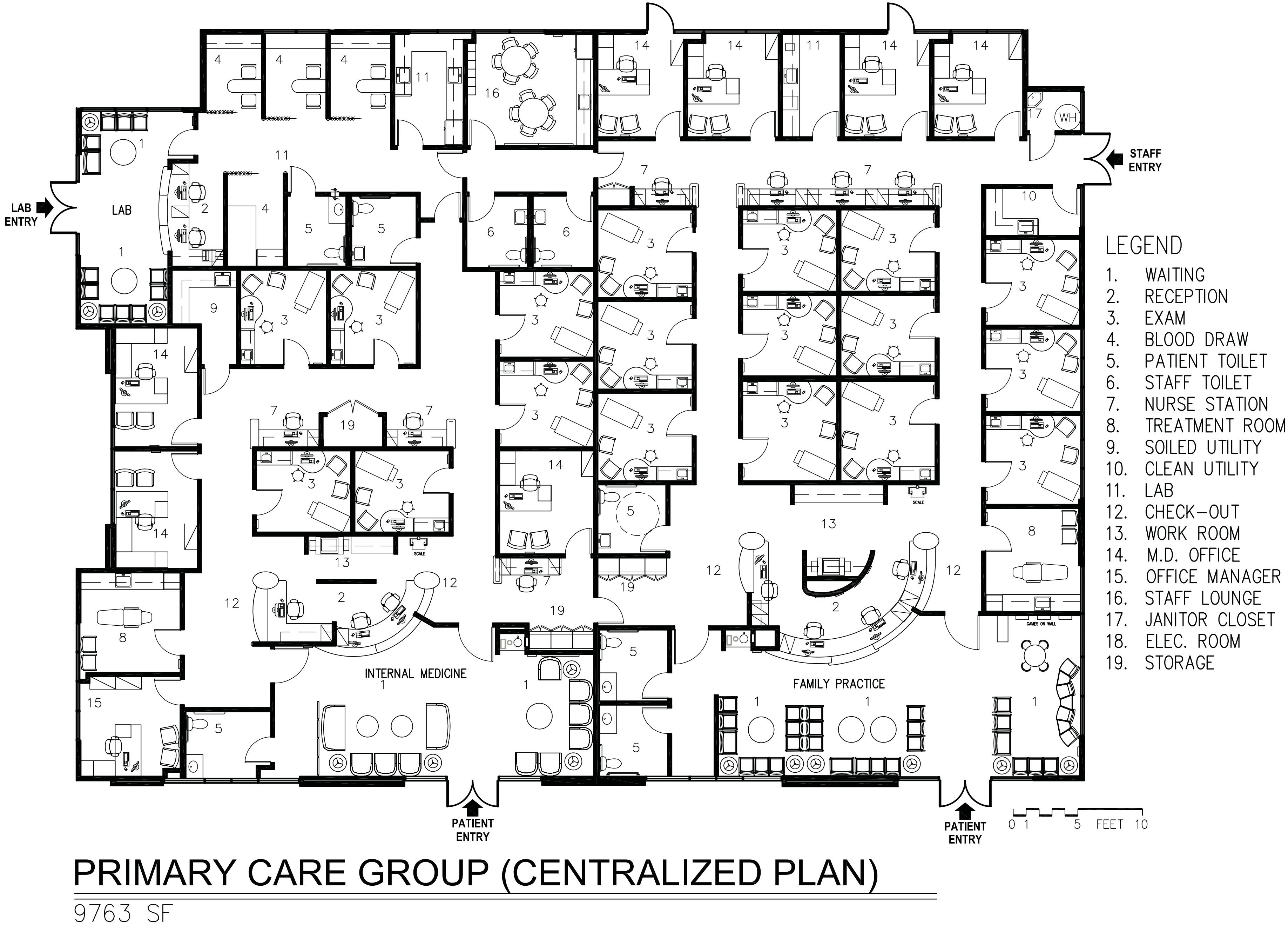
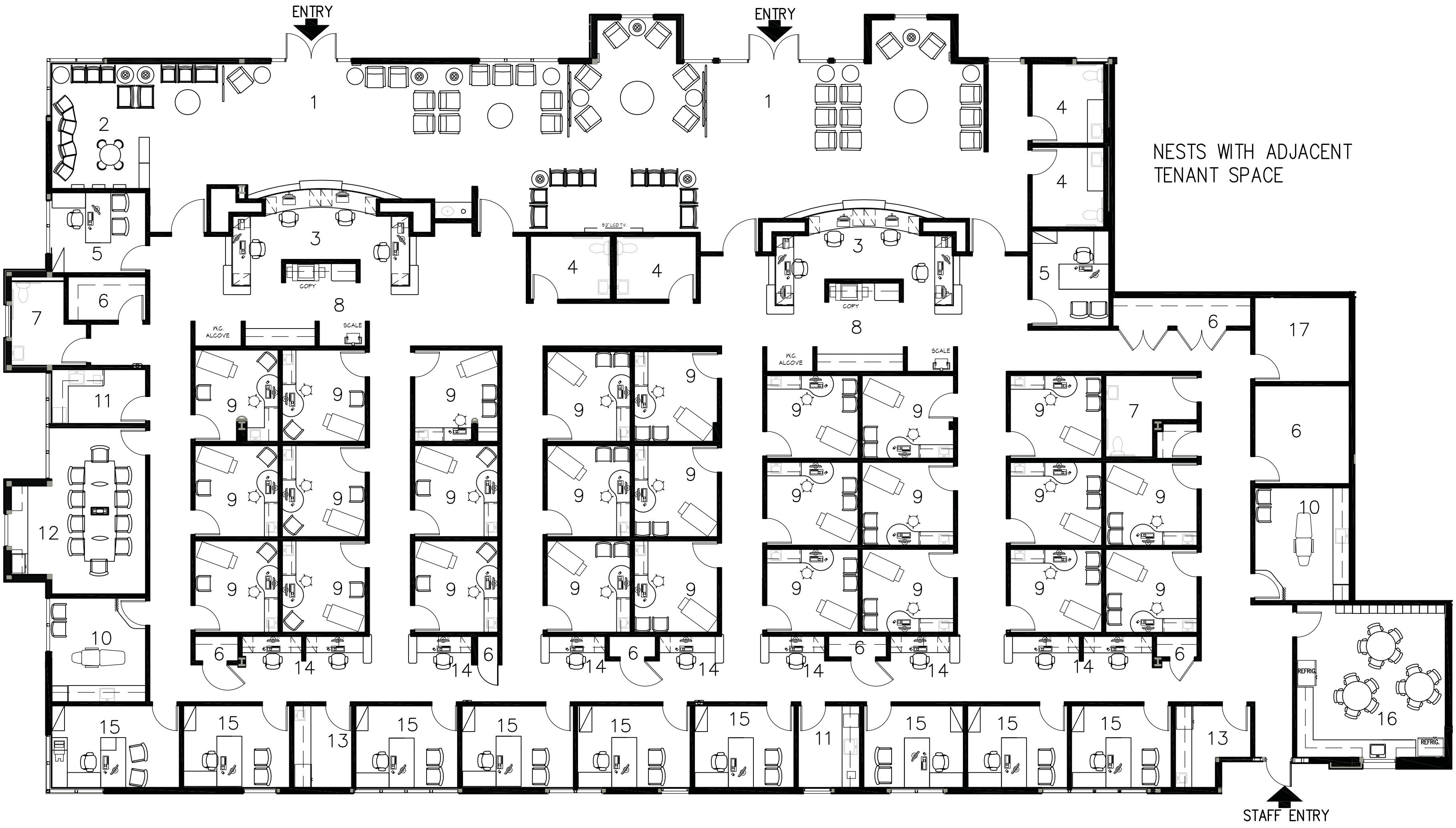


Figure 7-1. Space plan of primary care group, 9,763 square feet. *(Design: Jain Malkin Inc.)*



PRIMARY CARE GROUP (CENTRALIZED PLAN)

13,485 SF

LEGEND

1. WAITING ROOM
2. PEDIATRIC PLAY AREA
3. RECEPTION
4. PATIENT TOILET
5. ADMIN OFFICE
6. STORAGE
7. STAFF TOILET
8. WORKROOM
9. EXAM ROOM
10. TREATMENT ROOM
11. LAB
12. CONFERENCE ROOM
13. CLEAN UTILITY/MEDS
14. M.A. STATION
15. PHYSICIAN OFFICE
16. STAFF LOUNGE
17. TELCO/SERVER ROOM

Figure 7-2. Space plan of primary care group, 13,485 square feet. *(Design: Jain Malkin Inc.)*

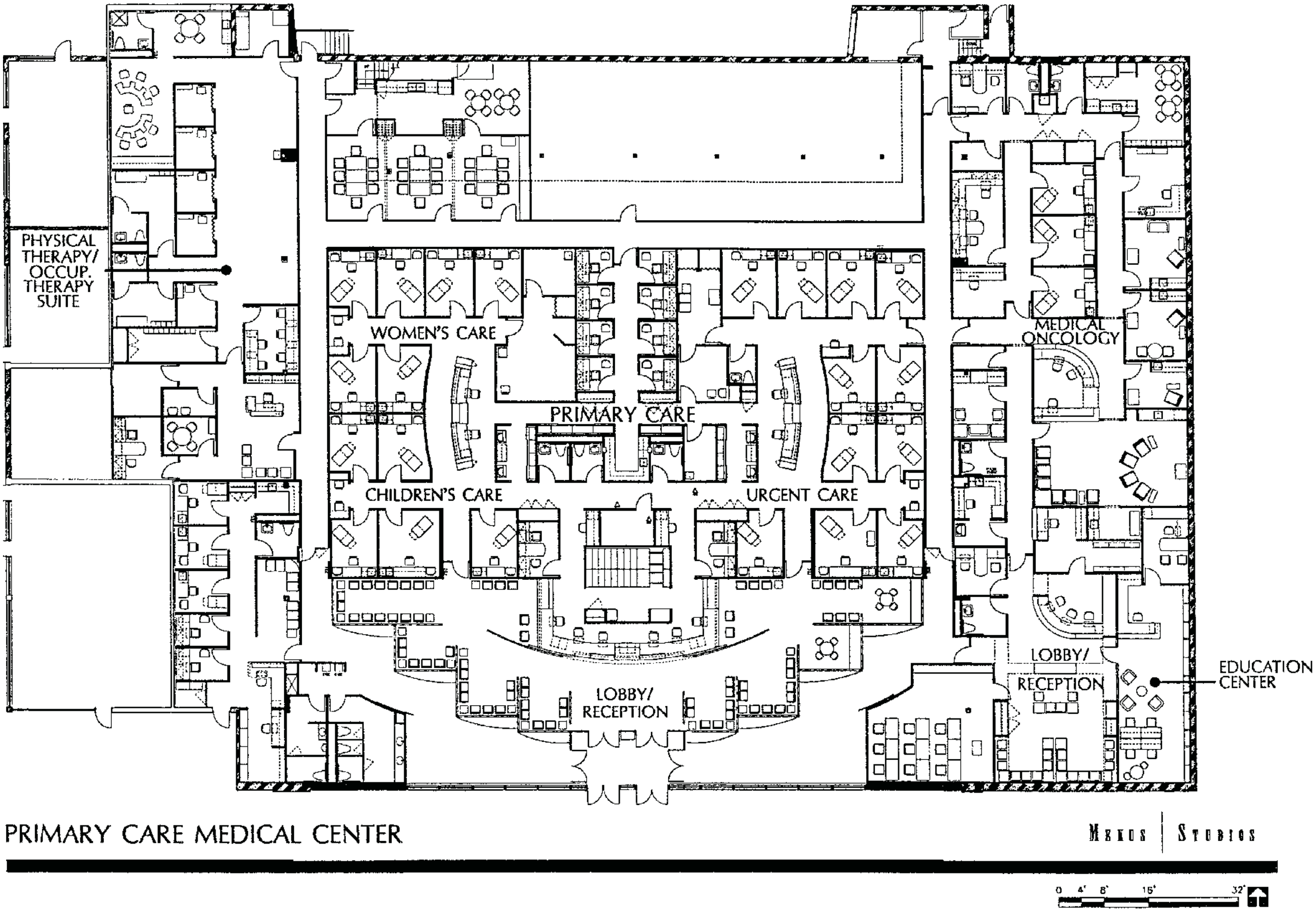


Figure 7-3. Space plan of St. Francis Hospital Primary Care Medical Center, Morton Grove, Illionois, 30,000 square feet. *(Architecture and Interior Design: Mekus Studios, Chicago, Illinois)*

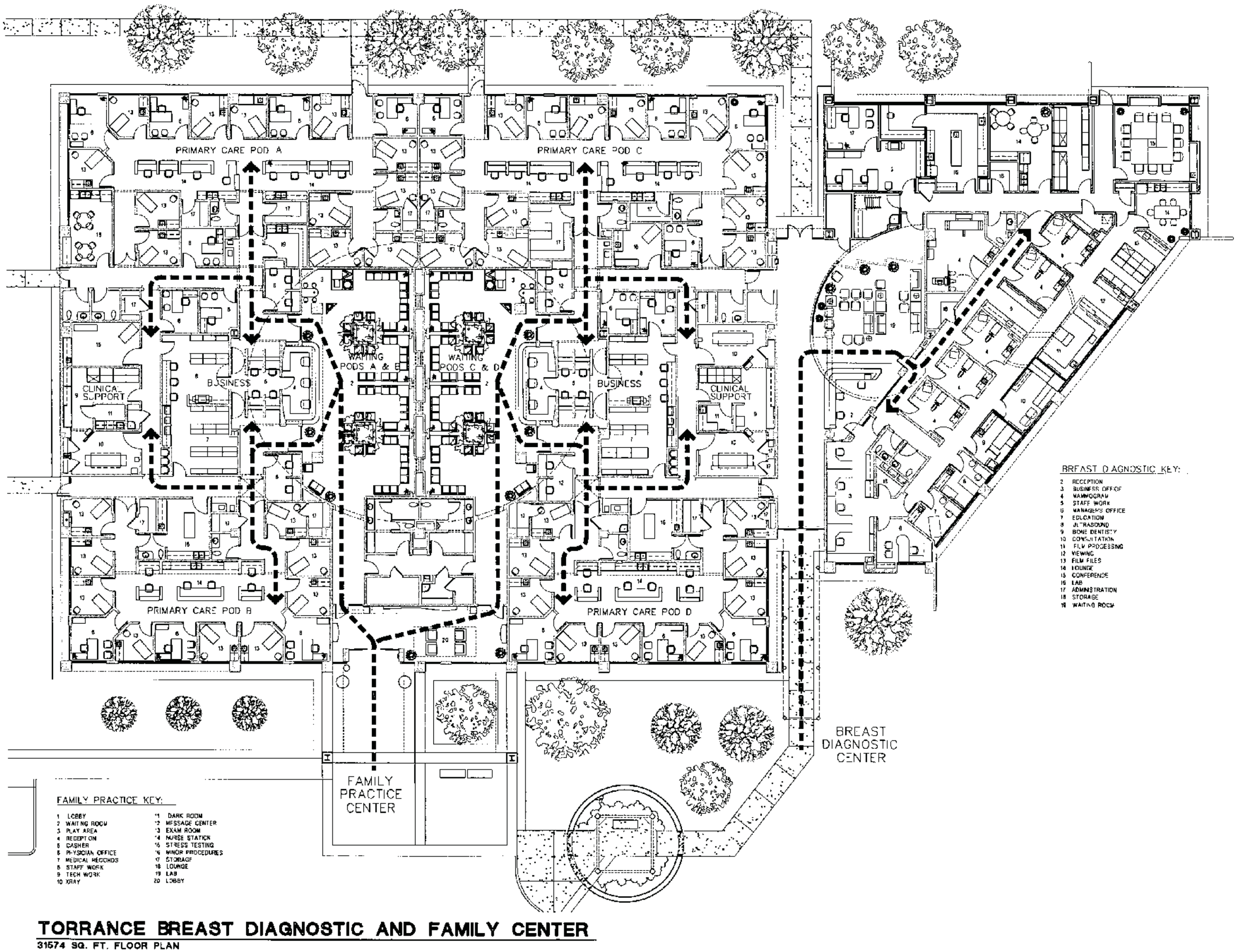


Figure 7-4. Space plan of Torrance Breast Diagnostic and Family Center, 31,574 square feet. *(Architecture and Interior Design: Boulder Associates, Inc., Boulder, Colorado)*

is less costly to keep people healthy than to treat them when they are sick. An HMO that follows this principle should be designed to accommodate many more patients than would a multispecialty group of the same number of physicians, and many more physician extenders may be employed in an HMO to provide health screening and other procedures aimed at preventive medicine. The ACA is changing all this, however, in new mandates for primary care that focus on value and continuity of care whether in an HMO setting or otherwise, and the use of physician extenders will also increase to be able to accommodate more patients and do more than episodic care. Having said that, the HMO of today differs from the somewhat idealistic model of yesteryear—one that promised to keep people healthy. Spending money to keep enrollees healthy only pays off if members stay with the plan a number of years. If they switch plans, the new HMO realizes the benefit. This has forced many HMOs to make tough decisions about how much they can offer at a capitated rate.

An HMO based on the staff or Kaiser *captive group* model will usually have a large physical therapy department, chemotherapy, cardiopulmonary lab, and allergy department—all of which may process a large volume of patients daily who do not usually have to see a doctor.

HMO MODELS

The four types of HMOs are the *independent practice association* (IPA), the *group* model, the *network* model, and the *staff* model. Current 2013 numbers are not readily available but in 2002, as mentioned in the former edition of this book, the IPA represented 58 percent of all HMOs, followed by group models with 23 percent, and network models with 12 percent. Staff and captive group models, together, total approximately 7 percent of the market. In all but the staff model, the HMO contracts with medical groups or individual physicians to provide care to its enrollees and, in turn, contracts with employers to provide services to their employees. In addition, HMOs enroll individual members and families. Following is a description of the various HMO models.

Independent Practice Association

In this model, the HMO either develops or contracts with an existing association of individual physician practices to provide services to enrollees. Physicians are paid on a negotiated fee-for-service basis or on a per capita basis, called "capitation." IPAs allow physicians to remain in private practice and to treat subscribers in their own offices. Patients select from a list of providers, which includes hospitals, physicians, physical therapists, and others, to meet their healthcare needs. An HMO may employ a "gatekeeper" system that requires patients to select a primary care physician, who makes referrals to specialists, although some HMOs permit patients to self-refer to a specialist.

Network Model

The HMO, in this model type, contracts with several multispecialty group practices to provide services to enrollees residing in a single large service area or several noncontiguous service areas, with physicians commonly reimbursed on a per capita basis. Medical groups may also provide services to non-HMO patients.

Group Model

The group model has two forms: the *captive* group, in which the HMO itself forms the group, usually a large multispecialty group (Kaiser is the most well-known example of this) and the *independent* group, in which the HMO contracts with an existing group to provide services. Geisinger Clinic is an example of the latter. Consisting of one or more medical group practices, care is delivered in one central facility, supported by several satellite facilities. The group practice is paid on a negotiated per capita rate, and physicians receive a salary plus incentive payment. Patient care is usually managed by a primary care physician who controls referrals to specialists. These groups primarily treat HMO members.

Staff Model

In this model, physicians and other healthcare providers are full-time employees of the HMO and as such receive a salary. Care delivery is centralized in one or more locations, typically in large clinics. Care is managed by a primary care physician who controls referrals to specialists. Harvard Community Health and Group Health Cooperative of Puget Sound are examples of staff models. In this model, physician salaries are guaranteed and work hours are "regular."

HMO Regulation

Health maintenance organizations are regulated by the state and are subject to close scrutiny by various health-planning regulatory agencies to ensure they have met strict requirements with regard to their clinical services, quality management and improvement, utilization of personnel, and schedule of fees. Over the years, consumer backlash against HMOs' stringent controls and restricted choices has resulted in significant increases in enrollment in Preferred Provider Organizations (PPOs), which offer greater choice and give the consumer more control. This situation changed, however, with the 2008 downturn in the economy, many layoffs, and people finding themselves without health insurance. An HMO is a lower-cost option, especially if you have to pay for it yourself.

POINT-OF-SERVICE

This is an alternative to the HMO called the *Point-of-Service* (POS) plan. It has many similarities to HMOs in that it provides prepaid, comprehensive health coverage for both hospital and physician services and it requires members to select a primary care physician. The difference is that enrollees may select a provider outside the plan's network and receive coverage at a discounted rate and also may receive care without requesting a referral from a primary care manager.

SINGLE-SPECIALTY GROUP

This suite is composed of the same elements as a standard medical office for a solo practitioner except on a larger scale. (The reader is referred to Chapter 3, Family Practice.) The functions of administration, patient care, and support services remain the same. It is the *relationship* of rooms that becomes critical as the suite becomes larger. It is no longer possible for all rooms to be close to each other as they are in a small suite. Administrative and support services may be *centralized* or *decentralized*—that is, the major decision to be made at the outset. With a centralized plan, the business office, lab, reception/waiting, central supply room, and possibly even the nurse station, would be grouped together, forming the core of the suite, with patient care areas (exam and treatment rooms, team collaboration area, and/or nurse station) grouped around the perimeter of the core (Figures 7-5, 7-6, and 7-7). "Consultation" rooms (private offices) are often ganged together in a quiet part of the suite, not arranged in pods with exam/treatment rooms.

The cardiology suite in Figure 7-7 enables 13 providers (9 physicians, a nurse practitioner plus 3 techs) to see patients simultaneously, with 18 exam rooms, 4 treadmill rooms, a holter room, and a nuclear medicine suite. It is assumed that one or two of the nine physicians on any given day will either have a day off or perhaps be seeing patients at a satellite site. In this high-volume specialty, the plan provides separate paths for patients entering and exiting the suite.

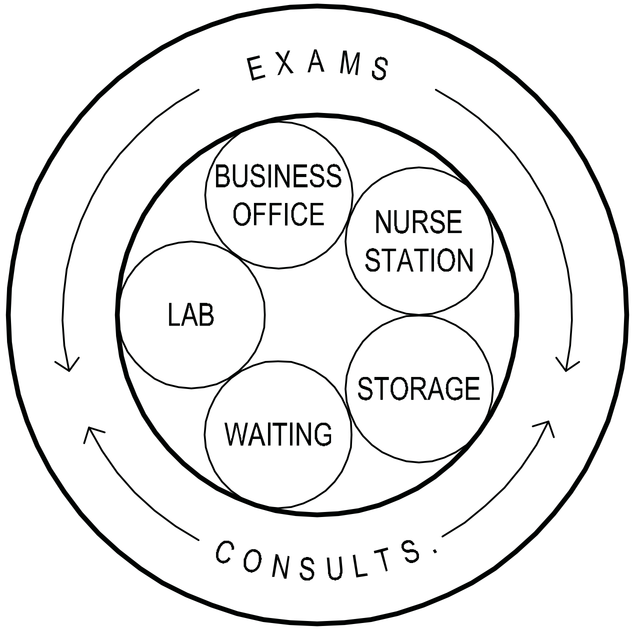
With a decentralized plan, administrative and support services would be divided into units, each serving a certain number of exam and treatment rooms (Figure 7-8). Exam and treatment rooms would be grouped into pods (three to six exam rooms to a pod) with an adjacent nurse station/lab and one or two consultation rooms (private offices) as in Figures 7-4 and 7-9. It would be impractical to have more than one business office or billing office, so these services would have to be located so that a patient exiting from any pod of exam rooms would follow a path leading him or her past the checkout desk and appointment desk and back into the central waiting room. In a

Table 7-1.
Analysis of Program
Group Practice—Single Specialty (Nonsurgical): Primary Care

	Internal Medicine		Family Practice	
	8 Physicians		8 Physicians	
Waiting Room(s)		3 @ 20 SF* = 1,000		40 @ 20 SF* = 800
Exam Rooms/ “Talking Rooms”	20@	10 × 12 = 2,400	24 @	10 × 12 = 2,880
Consultation Rm./Private Office	8 @	12 × 12 = 1,152	8 @	12 × 12 = 1,152
Nurse Stations	3 @	10 × 12 = 360	3 @	10 × 12 = 360
M.A. Workstation	2 @	6 × 10 = 120	3 @	6 × 10 = 180
Toilets	4 @	8 × 8 = 256	4 @	8 × 8 = 256
Storage	2 @	8 × 10 = 160	2 @	8 × 10 = 160
Staff Lounge		12 × 16 = 192		12 × 16 = 192
Laboratory[a]		750 SF		750 SF
Minor Surgery/Treatment	2 @	12 × 14 = 336	2 @	12 × 14 = 336
Cast Room		—		Use Minor Surgery
ECG/Treadmill		12 × 12 = 144		12 × 12 = 144
Radiology[b]		16 × 20 = 320		16 × 20 = 320
Flex Sig Room[c]		12 × 20 = 240		—
Pulmonary Function Testing (Optional)		12 × 18 = 216		—
Business Office[d]		700 SF		700 SF
Administrator		10 × 12 = 120		10 × 12 = 120
Insurance/Collections		14 × 16 = 224		14 × 16 = 224
Tel. Equip./Server Closet		5 × 6 = 30		5 × 6 = 30
Janitor’s Closet		4 × 4 = 16		4 × 4 = 16
Biohazard Storage		4 × 6 = 24		4× 6 = 24
Subtotal		8,772 SF		8,648 SF
25% Circulation[e]		2,193		2,162
Total		10,965 SF		10,810 SF

*No. persons × 20 SF each.
[a]Includes lab waiting, blood draw, and toilet. This assumes lab work done in-house.
[b]Includes control and dressing area. Assumes all-digital, no film storage.
[c]Includes toilet and scope workroom.
[d]Includes reception, bookkeeping, transcription, workroom, appointments, insurance/collections.
[e]Allows for 5- to 6-foot-wide corridors.

Note: Consultation rooms (private offices) may be smaller (10 × 12) or shared (two physicians in a 12 × 12 room). Exam rooms and “talking rooms” are the same size but furnished differently.



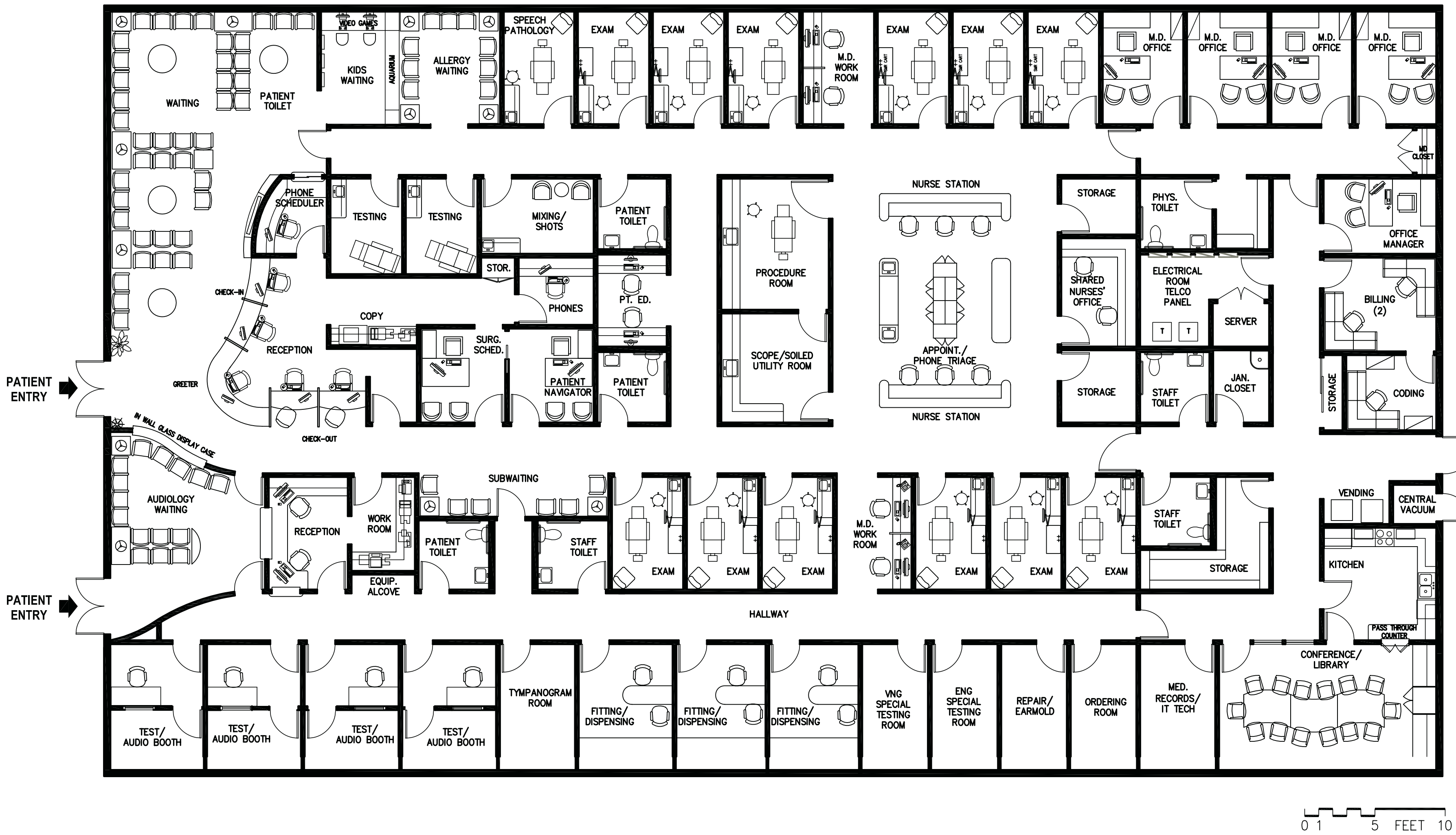
CENTRALIZED PLAN
SINGLE SPECIALTY GROUP

Figure 7-5. Schematic diagram of a centralized plan for a single specialty group.

large clinic, proper circulation must be reinforced by strategically placed, easy-to-read signage and even unique destination entries. Inset carpet designs can be effective as wayfinding cues.

MULTISPECIALTY GROUP

This type of clinic offers the greatest challenge to a designer. The space to be planned may be vast, and each specialty must be carefully analyzed for its relationship to other specialties (Figures 7-10 and 7-11). Large multispecialty clinics tend to grow and change a good deal. Physicians leave, and others join the group. Departments



SINGLE SPECIALTY GROUP – OTOLARYNGOLOGY (CENTRALIZED PLAN)

11,250 SF

Figure 7-6. Space plan for a single specialty group, otolaryngology, 11,250 square feet. *(Design: Jain Malkin Inc.)*

SINGLE SPECIALTY GROUP – CARDIOLOGY (CENTRALIZED PLAN)

9890 SF

Figure 7-7. Space plan for a centralized single specialty group, cardiology, 9,890 square feet. *(Design: Jain Malkin Inc.)*

are sometimes shuffled around to realign them according to new priorities. The facility should be designed for expansion with anticipation of which departments may outgrow their present limits.

Radiology, for example, tends to expand. New equipment is introduced and, due to the scale of it, a single piece is likely to require its own room. Thus, it is a good idea to locate the radiology department on the perimeter of the suite adjacent to the area allocated for expansion. Radiography rooms are very costly to build due to special electrical, plumbing, and lead-shielding requirements; therefore, it would not be economically feasible to abandon existing radiology rooms, tearing them down to remodel for less specialized use such as additional examination rooms or an expanded waiting room. By locating the radiology department contiguous to the area of the proposed future expansion, existing radiology rooms need not be altered and new rooms could be added.

The area of medical records is another that often has to be expanded. This has become a nonissue for most practices as EHR has become mainstream. For any large clinic, however, there will be paper charts for existing long-term patients until the records become sufficiently aged or the more recent portions can be scanned into the EHR.

If the building is designed for and owned by the doctors, the architect can take liberties with the design and make the structure of the building conform to the spatial requirements of the group's practice. A large clinic may be

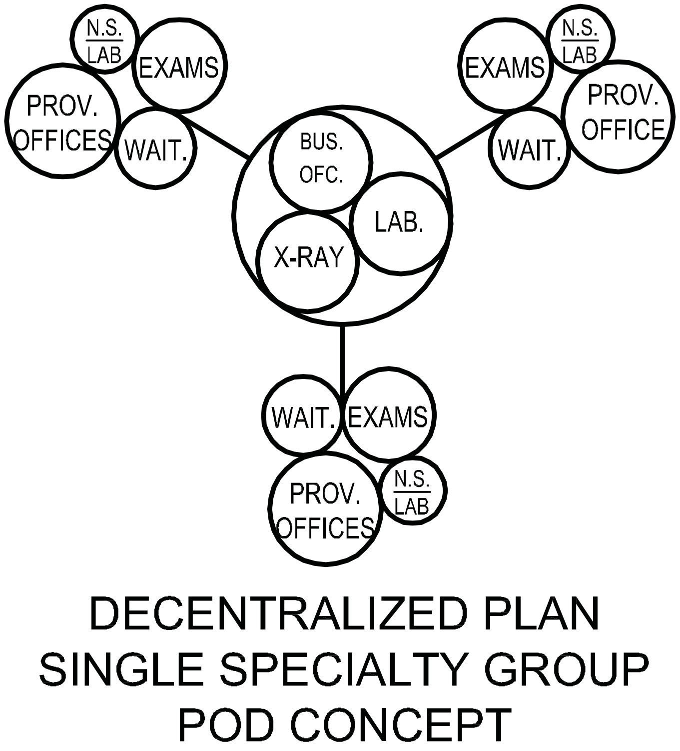


Figure 7-8. Schematic diagram of decentralized plan, single group specialty.

laid out with the administrative and support services in the core, with each specialty department radiating out from it like spokes of a wheel. Each "spoke" would have its own nurse station and waiting room, but the clinical lab, reception/registration, business office, and radiology would be in the core area (Figure 7-12). This is also known as a *satellite* plan. The diagram in Figure 7-11 is not intended to be taken literally as disconnected spokes because that would lack the flexibility to connect departments.

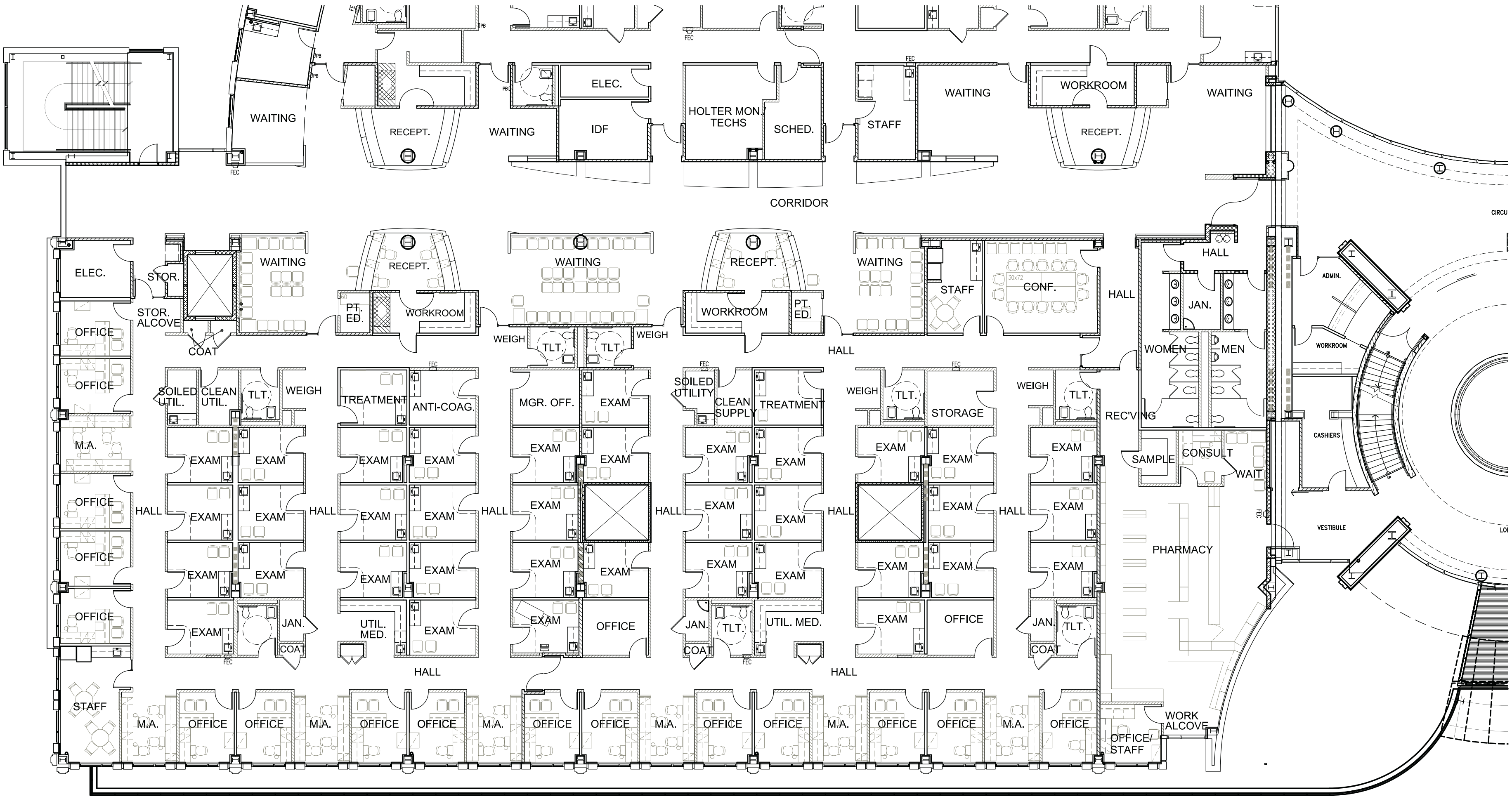
Occasionally, one large waiting area located near the reception and business office serves most patients. They are called from there to the various departments (see Figure 4-18). At Geisinger Gray's Woods, an ambulatory care clinic (Figure 7-13), patients check themselves in at kiosks. This is a two-story, 64,350-square-foot

Table 7-2.
Analysis of Program
Group Practice—Single Specialty (Surgical)

		OB-GYN		**Orthopedics**
		8 Physicians + Nurse Practitioner		8 Physicians
Waiting Room(s)[a]		35 @ 20 SF* = 700		30 @ 20 SF = 600
Exam Rooms	12[b] @	10 × 12 = 1,440	12[c] @	10 × 12 = 1440
Exam/Ultrasound	2 @	10 × 12 = 240		—
Toilet		8 × 8 = 64		8 × 8 = 64
Consultation Rm./Private Office	8 @	12 × 12 = 1,152	8 @	12 × 12 = 1,152
Nurse Stations[d]	3 @	8 × 10 = 240	3 @	8 × 10 = 240
Toilets	6 @	8 × 8 = 384	4 @	8 × 8 = 256
Storage	2 @	8 × 10 = 160	2 @	8 × 10 = 160
Staff Lounge		12 × 16 = 192		12 × 16 = 192
Lab		12 × 16 = 192		—
Minor Surgery	2 @	14 × 16 = 448		12 × 14 = 168
Cast Rooms		—	2 @	12 × 12 = 288
Radiology[e]		—		16 × 40 = 640
Business Office[f]		700 SF		700 SF
Surgery Scheduling		10 × 12 = 120		10 × 12 = 120
Administrator		10 × 12 = 120		10 × 12 = 120
Insurance/Collections		14 × 16 = 224		14 × 16 = 224
Nurse Practitioner Office		10 × 10 = 100		—
Physical Therapy (Optional)		—		20 × 40 = 800
Tel. Equip./Sever Closet		6 × 8 = 48		6 × 8 = 48
Janitor's Closet		4 × 4 = 16		4 × 4 = 16
Biohazard Storage/Soiled Linen		6 × 8 = 48		6× 8 = 48
Subtotal		6,588 SF		6,680 SF
25% Circulation[g]		1,647		1,670
Total		8,235 SF		8,654 SF

*No. persons × 20 SF each.
[a]Includes children's play area.
[b]Assumes no more than five providers seeing patients in the office at one time.
[c]Assumes no more than four physicians seeing patients in the office at one time.
[d]Tech or M.A. workstations.
[e]Includes two radiography rooms control, and tech workstation. Assumes all-digital, no film storage.
[f]Includes reception, bookkeeping, transcription, and workroom.
[g]Allows for 5- to 6-foot-wide hallways.

Note: Consultation rooms (private offices) may be smaller (10 × 12) or shared (two physicians in a 12 × 12 room. Exam rooms and "talking rooms" are the same size but furnished differently.



INTERNAL MEDICINE

16,400 SF

Figure 7-9. Space plan of internal medicine decentralized plan, 16,400 square feet. *(Architecture and Interior Design: Hawley Peterson Snyder)*

LEED® Gold facility. The building includes 70 exam rooms, 16 procedure rooms, an imaging center, laboratory, and onsite pharmacy. Primary care services include OB-GYN, pediatrics, and family medicine. Specialty services include ophthalmology, cardiology, urology, and pulmonology. (Only a portion of the clinic is visible in this plan.) Geisinger is an example of a decentralized plan with pods consisting of nurse station, exam rooms, and offices, with one large waiting area serving all. Alternatively, each specialty department would function

Table 7-3.
Analysis of Program
Group Practice—Multispecialty—Nine Physicians plus Two Nurse Practitioners

This program assumes the following: Two internists, three family practitioners, two family practice nurse practitioners, three pediatricians, and one otolaryngologist; a central business office, administrator, and lab will serve all; in addition to the central supply, several small storage rooms would be dispersed throughout the facility.

Main Lobby				300
Waiting Rooms (ENT, I.M., F. P.)				800
Peds Sick and Well Waiting				600
Peds Exam Rooms	2 @	10 × 12 = 240	8 @	10 × 10 = 800
Peds Nurse Station			3 @	10 × 10 = 300
Peds Private Office			3 @	10 × 10 = 300
Peds Minor Surgery				12 × 12 = 144
Peds Storage				6 × 6 = 36
ENT Exams			3 @	10 × 12 = 360
Audio Testing w/ Booth				12 × 16 = 192
ENT Minor Surgery				12 × 14 = 168
ENT Consultation Room (Private Office)				12 × 12 = 144
ENT Nurse Station				10 × 10 = 100
ENT Storage				6 × 6 = 36
I.M. Exam Rooms/Talking Rooms			6 @	10 × 12 = 720
I.M. Consultation Rooms (Private Office)			2 @	10 × 12 = 240
I.M. Nurse Station			2 @	10 × 10 = 200
I.M. M.A. Station				6 × 12 = 72
I.M. Storage				6 × 8 = 48
Flex Sig Room[a]				12 × 20 = 240
ECG/Cardiopulmonary Lab				16 × 20 = 320
F.P. Exam Rooms (Two for Nurse Pract.)			11 @	10 × 12 = 1,320
F.P. Consultation Rm. (Private Office)			3 @	10 × 12 = 360
F.P. Nurse Station			2 @	8 × 10 = 160
F.P. Nurse Practitioner Office			2 @	8 × 10 = 160
F.P. M.A. Station				6 × 12 = 72
F.P. Storage				6 × 8 = 48
Cast Room				Use Minor Surgery
Minor Surgery/Procedures				12 × 14 = 168
Staff Lounge /Lockers				16 × 20 = 320
Central Supply				12 × 16 = 192
Soiled Linen Holding				6 × 6 = 36
Tel. Equip. /Server Closet				6 × 8 = 48
Biohazard Storage				6 × 6 = 36
Medical Records (Assume Electronic)				_____
Administrator				12 × 14 = 168
Lab[b]				24 × 32 = 768
Radiology[c]				12 × 26 = 312
Toilets (throughout the departments)			12 @	8 × 8 = 768
Business Office				
Reception				14 × 18 = 252
Bookkeeping				16 × 20 = 320
Insurance/Collections				16 × 20 = 320
Transcription				10 × 12 = 120
Workroom				10 × 10 = 100
Subtotal				12,408 SF
25% Circulation[d]				3,102
Total				15,510 SF

[a]Includes toilet and scope workroom.
[b]Includes lab, lab waiting, blood draw, toilet, and storage. This assumes lab work done in-house.
[c]Includes control, viewing, and dressing area.
[d]Allows for 5- to 6-foot-wide hallways.

independently with its own waiting room, reception desk, nurse station, and other support facilities (see Figure 4-5 and 7-12). Upon checking out, the patient may book a future appointment either at the subreception desk or at the central reception desk, depending on how the flow is set up. Payment for services would usually be made at the central reception desk or cashier's counter, if one exists, rather than at the specialty department. Copays are collected when patients check in.

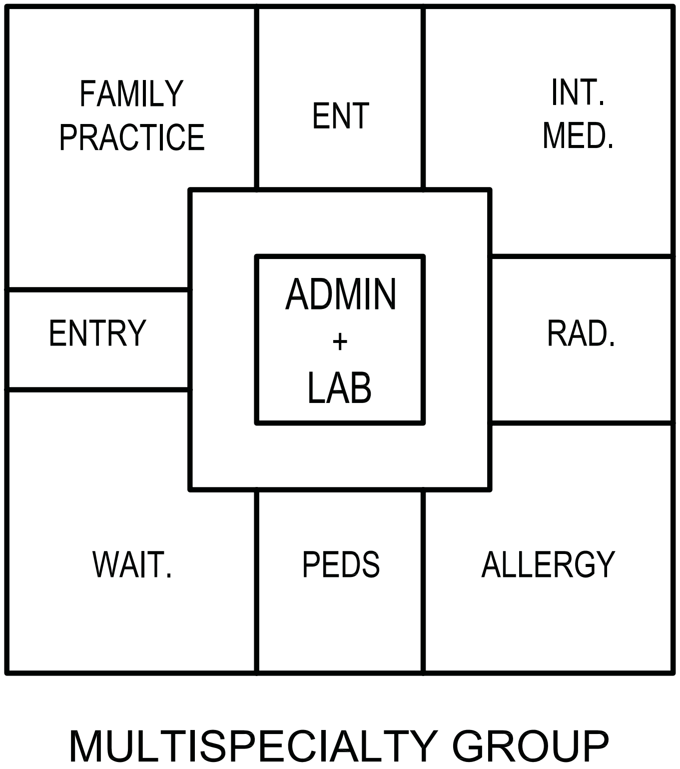


Figure 7-10. Schematic diagram of multispecialty group.

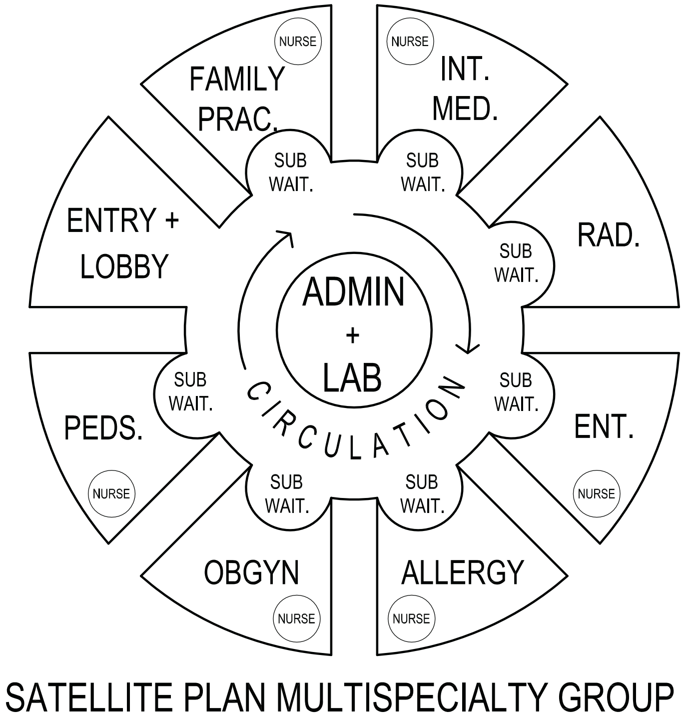


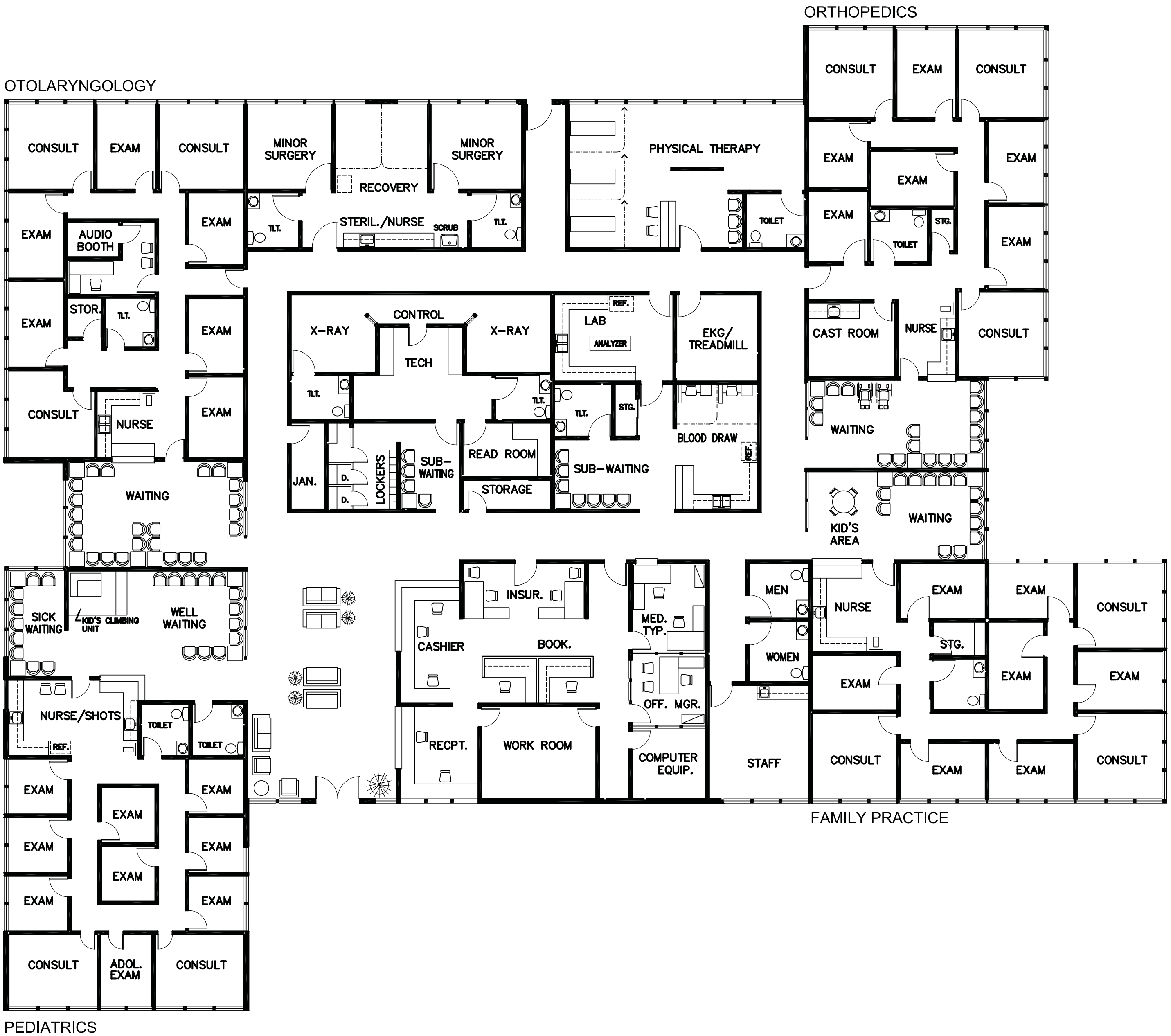
Figure 7-11. Schematic diagram of satellite plan for multispecialty group.

The multispecialty group practice clinic shown in Figures 7-14a and b is 30,000 square feet in size and located on two floors of a large medical office building. The clinic includes internal medicine, family practice, radiology, pharmacy, vascular lab, cardiopulmonary testing, clinical lab, and a large endoscopy suite. The conference room/staff lounge and the clinic administrator's office are on the lower level. One might consider this single-specialty primary care (family practice and internal medicine), but it does have subspecialties such as gastroenterology and pulmonary medicine plus a pharmacy and radiology.

The clinic functions as a *group-practice model* HMO, a preferred provider organization (PPO), and also accepts fee-for-service patients. On the first visit the patient registers on the main floor, near the family practice reception desk, where an embossed card is dispensed, a medical history is recorded, and an electronic medical record is initiated. The patient is then referred to the appropriate decentralized reception desk to check in prior to receiving treatment. On subsequent visits, the patient proceeds directly to the reception desk at the respective department and does not need to stop at the registration desk.

This is an example of a decentralized plan where each specialty department has its own reception and waiting area, with nurse stations, exam rooms, and private offices arranged in pods.

Circulation patterns were emphasized in order to minimize the possibility of patients leaving without passing the cashier's desk. On the first floor, inset carpet designs and unique signage properly placed lead patients past the principal cashier station, while radiology patients exit



GROUP PRACTICE MULTISPECIALTY (SATELLITE PLAN)

11,250 SF

Figure 7-12. Space plan for group practice multispecialty, 11,250 square feet. *(Design: Jain Malkin Inc.)*

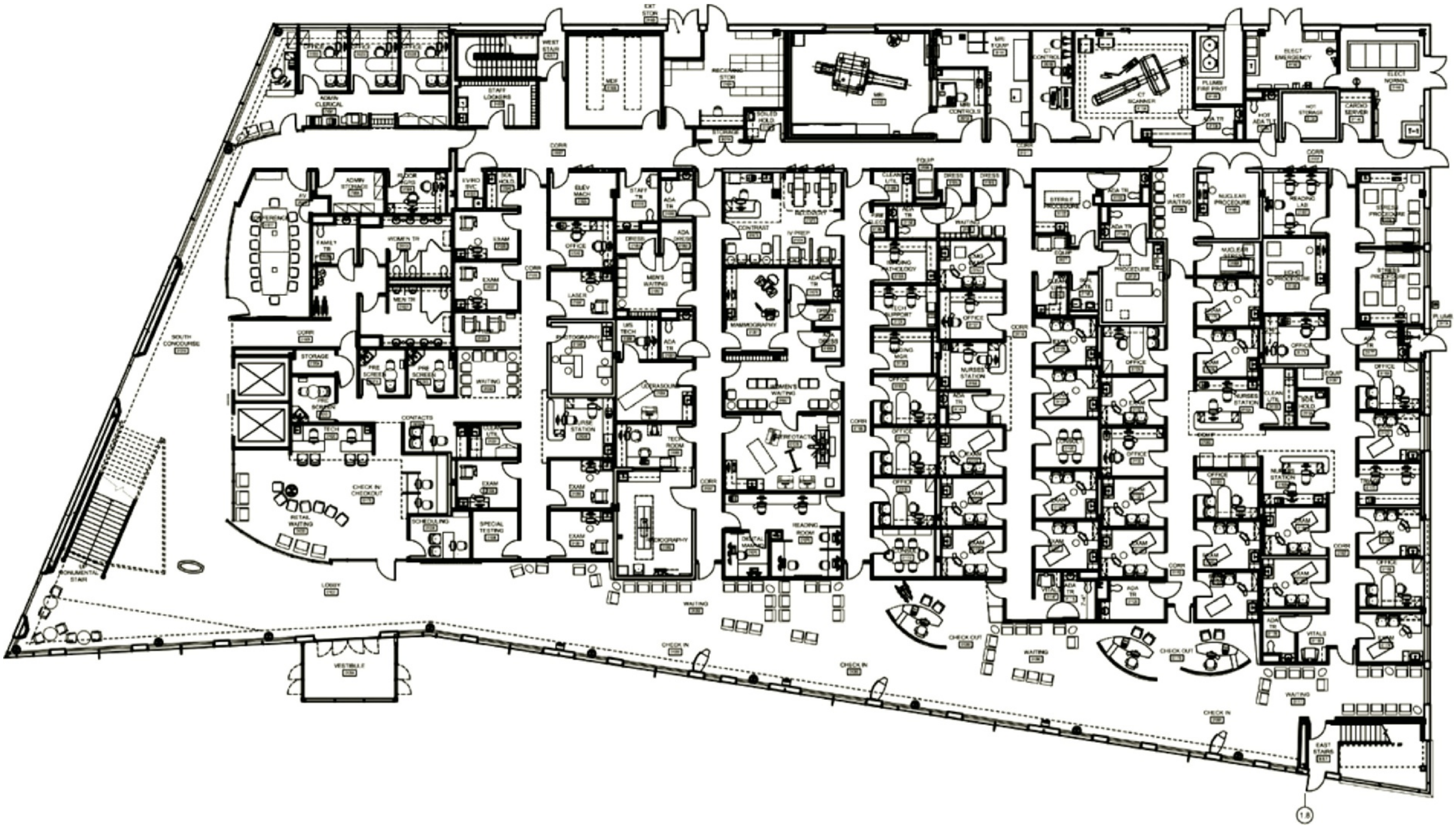
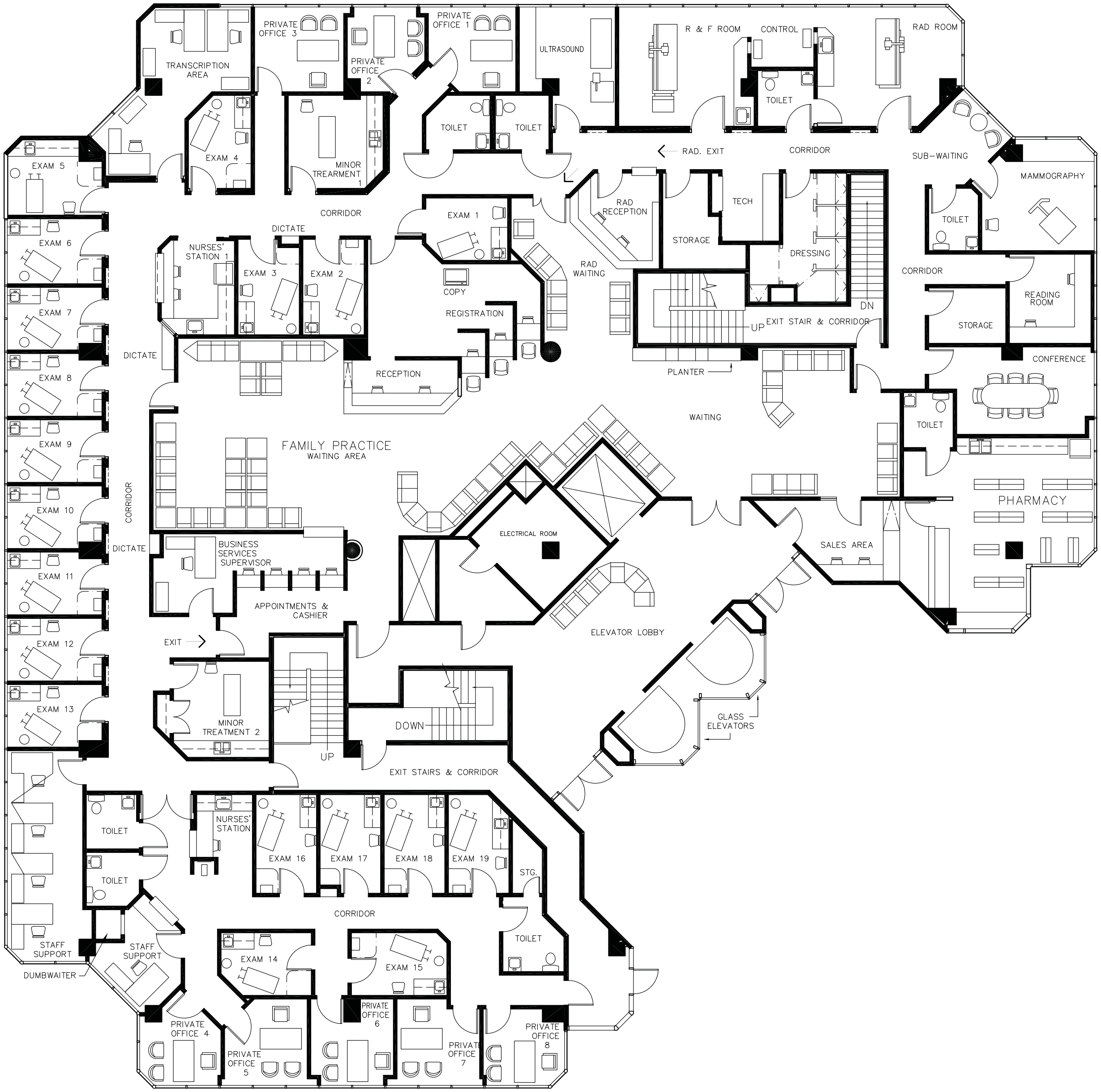
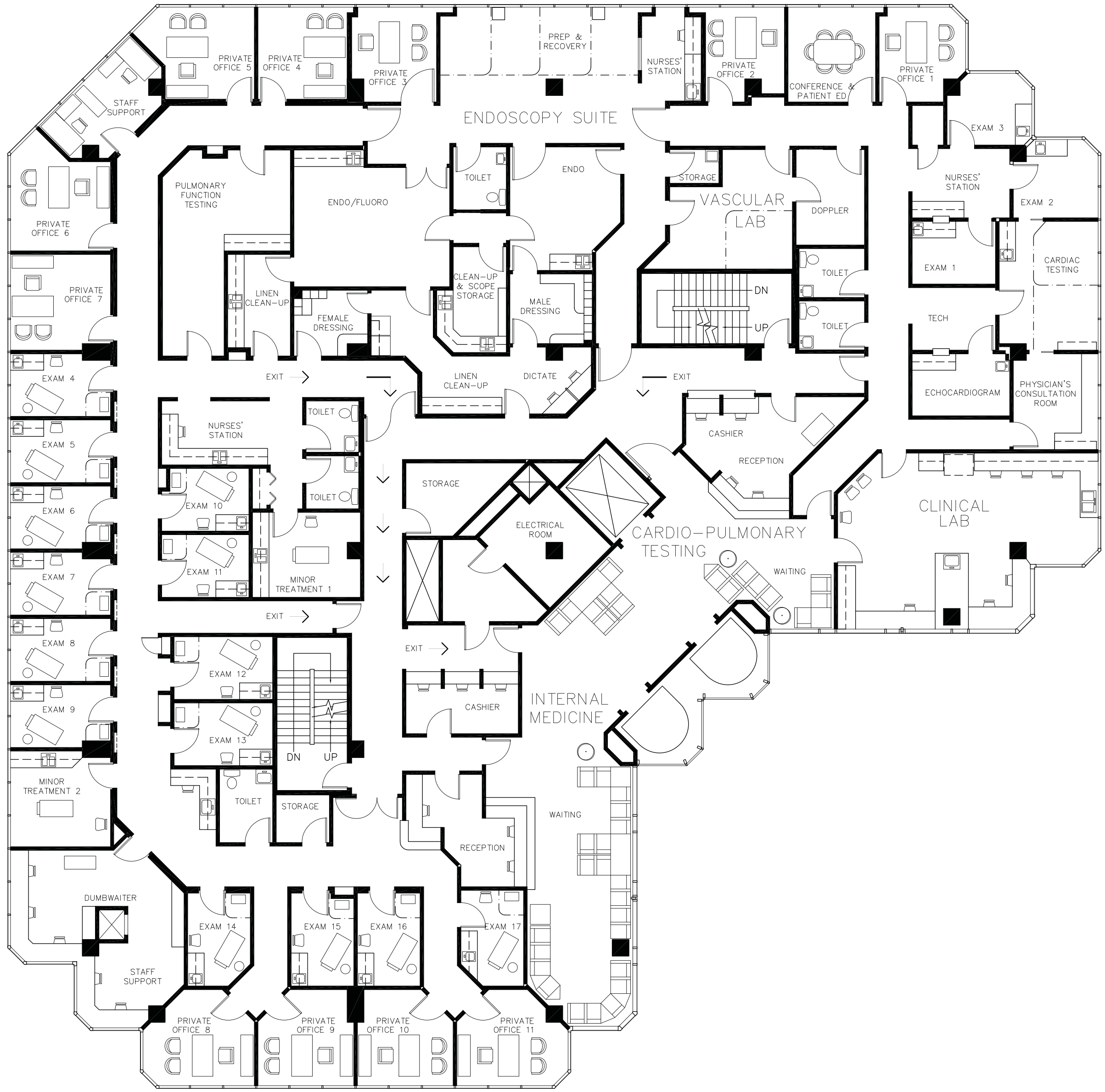


Figure 7-13. Space plan for Geisinger Gray's Woods multispecialty ambulatory care group decentralized plan, 64,350 square feet. *(Courtesy of Ewing Cole)*



MULTISPECIALTY GROUP PRACTICE CLINIC, 30,000 SF
MAIN LEVEL FLOOR PLAN

Figure 7-14a. Space plan for multispecialty group practice, 30,000 square feet. *(Design: Jain Malkin Inc.)*



MULTISPECIALTY GROUP PRACTICE CLINIC, 30,000 SF
SECOND LEVEL FLOOR PLAN

Figure 7-14b. Continued

through the radiology waiting room. On the second floor, all exiting circulation is directed past two cashier stations.

INTERNAL MEDICINE GROUP

This is a single specialty group, but due to the many internal medicine subspecialties, more specialized rooms and a larger clinical lab and radiology suite are required than with most single specialty groups. The subspecialty nature of this practice sometimes leads to it being called "multispecialty" (see Figures 7-14a and b). An internist specializing in cardiology or in pulmonary disease would need an ECG room and a cardiopulmonary lab. One who specializes in gastroenterology would require a sigmoidoscopy room but would likely do endoscopy procedures in an endoscopy center located in an MOB or possibly do the procedures in the hospital. Alternatively, as in this example, they may have an in-house endoscopy center. Endocrinologists, on the other hand, order many lab studies—some of which require patients to report to the lab in the morning and remain nearby for four to six hours, with blood being drawn every hour. Thus, the lab must be of sufficient size to accommodate a high volume of work and should have a comfortable lounge for waiting patients.

The suite for a group practice of internists would typically have three exam rooms for each doctor, a consultation room/private office for each physician adjacent to his or her pod of exam rooms, a toilet, and a nurse station. The flex sig room, ECG treadmill, cardiopulmonary lab, clinical lab, and radiology suite would be located in the core area central to all exam rooms. The business office, insurance office, cashier's desk, and waiting room would be located at the entrance to the suite so that each patient, upon entering and leaving, must pass by the reception and cashier's desks.

A group practice will have a business manager or an administrator who will require a private office, possibly with a window wall (starting at 48 inches off the floor) facing the business office so that he or she can keep an eye on operations.

Patients may at times report to the lab without having to see a physician, so the lab should be located at the front of the suite, enabling a patient to enter and leave without mingling with patients waiting for visits with a physician (see Figures 7-1 and 7-13). The reader is referred to Chapter 6 for space planning requirements of a clinical lab.

The waiting room must accommodate one hour's patients per doctor. Thus, if each doctor can see an average of four patients per hour and each has three exam rooms, an eight-physician group would need seating for approximately 40 persons in the waiting room or elsewhere within the suite when all doctors are seeing patients simultaneously. A formula for estimating the required number of seats is

$$2P \times D - E = S$$

where

P = Average number of patients per hour per physician

D = Number of doctors

E = Number of exam rooms

S = Seating

The formula assumes that each patient arrives with one other person, a friend or relative.

Allowing that some patients will arrive unaccompanied by a friend and some will be directed to the lab, X-ray, or ECG room, the 40 required seats might be reduced to 35 at the absolute minimum. Figuring 18 to 20 square feet per person, a waiting room that will accommodate 40 persons will have to be approximately 800 square feet in size, allowing extra space for wheelchairs. Include additional space for a children's play area. If the desire is to create a more "open" seating arrangement, as opposed to a bus station, 18 square feet per person will not be adequate. It is ideal if seating can be arranged in privacy groupings and includes different types of seating (see Color Plate 22, Figure 7-15).

Figure 7-15. Lobby/waiting area with furniture arranged in intimate groupings. *(Courtesy of HKS; Photographer: Marvin Blake/HKS)*

FAMILY PRACTICE GROUP

The suite for a family practice group would be an expansion of a suite for a solo practitioner or perhaps a three-physician practice (refer to Chapter 3). It would also include an X-ray facility, lab, private office for a business manager, and maybe a small allergy suite. A group of family practitioners may include a general surgeon. The formula discussed above for estimating the number of seats in the waiting room applies here, except that a family practitioner can see up to six patients an hour, and each physician should have the use of three exam rooms.

Shared Medical Appointment

The shared medical appointment (SMA) is a strategy for achieving more successful outcomes for individuals with chronic conditions who need to make lifestyle modifications. At Harvard Vanguard Medical Associates (the largest SMA program in the nation) these 90-minute enhanced appointments have been so well received that 77 percent of patients, after having experienced it, said they would schedule it again.[1] In patient satisfaction surveys they said they were as satisfied as with a private visit. This provider has found shared medical appointments especially successful for noncompliant individuals who respond much better to another patient telling them how they solved a problem, found the time to check blood sugar after eating, changed their diet to accommodate their medical condition, and so forth. They have groups specific to diabetes, extensive kidney dysfunction, lipid management, hypertension, diabetic foot, and other disorders. This is how it works. There are two types of SMAs. One is used for follow-up and the other involves a private exam with a clinician in a room with others present as in Figure 7-16, in addition to a group discussion. The latter type is called Private Shared Medical Appointments (PSMAs).

After checking in, patients are escorted to the group visit room, where they change into a gown for the examination. This goes on while the group is chatting. Each patient is examined and receives a report from the clinician. Not only is this successful for patients, but it makes more productive use of a clinician's time. It works well in the patient-centered medical home scenario, and this is why so many community health centers have group visit rooms (Figures 4-29 and 4-30). Under the ACA these will more commonly be found in primary care group practices.

[1]Jill Berger-Fiffy: "Are shared medical appointments right for your practice?" July 25, 2012 (mgma.com/screencast/FAQ-shared-medical-appointments, retrieved August 21, 2013).

A FEW CONSIDERATIONS

New planning ideas have recently emerged, stimulated by the Affordable Care Act. The concept of team collaboration has taken root in primary care because it fosters multidisciplinary coordination to manage a patient's medical conditions, whether the focus is on chronic conditions or wellness/preventative care. This can be seen in space planning in Chapter 4, Community Health Centers, and is discussed in Chapter 3 under the *Patient-Centered Medical Home* and, specifically, *The Ambulatory Practice of the Future*. The adjustable-height team workstations in Figures 3-15, 3-16, 3-17, and 7-17 are examples of this new direction.

As large clinics are designed, the application of LEAN process should be part of the planning to achieve effective patient flow. This includes preregistering patients in advance of arrival to avoid a queue at the reception desk, having medical histories updated in advance through a secure portal, and the use of mobile monitoring devices to transmit data to help manage chronic conditions remotely. Patients should be able to get text message notifications if a provider is running late, and text messages via cell phones can be used instead of pagers onsite to alert a patient to proceed to the exam room. Choreographing the patient's experience throughout the medical encounter

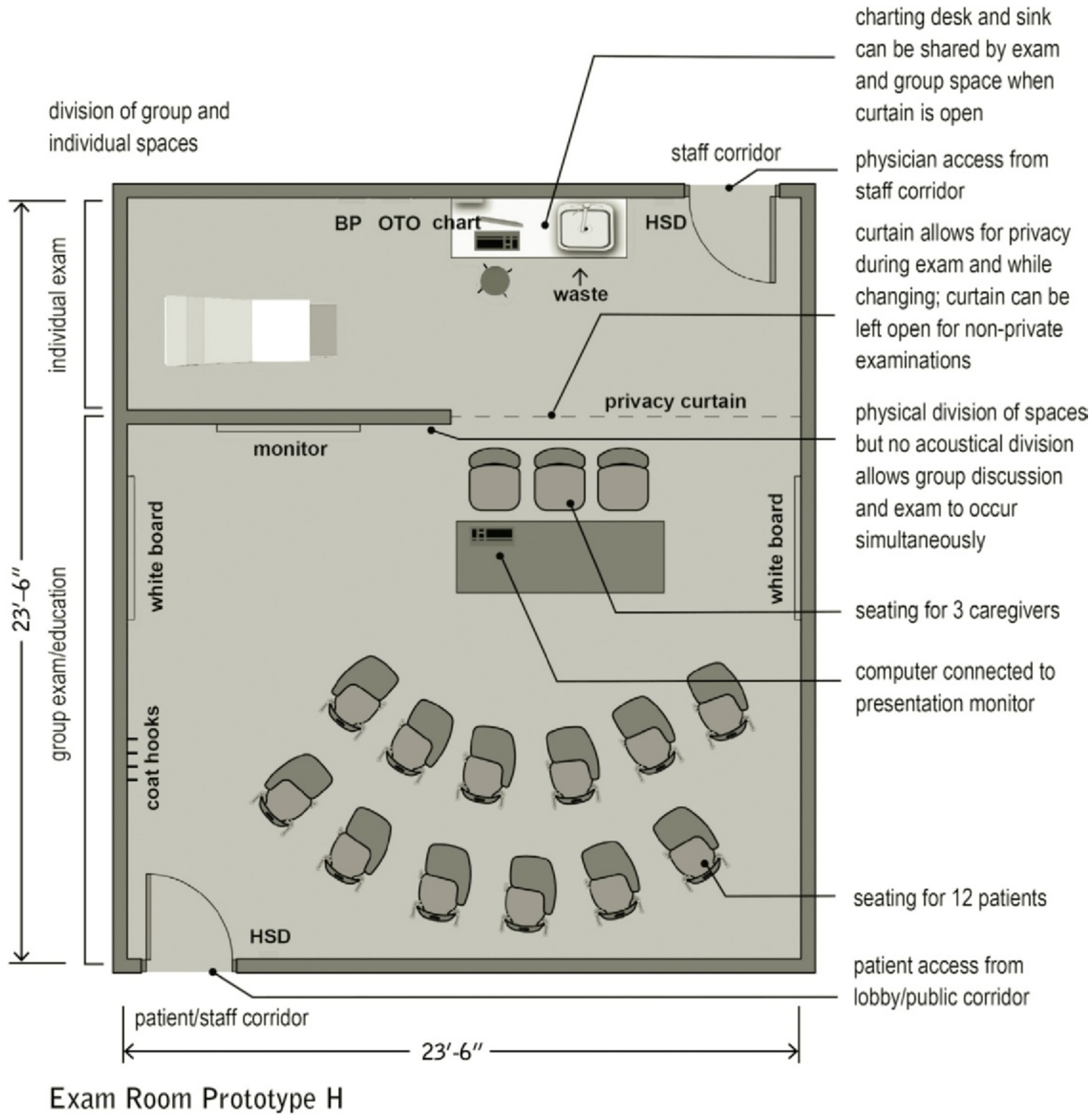


Figure 7-16. Group room for shared medical appointments. *(Courtesy of HGA Architects and Engineers)*

Figure 7-17. Team collaboration station. Note artwork on glass wall. *(Courtesy of NBBJ: Photographer: Benjamin Benschneider/Otto; Artist: Zaara/Marta Windeisen, KittenChops Graphic and Design Illustration)*

Figure 7-18. Off-stage staff relaxation area, Cisco LifeConnections Health Center. *(Design: Jain Malkin Inc.; Photographer: Steve McClelland Photography)*

will enable the planning team to streamline operations and embrace new technology.

Interior Design

The importance of respite and restoration for clinical staff is a topic that arises in evidence-based design, especially in the acute care arena. However, working in a fast-paced outpatient setting can also be stressful and emotionally draining. Some clinics employ the Disney on-stage/off-stage concept (see Village Family Medicine, Chapter 1 and Cisco LifeConnections in Chapter 3) while others provide a staff lounge/break room with natural light, and possibly, a view of a garden. The staff respite area in Figure 7-18 (Cisco LifeConnections) is close to exam

Figure 7-19. Main lobby medical office building, Kaiser Permanente, Gaithersburg Medical Center. *(Courtesy of AECOM; Photographer: Don Pearse Photographers, Inc.)*

rooms. Elsewhere, a lively break room is available for socializing and lunch.

First impressions count. Humans are designed to make a subconscious assessment in seconds as to whether an environment is threatening or not. Evolutionary biologists tell us this is why we get that queasy feeling in our stomachs and our heartbeat increases when we encounter a setting that makes us uncomfortable. The lobby is the first thing people encounter. If it is well designed, has some color and texture, and has good lighting, as in Figure 7-19, the lobby of a large clinic, it sets up expectations of good clinical care. This has been established in a number of studies at Weill Cornell Medical Center and elsewhere. The same is true for waiting rooms (Figure 7-20). Patients cannot assess the quality

Figure 7-20. Departmental waiting area, Kaiser Permanente, Gaithersburg Medical Center. *(Courtesy of AECOM; Photographer: Don Pearse Photographers, Inc.)*

Figure 7-21. Colorful examination room with inset floor design, Kaiser Northwest in Washington, D.C. *(Courtesy of AECOM; Photographer: Don Pearse Photographers, Inc.)*

of the clinical care but they make a judgment nonetheless based on an assessment of the built environment and interactions with staff. Like detectives, they pick up clues as they look around the facility. Professor Leonard Berry of Texas A + M University has written extensively about this. The exam and procedure rooms in the Kaiser Northwest clinic in Washington, D.C. (Figures 7-21 and 7-22) have playful inset geometric designs in the floor and painted accent walls in colors of blue, green, yellow, and lavender.

Figure 7-22. Procedure room with colorful inset flooring design, Kaiser Northwest, Washington, D.C. *(Courtesy of AECOM; Photographer: Don Pearse Photographers, Inc.)*

CHAPTER 8
Ambulatory Surgical Centers

OVERVIEW

Ambulatory surgery refers to scheduled surgical procedures provided to patients who do not require overnight hospitalization. Ambulatory surgery may be provided in a physician's office—in which case it is called *office-based surgery*—or in a freestanding, independent facility specifically organized to provide scheduled ambulatory surgery. In this chapter the acronyms FOSC (freestanding outpatient surgery center) and ASC (ambulatory surgical center) are used interchangeably.

The practice of ambulatory surgery originated more than 100 years ago. The British Medical Association in 1909 reported 7,320 operations performed by a Scottish physician on ambulatory patients at the Royal Glasgow Hospital for Children.[1] The results were reported to be as successful as those for inpatient surgery. However, the interest in ambulatory surgery declined somewhat until the early 1960s when the development of new fast-acting anesthetics made ambulatory surgery more practical.

The first successful freestanding ambulatory surgical center is generally recognized to be the Phoenix *Surgicenter*®, which began operations in February 1970. Anesthesiologists Wallace Reed and John Ford established the facility that has become the model for other non-hospital-based ambulatory surgical centers.

The freestanding ambulatory surgical center may be organized according to a variety of operational models that vary according to type of ownership and sponsorship, affiliation with hospitals, and types of services offered. The term *freestanding* may be used to refer to a facility that is physically separate from another, such as a hospital, or it may mean a facility whose program and ownership are independent and legally distinct from any other organization.

Ambulatory surgical centers are often located either within a hospital or a separate building located on the hospital campus, or may be a satellite facility located off campus. Some ambulatory surgical centers are entrepreneurial enterprises owned and operated by a group of anesthesiologists or surgeons and have no affiliation with a hospital. These facilities are commonly located within a medical office building, or they may be physically freestanding in a single-tenant building. It is this last example that is the focus of this chapter—a facility not owned by a hospital and located in either a freestanding or medical office building.

Surgery Center Consultants

When developing an ASC it is important to engage an experienced licensing consultant who can provide guidance on the complex requirements of state licensing, Medicare certification, and accreditation. These individuals also prepare the staff for a successful survey.

ADVANTAGES OF AMBULATORY SURGERY

There are many advantages to ambulatory surgery from both the patients' and the physicians' viewpoints. Some of these advantages follow.

1. Hospitals are geared to traditional inpatient surgery protocols, which are often inappropriate for ambulatory

[1] Thomas O'Donovan, *Ambulatory Surgical Centers*, Aspen Systems Corp., Germantown, Maryland, 1976, p. 4.

patients, whereas a facility organized for the sole purpose of ambulatory surgery would have a staff trained to meet the specific needs of these patients. Hospitals sometimes find it difficult to merge new protocols with existing systems.

2. Ambulatory surgery patients are generally healthy; they are candidates for elective procedures. In a hospital, their families may have to share a common surgery waiting room with inpatients' families, which can have a devastating psychological effect. Imagine the stress of sitting next to someone whose husband may be having heart bypass surgery.
3. Patients often experience psychological stress when entering a hospital. Fear of the unknown is heightened by unexpected sights, such as a view of a patient arriving in an ambulance or seeing a patient on a gurney with an IV in the arm. Patients are generally less apprehensive when arriving for surgery in a facility located in a medical office building.
4. Physicians and staff often experience greater satisfaction in an FOSC because they can tailor operational systems as they wish, with less bureaucratic red tape.
5. There is much greater flexibility in scheduling procedures in an FOSC. In a hospital, ambulatory patients will be bumped to open up the schedule for urgent or emergent patients. Both physicians and patients find ease of scheduling an advantage in an FOSC.
6. Ambulatory surgery provides better utilization of hospital beds and costs considerably less than doing the same procedure in a hospital. The major savings is due to elimination of a hospital stay. Insurance payers often stipulate they will pay for certain procedures only if done within an ambulatory surgical center.
7. Ambulatory surgical patients receive less medication both pre- and post-operatively, and they often return to work sooner than people who have those same procedures as inpatients. Perhaps this is due to the fact that FOSCs promote a wellness philosophy, treating patients as if they are healthy, and allowing them to take responsibility for a large part of their own care.

OWNERSHIP AND AFFILIATION

Ambulatory surgical centers are big business—approximately 80 percent of surgeries are outpatient, performed in an ASC or in a physician's office. The titans of this industry are the for-profit chains, also known as "investor-owned." Surgical Care Affiliates, Inc. in Birmingham, Alabama is the largest with over 150 facilities. In 2009, 67 percent of ASCs were hospital-owned.[2] The fortunes of ASCs rise and fall with fluctuations in financing and the regulatory environment, causing one for-profit to suddenly divest itself of most of its holdings and another to buy them. There is often an acrimonious relationship between the for-profits and physician-owned ASCs although, it should be noted, there is a federal ban on physicians referring patients to facilities of any kind in which they hold a direct or indirect financial interest. An excellent discussion of the Stark law explains these restrictions.[3] The Centers for Medicare & Medicaid Services (CMS) requires that physician owners or investors provide written notice to patients prior to the start of a surgical procedure that the ASC has physicians with a financial interest in the enterprise and they must be named. Other ASCs are owned by and/or affiliated with not-for-profit healthcare organizations such as community hospitals, Kaiser Permanente, and academic medical centers.

ECONOMIC AND REGULATORY ISSUES

Prior to designing an ASC, it is necessary to understand the facility's goals with respect to licensing, certificate-of-need (CON) requirements, accreditation, and reimbursement

[2] Healthcare Cost and Utilization Project (HCUP) Report #2011-07, www.hcup-us.ahrq.gov.

[3] Linda Grimms, "Stark Law and Related Limitations on Financial Interests in Health Care Reimbursement," Jan. 6, 2012: Oregon.gov/oha.OHPR/docs/medliab_starklegalanalysis.pdf (accessed July 23, 2013).

by Medicare/Medicaid and commercial insurance carriers. An entity cannot be an ASC if it does not have an agreement to participate in Medicare as an ASC.[4] Ambulatory surgery centers are highly regulated at the federal, state, and peer level. Most facilities will be state licensed, have Medicare certification, and Joint Commission or AAAHC or AAAASF accreditation. AAAHC, the Joint Commission, and AAAASF have been granted "deemed status" by CMS to certify ASCs for Medicare participation. In order for a healthcare entity to participate in and receive payment from Medicare or Medicaid programs it must meet eligibility requirements for participation, including a certificate of compliance with the Conditions of Participation (CoP) set forth in the federal regulations (jointcommission.org). This is based on a survey conducted by a state agency on behalf of CMS. If a national accreditation organization such as the three mentioned above enforces standards that meet or exceed those of CMS, they may be granted "deeming" authority referred to as "deemed status" to carry out these surveys.

Licensure

A facility owned and operated by a physician group practice may not need to be state licensed, provided that nonowner surgeons are not allowed privileges. However, the state business and professions code in some states does require even solo practitioners to obtain licensure, certification, or accreditation if they administer general anesthesia "in doses that place patients at risk for loss of life-preserving protective reflexes." In other states, a physician's license to practice his or her specialty may meet the requirements. The surgical procedures are usually done on a small scale and are performed within the context of the physician's practice. In California, as of 2008, following a court order, the California Department of Public Health became unable to license or regulate a surgical clinic having any degree of physician ownership. Some states do not regulate office-based surgery, although there is increasing pressure for greater regulation. The American Society for Aesthetic Plastic Surgery, for example, mandated that, by January 1, 2002, practitioners must be accredited by one of the national organizations such as American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF), which accredits all surgical specialties. Office-based surgery facilities are discussed in greater detail in Chapter 5 under Plastic Surgery.

When a facility is organized specifically for the purpose of ambulatory surgery, then licensure of the facility is an issue. Licensing is often a requirement for receiving state reimbursement, and insurance payers may require that a facility be licensed for their participation. Furthermore, licensed facilities may be eligible for rate discounts from liability carriers. The regulations and laws regarding ASC licensing are the province of specialist consultants who can guide facilities through the many issues and requirements and also prepare them for the survey. Every ASC should avail themselves of this expertise. Likewise, there are law firms with a specialty in this area.

NFPA 101® 2000 edition Life Safety Code and state building codes are the standard for all licensing and certification requirements. For design and planning, the *Guidelines for Design and Construction of Health Care Facilities*, published by the Facilities Guidelines Institute, Section 3.7, "Specific Requirements for Outpatient Surgical Facilities" provides good direction. The designer must check with the state fire marshal, state facilities' development agencies, the local building department, and the local department of health services to ensure that all requirements are identified. The cost of designing a facility initially to meet licensing requirements will be comparatively small compared with trying to retrofit it later to achieve compliance. Licensing offers a certain amount of economic security in that it assures the facility of receiving the maximum amount of reimbursement offered by payers. Currently, 43 states require state licensure of ASCs, making them the most highly regulated type of ambulatory medical facility.

[4] www.cms.gov/Regulations and Guidance/Guidance/Manuals/downloads/som107ap_l_ambulatory.pdf.

CON/Health Systems Agency Review

Each state is unique in its approach to regulating FOSCs. The Health Planning and Resources Development Act of 1974 mandated that state governments establish Certificate-of-Need (CON) programs to regulate healthcare facilities and services. In some states, a CON may be required for an FOSC, whether it is owned by a hospital or another entity. The purposes of the CON are to prevent duplication of highly specialized facilities and equipment and to keep a lid on rising healthcare costs. Some states exempt facilities from the CON process if they are not owned by a hospital.

In many states, the CON process starts with a review by the local health systems agency (HSA), which must endorse the project and make recommendations to the state. Early in the planning stages of an FOSC it is essential to ascertain whether a CON may be required and whether HSA endorsement is mandatory. If a local HSA does not exist there may be another area-wide health planning agency that should be consulted. Many states have abandoned their CON programs since the federal government ceased funding them. The national trend toward deregulation allows FOSCs a much easier path to their goals. Currently, all but 15 states have some type of CON regulations.

There is often contention between hospitals and physician groups about CON restrictions, as evidenced by a struggle in Georgia, reported by Sheinin and Williams in the *Atlanta Journal-Constitution* (www.ajc.com/news/news/bill-to-allow-bigger-surgery-center-sparks-battle/nWfGw, accessed July 24, 2013). A bill before the House would allow *multispecialty physician practices* to circumvent the state's lengthy approval process to plan and develop new medical facilities. Georgia currently exempts single-specialty physician practices from the CON process. If successful, this would threaten ASCs owned by hospitals, hence the "much is at stake" battle in play.

Accreditation

The Joint Commission can accredit freestanding ambulatory surgical centers that are not owned by hospitals; however, accreditation by the Accreditation Association for Ambulatory Health Care (AAAHC) established in 1979 (located in Skokie, Illinois), or the American Association for Accreditation of Ambulatory Surgical Facilities (AAAASF) established in 1980 (located in Gurnee, Illinois) is more common. According to their website, the AAAASF is the largest not-for-profit accrediting organization in the United States, having accredited over 2,000 ASCs. This is a voluntary program aimed at quality assurance in all aspects of patient care. The agency publishes a handbook of standards for ambulatory healthcare as well as a code checklist for ambulatory surgical facilities based on compliance with the NFPA 101® Life Safety Code. In summary, accreditation is a voluntary assessment process whereby industry experts and peers define conformity standards by which surveyors evaluate and rate the organization's performance. It's a means of identifying and validating for the consumer quality facilities that meet recognized standards.

There is a national nonprofit membership organization for freestanding ambulatory surgical centers, called the Ambulatory Surgery Center Association (ASCA), with national headquarters located in Alexandria, Virginia (www.ascassociation.org).

Medicare certification is a requirement for receipt of federal reimbursement for patients eligible to receive these benefits. Medicare and Medicaid are programs administered by CMS. With respect to the physical plant, Medicare does not stipulate sizes of rooms or number of scrub sinks per operating room, but rather relies entirely on compliance with NFPA 101® Life Safety Code and the Medicare Conditions for Coverage. Medicare engages a local state fire marshal to conduct the survey of a new facility to verify compliance. Medicare certification paves the way for approval by other reimbursement agencies and insurance payers. It constitutes the seal of approval, so to speak. In reality, there is little difference between licensure and certification with respect to design criteria, because both rely on compliance with the Life Safety Code. All ASCs must be Medicare certified.

CMS Definition of ASC

CMS defines an ASC as "any distinct entity that operates exclusively for the purpose of providing surgical services

to patients not requiring hospitalization and in which the expected duration of services would not exceed 24 hours following an admission. An ASC satisfies the criterion of being a 'distinct' entity when it is wholly separate and clearly distinguishable from any other health care facility or office-based physician practice. It needs a one-hour fire separation minimum or more if State licensure is more stringent." (§416.44 *CMS Conditions for Coverage: Environment)*.[5]

Reimbursement Policies

The total charge for a surgical procedure has two components. One is the anesthesiologist's and surgeon's professional fees, and the other is the facility fee: The charge for the surgical suite, operating room staff, and supplies. Third-party payers vary in their reimbursement policies with respect to these two components; however, they will not pay for the use of the facility unless it meets certain criteria. These usually involve a strict adherence to the Life Safety Code. Therefore, Medicare certification and/or state licensure ensure that the FOSC will be reimbursed for the use of the facility. CMS is the single largest payer for healthcare services in the United States. They are the litmus test for other payers.

The payer mix for ASCs is:

Medicare 25 percent

Medicaid 5 percent

Commercial 59 percent

Workers' Comp 6 percent

Self-pay 5 percent

Other 7 percent

Source: www.beckershospitalreview.com/asc-turnarounds/100-surgery-center-benchmarks.html, Sept. 9, 2011 (accessed July 24, 2013).

[5]Title 42, Vol. 2, Sec. 416.2 Code of Federal Regulations, revised May 18, 2009.

MARKETING CONSIDERATIONS

An appealing aspect of surgery in a freestanding facility is the element of choice. A physician may have privileges at several facilities and may offer the patient the opportunity to choose the preferred setting. Along with that choice comes the expectation of convenience and care delivered in a small-scale, noninstitutional, friendly environment. Patient satisfaction is necessary for a facility's success, and many ASCs are keenly aware of guest relations. Both patients and physicians benefit from the fact that the majority of surgeries start on time.

Psychologically Supportive Design

The interior environment is a critical element of patient satisfaction. The facility should use color and design to relax patients and relieve their anxiety (see Figures 3-117 and 3-118). According to CMS (§416.50(f)(2) *Federal Register*, Regulations and Guidance) "respect, dignity and comfort are components of an emotionally safe environment." Success at achieving this will be evident in patient satisfaction scores.

Evidence-based design principles for creating a psychologically supportive environment include:[6]

- *Options and choice* are known to reduce stress whether it is different types of seating in the waiting area, privacy versus a more social exposure, or whether a family member accompanying the patient into the intake and prep area.
- *Positive diversion* refers to artwork, aquariums, gardens, a nice view—anything that takes one's mind off of a stressful situation can be restorative.
- *Views of nature* and natural light are known to reduce stress and anxiety, according to a large body of research.

[6]Jain Malkin. A Visual *Reference for Evidence-Based Design*, (The Center for Health Design: Concord, CA, 2008), pages 8 and 9.

- Consider the waiting area and post-op recovery for access to daylight and possibly garden views or trees.
- *Social support* whether from caring surgery center nurses and staff or from accompanying family does much to reduce stress and provide reassurance about the surgical experience, pain control, and positive outcome of the surgery.
- *Reduction of environmental stressors* includes lighting without glare, attention to noise, including the buzzing or pinging of monitors and equipment, and other aspects of the built environment that have sensory impact.

Texture may be introduced in carpets and commercial vinyl wallcovering as appropriate (in terms of maintenance and infection control). Artwork and accessories should not be overlooked as a means of distracting patients and making the experience less threatening. However, patients and their families are not the only ones who benefit from a well-designed environment. To attract physicians and nursing staff and to keep morale high, staff areas must be properly designed so that they are not only functional, but attractive. Clinical spaces need not be colorless; pre- and post-op areas benefit from a colorful cubicle drape, design in the sheet goods flooring, and accent paint on one or more walls (see Figure 3-118).

SURVEY OF SURGICAL PROCEDURES

Advancements in medical technology such as lasers and endoscopic surgery enable an increasing number of procedures to be carried out in a minimally invasive manner. The outpatient setting provides lower cost, greater convenience, safety, and quality that meets or exceeds that of hospital-based surgical facilities.

According to Healthcare Cost and Utilization Project data (HCUP), in 2009, 47 percent of procedures involved one of five body systems: digestive, integumentary (skin), musculoskeletal, cardiovascular, and eye.

CMS-Covered Procedures

Covered surgical procedures defined by CMS are those that can be safely performed in an ASC, are not commonly or safely performed in physicians' offices, require a dedicated operating room and post-op recovery room (not overnight), can generally be executed in 90 minutes in the OR and do not exceed 4 hours' recovery time, do not result in extensive blood loss, do not require major or prolonged invasion of body cavities, do not directly involve major blood vessels, and are generally not life-threatening or emergency in nature. In addition, general anesthesia must not exceed 90 minutes duration.

TRENDS AND INNOVATION

Advances in Pharmacology

Pharmaceuticals have continued to advance outpatient surgical practices. These include short-acting anesthesia agents that wear off in minutes, fast-acting agents for pain and post-operative nausea, and anesthetic agents that enable "fast-tracking"—bypassing the recovery room by transferring the patient directly from the OR to the second-stage recovery area, although this is appropriate primarily for patients who have had uncomplicated procedures and only if they meet physiological discharge criteria. The patient may be awakened while still in the OR and allowed to recover there (which requires only a few minutes) prior to being moved to second-stage recovery. In all cases, however, nurses must first verify that the patient is medically stable and that vital signs are normal.

Minimally Invasive Surgery

Although no longer considered new, surgery performed in ways that do not require large open incisions—for example, laparascopically—has been especially beneficial for outpatient surgery. There is less scarring, shorter

recovery times, less disability, lower medical risks, better clinical outcomes, and reduced costs. This is also known as “videoscopic surgery” because the laparascope has a tiny video camera on the end. Frequently performed surgeries of this type involve hernia repair, colon resection, and removal of the gallbladder.

FACILITY DESIGN

An enormous amount of careful planning precedes the establishment of an ambulatory surgical center. Feasibility studies analyze the demographics of the area and determine the demand for such a facility. In terms of codes and regulatory agency review, an FOSC is certainly the most complicated of any outpatient facility.

Location

The feasibility study will identify, among other things, the geographical area from which patients will be drawn. Travel time factors heavily into the equation. FOSCs, after all, are designed to be convenient for patients and physicians; therefore, driving distance and site accessibility are important. Traffic patterns near the location, parking availability, visibility from the street, and building appearance all require consideration.

What makes an FOSC so sensitive to these factors is that the best marketing efforts cannot create an increased demand within a given area for surgical services. Business must be generated from within the existing demand of the area served. Marketing studies will reveal whether there is excess demand, whether existing facilities are underutilized, and whether projected growth will support the additional service.

Transfer Agreement

The preference for a facility to be located near a hospital is a matter of individual consideration. The incidence of need for patient transfer to a hospital following outpatient surgery has been much lower than originally anticipated. Those transfers that have occurred were nearly always for pain control or for persistent bleeding. Transfer for life-threatening conditions has been rare according to numerous studies. This is the result of careful patient screening to determine potential risks and careful selection of types of procedures. Nevertheless, a transfer agreement with a local hospital is required.

Codes

The FOSC has many characteristics of a hospital inpatient surgery unit and must comply with many, but not necessarily all, of the same requirements imposed upon hospitals. To receive certification and/or licensure, state administrative codes and NFPA 101® Life Safety Code® and CMS *Conditions for Coverage* must be followed. In particular, note the *New Ambulatory Health Care Occupancies* section in NFPA 101®. Federal guidelines focus almost entirely on operational policies and procedures of the facility and they make no demands above state requirements for the built environment; the *Guidelines for Design and Construction of Health Care Facilities* (Facilities Guidelines Institute), however, should be used for facility planning and design. State agencies and local building departments charged with issuing approvals and permits for projects refer to this document.

Explosion/Fire/Electrical Shock. Codes are designed to prevent a variety of hazards in the operating room and recovery areas and to reduce fire hazards elsewhere. The National Electrical Code (NEC) is widely used across the nation to set standards for the use of electricity. This code, like the others described here, is implemented through adoption by state and local jurisdictions; exact requirements vary somewhat from region to region.

NFPA 101® concentrates on fire protection and prevention. NFPA 99 covers healthcare facilities and is the industry standard for storage and distribution of hazardous gases, vacuum systems, and essential electrical systems. It covers piped gases and storage of cylinders.

Power Failure. Emergency power for certain medical equipment and for egress lighting is required. The capacity and intended use are described in the NEC, §517. It gives requirements for ORs and recovery areas and defines which features are required to enhance life safety. A generator is an important item for an ASC. It must be sized appropriately for the number of ORs and facility size to enable any surgeries in progress to be completed when a power outage occurs.

Infection Control. The most pervasive risk in the surgery setting is that of infection. This involves two issues: contamination of the open wound and staff exposure to HIV or hepatitis virus. Facility design, internal protocols for handling infectious waste, and proper protection during surgery are the three principal ways of reducing this hazard.

Patient and staff circulation patterns bear significantly on the spread of infectious microorganisms. This often poses a challenge for the space planner, since program requirements often exceed available space, sometimes reducing circulation alternatives. State building codes usually establish standards for smooth and washable finishes and for special ventilation requirements within specific areas, but there is little of a definitive nature in the way of regulatory codes to assist the designer in laying out the suite to minimize the spread of infection. Common sense, experience, and guidance of the OR supervisor often dictate best practices.

The risk of HIV and hepatitis B and C is the major health hazard to be encountered whenever working with blood or body fluids. Extreme care must be taken in the surgery setting to protect both patients and staff. The Centers for Disease Control in Atlanta and the Association of periOperative Registered Nurses (AORN) in Denver offer written guidelines on facility design and patient handling to control the risk of infection. CMS also makes available regulations and guidance on infection control in document §416.51, which speaks to the unique challenges in an ASC setting due to patients remaining in common areas such as surgery pre-op, recovery, and ORs, the fact that they are turned around quickly, and patients with infections or communicable diseases may not be identified.

OPERATIONAL PROTOCOLS

FOSCs adhere to very strict procedural protocols. To ensure life safety and quality of care, and to move patients and supplies through the facility with ease and efficiency, it is imperative that each task be performed routinely, in the same manner, by all personnel. The AAAHC and AAAASF guide facilities on protocols for medical recordkeeping, patient discharge procedures, quality assurance/peer review, patients' rights, and so forth.

Every aspect of patient handling is based on a protocol developed by the individual facility, to ensure that nothing is forgotten or overlooked. While many of these protocols do not actually have an impact on the physical design of the facility, it is important for a successful project to include in the planning process representatives of all staff functions, including anesthesiologists, surgeons, nurses, and administrative staff. The space planner must avoid making any assumptions about a center's operations that could inadvertently defeat operational effectiveness.

Patients' rights are an important issue discussed frequently in ASC guidelines and regulations. Patients must be provided a written copy of their rights prior to surgery and they have the right to not proceed with the surgery if they disagree with some aspect of it. The designer needs to provide a bulletin board for display of patients' rights, certificates of accreditation, and other state-required documents in a highly visible location in the reception/waiting area.

PATIENT FLOW

There are seven stages of patient flow through the facility: *pre-admitting, arrival, patient prep, induction, recovery, postrecovery*, and *discharge*. The patient's first encounter with the facility may be a day or two prior to surgery to complete preadmission forms, although this may be handled in the physician's office, which is where orders originate for lab and other tests prior to surgery. The surgery center often mails instructions to patients in advance so

they know what to expect and to explain dietary restrictions and prep. This may be followed up by phone.

This may be the first time the patient has ever had surgery, or perhaps the first time the patient has had ambulatory surgery, and he or she may have no frame of reference upon which to rely to combat fear and anxiety. Therefore, it is important that the pre-admitting process give the patient confidence about the experience. After all, a patient truly cannot evaluate the quality of the clinical care or the surgeon's competence, but patients do make judgments nevertheless, based on interactions with staff and an assessment of the interior environment.

A patient's confidence can be bolstered by an understanding of exactly what to expect on the day of surgery. Nursing staff, anesthesiologists, and surgeons all play a significant role in educating and reassuring the patient. If the facility is designed well, circulation patterns will be predictable and convenient, allowing easy access for patients, staff, and family. Good design should make it easy for staff to do things correctly.

The patient arrives on the day of surgery approximately one and one-half hours prior to the scheduled surgery time, accompanied by an escort. Some facilities (likely only hospital-based ones) do the lab work on the day of surgery, which means patients may have to arrive a little earlier. The patient is next directed to a preparation area where street clothes are exchanged for surgical apparel. This may be handled in a number of ways. Some facilities have dressing rooms and lockers for storage of the patient's belongings (Figures 8-1 and 8-2), while others have the patient undress in a private prep/exam room (Figures 8-3 and 8-4), and belongings may be placed in a container that is stored in a secured area. In the recovery room, belongings are returned to the patient prior to dressing for discharge. In many states, regulators require that patient belongings be stowed in lockers.

Some facilities do not have individual patient prep rooms and instead separate gurneys by cubicle drapes for privacy and first-stage recovery (see Figures 8-2 and 8-5). In this situation, patients sometimes change clothes within this enclosure, or they may use a dressing/locker room. Since the facility in Figure 8-5 was designed primarily for oral and maxillofacial surgery, patients are not necessarily entirely disrobing, depending upon the extent of the surgery. It should be noted that the Joint Commission, CMS, and state surveyors are especially interested in visual and auditory privacy for patients in pre-op and post-anesthesia recovery units (PACUs) as well as in registration or interview areas. Cubicle drapes provide visual privacy but do nothing for auditory privacy. New facilities should not consider cubicle drape separation as an option if the budget will allow for a stud and drywall partition between beds to address these standards.

After the patient is gowned, the operative site is scrubbed, shaved, and prepped for surgery. The anesthesiologist will interview the patient in the prep room or in the pre-operative holding area, discussing the alternatives for anesthesia and answering any questions the patient may have. This is also done in private intake/interview rooms (see Figures 8-1 and 8-5).

Most FOSCs do not use pre-operative sedatives, as they increase recovery time. Therefore, patients may read or visit with their families prior to being taken to surgery. The patient may walk or be wheeled on a gurney into the operating room. Some facilities prefer to have patients walk in order to enhance their perception of being healthy and undergoing an elective procedure.

Anesthetic induction almost always takes place in the operating room, although an intravenous fluid may be started in the pre-operative holding area. Following surgery, the patient is transferred to the post-anesthesia recovery area until he or she is conscious and stabilized. Many facilities use a second-stage or step-down recovery area that has recliner chairs and lounge seating (see Figures 8-1 and 8-2). Patients remain here after they are dressed, have some juice or tea, and leave when they feel well enough for discharge or when their escort has arrived. Often, the escort is allowed to sit with the patient in the secondary recovery area. Instructions for post-operative care may be delivered here or in a private office, adjacent to the discharge area. HIPAA considerations must always be observed.

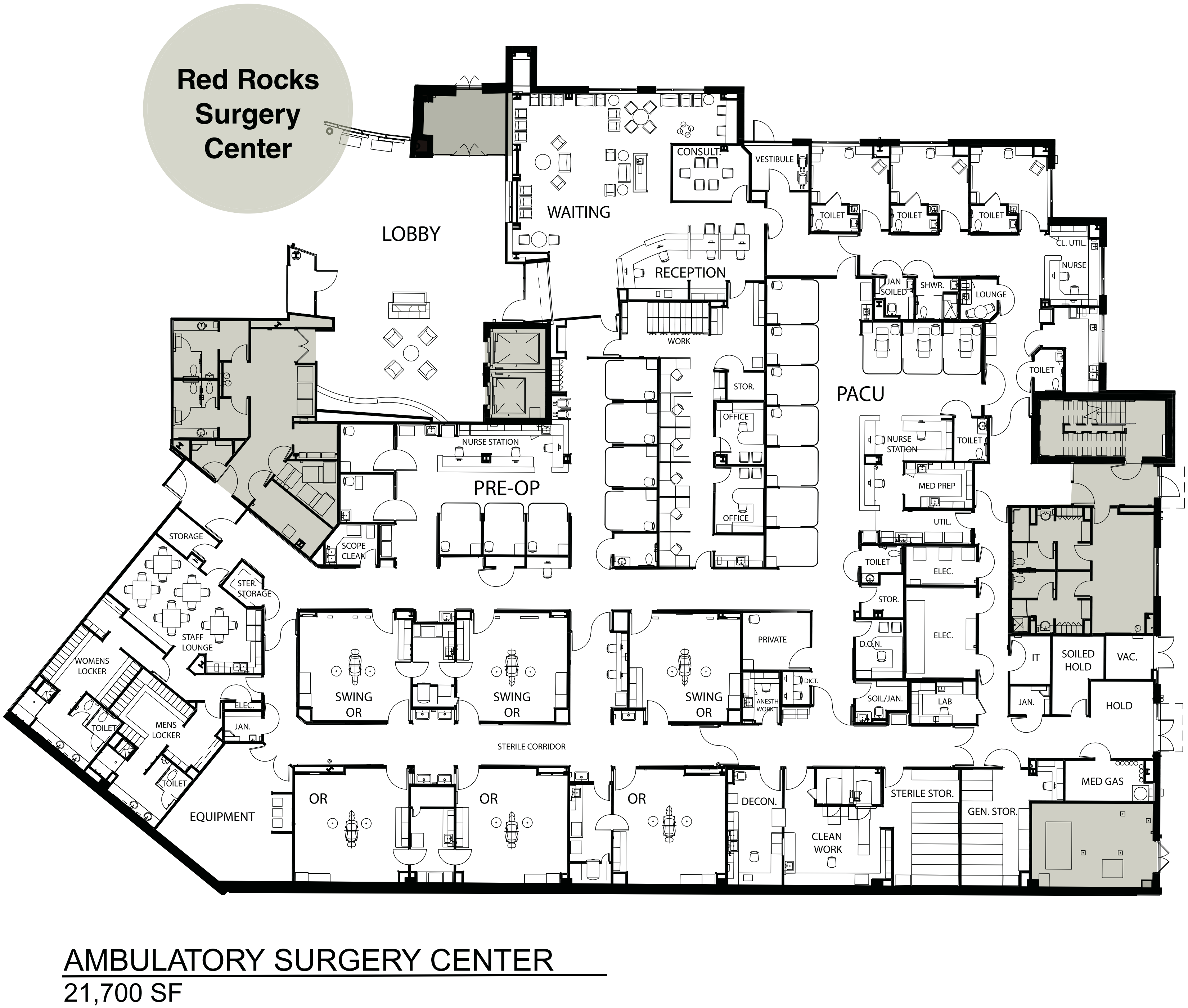
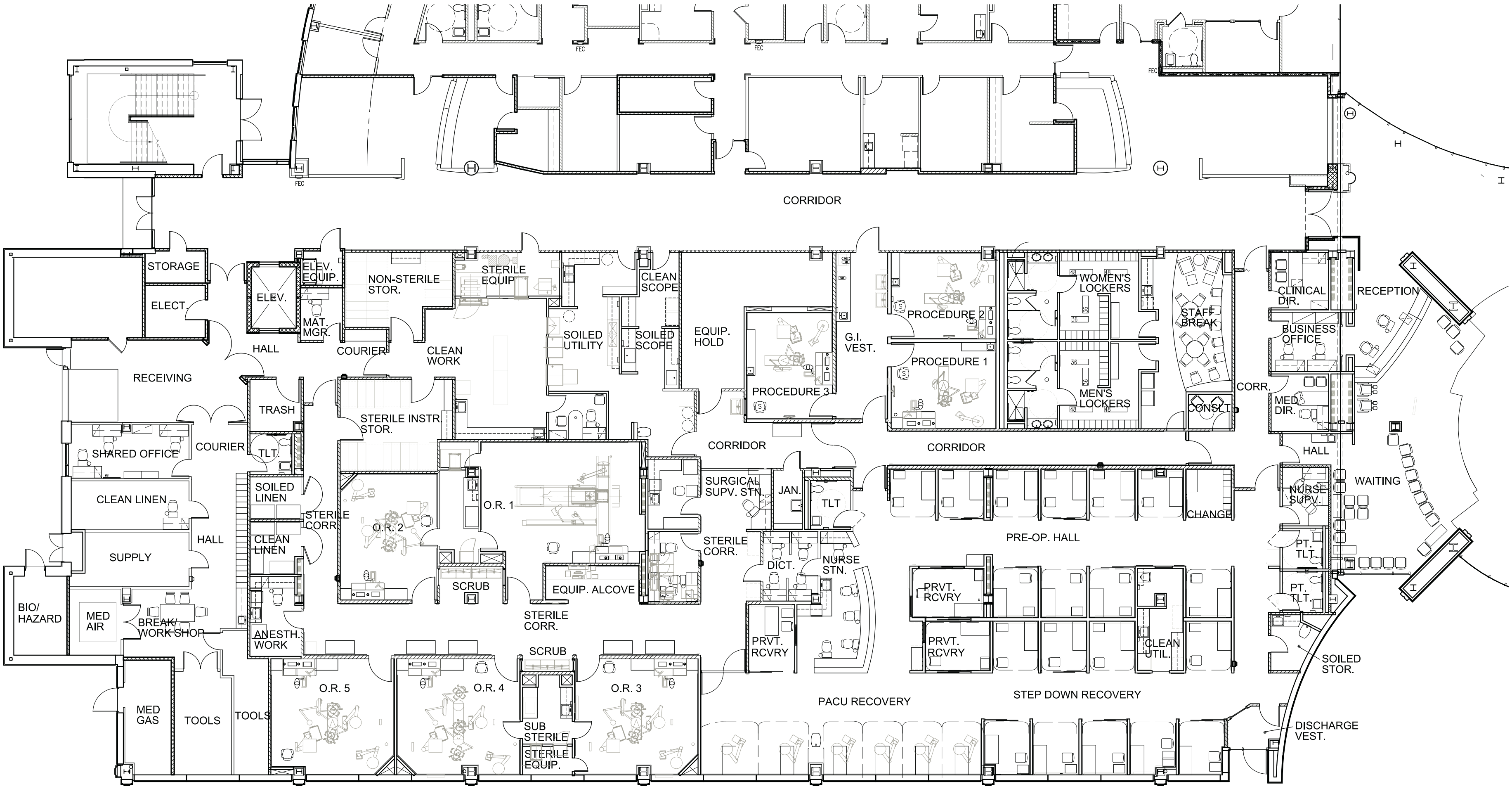


Figure 8-1. Space plan of ambulatory surgical center, 21,700 square feet. *(Courtesy of Boulder Associates)*



AMBULATORY SURGERY CENTER

15,438 SF

Figure 8-2. Space plan of ambulatory surgery, 15,483 square feet. *(Architecture and Interior Design: Hawley Peterson Snyder)*

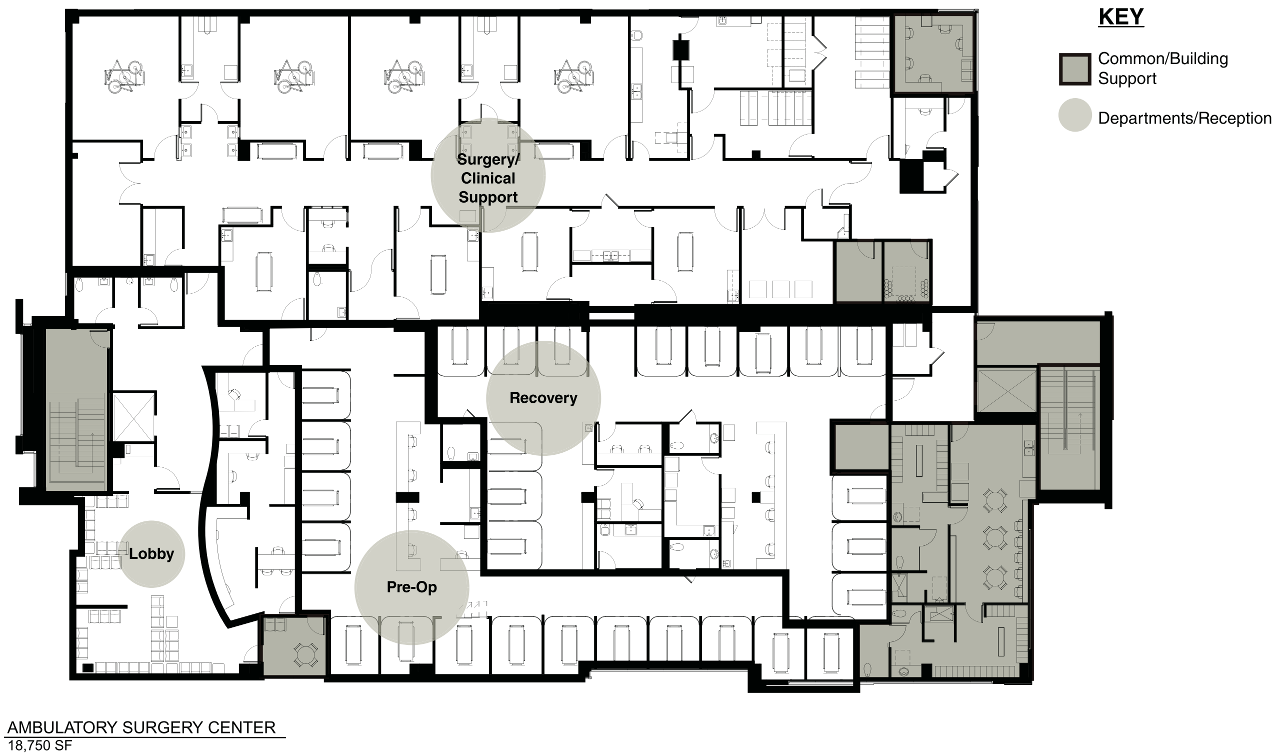


Figure 8-3. Space plan of ambulatory surgical center, 18,750 square feet. *(Courtesy of Boulder Associates)*

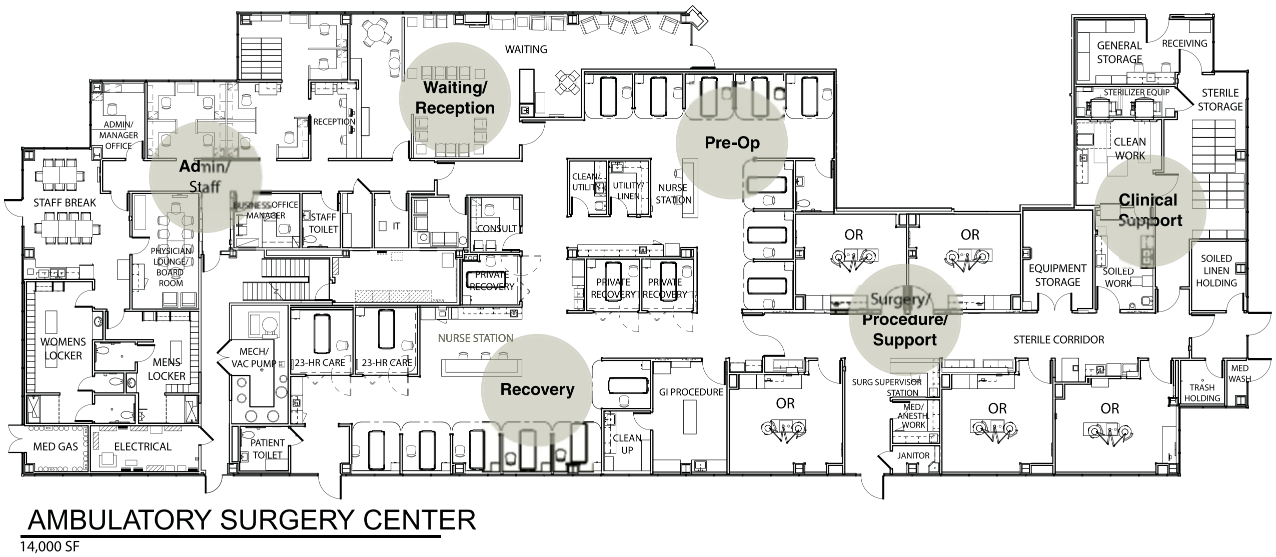


Figure 8-4. Space plan of ambulatory surgical center, 14,000 square feet. *(Courtesy of Boulder Associates)*

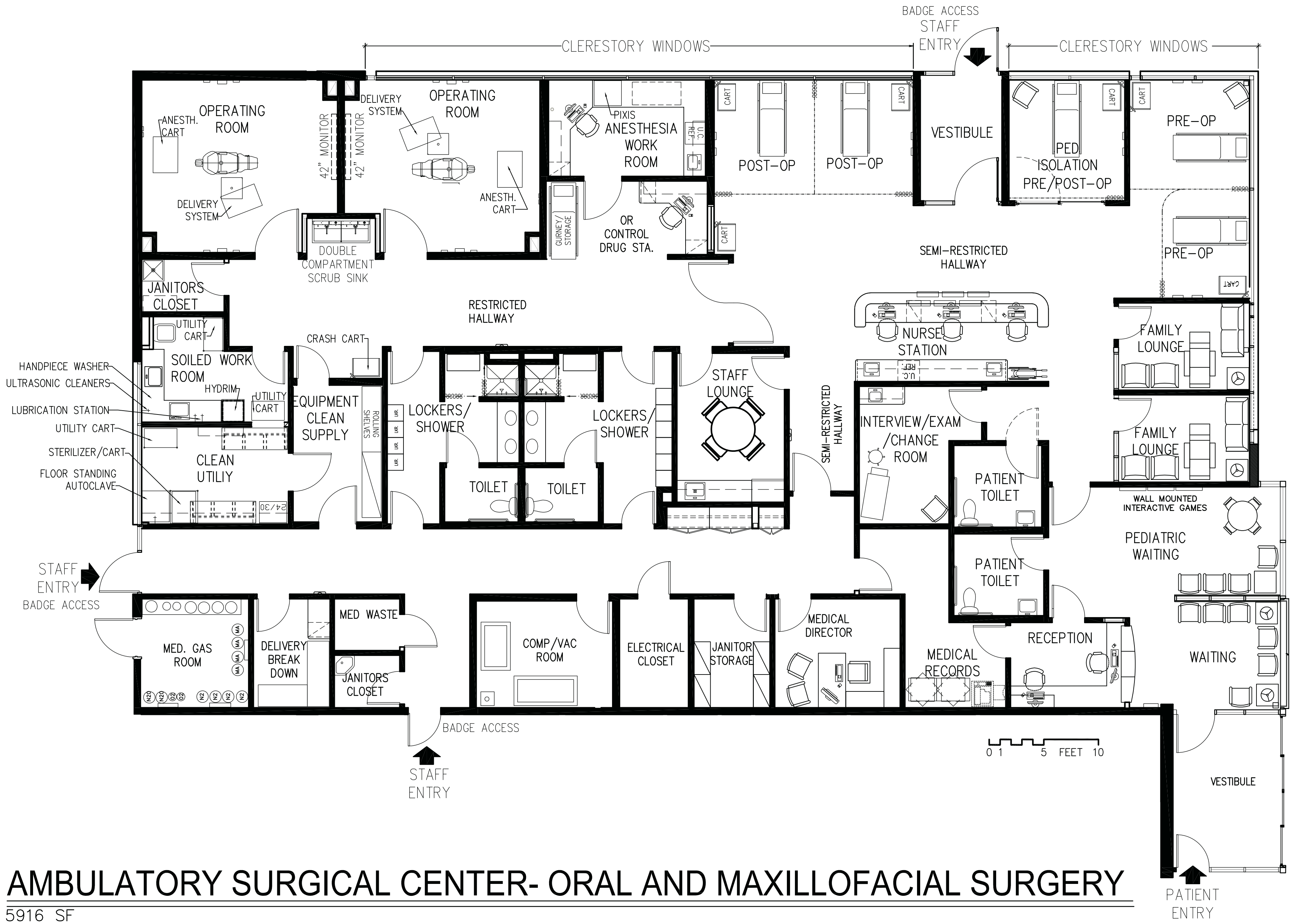


Figure 8-5. Ambulatory surgical center for oral and maxillofacial surgery, 5,916 square feet. *(Design: Jain Malkin Inc.; Architect: Rhode May Keller McNamara Architecture, P.C.)*

FACILITY ACCESS

Handicap Requirements. Barrier-free access is a code requirement throughout the nation, and although patients are accompanied by staff in almost all areas of an ambulatory surgical center, the facility must be designed to accommodate the disabled.

Vehicular Access—Patient Pickup/Emergency. As the term *ambulatory surgery* implies, patients are able to walk into the facility without assistance. However, patients often leave a facility in a wheelchair, due to protocols established by insurance carriers and regulatory agencies. The patient will be met by transportation at the facility's entrance or pickup area, which is often a private driveway located near the surgical center's discharge area. Optimally, patients and families should never have to backtrack through the facility. As the patient progresses through the facility and ultimately to the secondary recovery and discharge area, the escort proceeds from the waiting room to the discharge area to greet the patient, and then goes to pull up the car at the patient pickup exit.

When designing a medical office building with an ambulatory surgical center as a tenant, it is advisable to plan for a vehicular turnaround or drive-through, separate from the medical building lobby. This driveway must be large enough to accommodate an ambulance or a van and the patient exit must have a canopy.

Facility Entrance. The building or facility entrance and path to the reception area should be easily identifiable and welcoming. If the patient has to hunt for the entrance, if signage is poor, or if the entry is poorly illuminated, it undermines the patient's confidence about the surgical experience. The building lobby or the waiting room of the FOSC must have a public telephone and a drinking fountain. Comfortable seating and current reading material should be provided for the patients' escorts. An outdoor courtyard or garden, accessible to the patients' companions, is a pleasant addition to the facility. If the FOSC is located on an upper floor of the building, at least one of the elevators must be large enough to accommodate a gurney and must have an override call button for emergencies.

Physician/Staff Access. A physician/staff entrance should be provided near the staff lounge and locker area, oriented so patients do not observe the coming and going of personnel. Dedicated physician parking close to the staff entry will be expected and appreciated by physicians.

Service Access. Thought must be given to service access for pickup and delivery of laundry and for disposal of infectious waste and trash. Boxes of disposable supplies might be purchased in bulk lots and stored outside the surgical suite, replenishing the clinical area as needed.

INDIVIDUAL COMPONENTS OF AN FOSC

The outpatient surgical facility is divided into three designated areas—unrestricted, semi-restricted, and restricted—defined by the activities performed there. Intermediate and major surgical procedure rooms must be located in the restricted area, whereas a minor surgical procedure room may be located in the restricted or semi-restricted area. This is discussed in more detail under Surgical Core.

Waiting/Reception Area

The patient's first impression of the surgical center will be formed in the waiting room. The patient should be able to reach the receptionist easily and be able to speak with a certain amount of privacy. The registration area, where scheduling and financial arrangements are made, must be private, quiet, and comfortable. Figures 8-1 and 8-6 show a registration area divided into privacy carrels. The importance of patient privacy and confidentiality resulting from Health Insurance Portability and Accountability Act of 1999 (HIPAA), which deals with electronic transmission of data, cannot be overestimated. The Joint Commission and other accreditation agencies have extended this to the

Figure 8-6. Registration area provides privacy. *(Architecture and Interior Design: Shepley Bulfinch Richardson and Abbott, Boston, Massachusetts; Photographer: Peter Mauss©/Esto)*

built environment in terms of acoustic and visual privacy. In addition, a drinking fountain, restrooms, and wheelchair storage are required. Wheelchair storage need not specifically be in the waiting room.

The design of the waiting room enables the surgical center to demonstrate visually to patients its concern for their comfort. Colors should be cheerful, furniture comfortable, and lighting appropriate for reading and/or relaxing (see Color Plate 5, Figure 3-117). Natural light and views of the outdoors should be taken advantage of whenever possible (Figure 8-7). Figure 8-8 shows a waiting room with a fireplace, bookshelves, and seating arranged more like a living room, while Figure 8-9 has a coffee bar. Seating arranged in privacy groupings (Figure 8-7) is preferable to that which lines the perimeter of the room. Consider providing a choice of environments such as a quiet area where family can read and another that has a flat screen monitor so that TV doesn't dominate the room. A refreshments area with coffee and tea is welcomed by escorts dropping off patients for early-morning surgeries.

An ASC that is part of a large ambulatory care center has the potential to provide, by virtue of scale, a number of attractive alternatives for waiting families. An outstanding design with an interior that provides numerous positive diversions, dynamic architecture, natural light, and connects people to nature—even during robust Michigan winters—can be seen in Figure 8-10.

In many surgery centers, families are issued a beeper that enables them to shop, leave the facility to enjoy a meal, or sit in the garden, knowing that they will be notified when the patient is in second-stage recovery.

Waiting Room Capacity

Waiting room capacity will be determined by the facility program. Most patients will be accompanied by a companion. Scheduling practices in an individual facility may cause last-minute rescheduling, necessitating a one- to two-hour patient wait in the waiting room. Turnover in an individual OR can be quite high, when taking into account that some procedures may only be 30 to 40 minutes in length. This means that a substantial number of patients and their companions may be in the waiting room at any one time, especially at peak scheduling periods. For example, patients who work often tend to schedule surgery on Thursday or Friday so that they have the weekend to recover. Sometimes a small secondary family waiting room is provided for family or escorts near the secondary recovery area and discharge exit (see Figure 8-5).

Business Office

The size of the business office will depend on the program established by the FOSC. The reader is referred to Chapter 3 for a discussion of the business office and related areas. It is assumed that medical records are electronic. The patient's complete electronic health record is retained by the referring physician while only a brief medical history and a report of the surgical procedure are retained by the ASC. Verification of insurance coverage and preauthorization for the procedure is carried out in advance of the surgery.

Scheduling is an important aspect of this enterprise. Sophisticated computer software that is linked to a physician referral network is used whereby patients' histories

Figure 8-7. Waiting area with furniture arranged in intimate groupings. *(Courtesy of Ewing Cole; Photographer: Halkin Photography)*

and pre-admitting information are transmitted electronically, eliminating the need for the patient to be present prior to the day of surgery. ASCs often schedule blocks of time for individual physicians who use the facility regularly.

Pre-admit Testing

Although not specifically part of an ambulatory surgical center, hospitals often have a pre-admit testing area located either in the hospital or in an ambulatory care facility. Patients are directed to this unit several days prior to surgery for "one-stop" pre-surgical testing, which may include blood tests, chest X-ray, ECG, verification of insurance and preauthorization, and completion of patient histories.

Patient Examination/Prep Area

The patient examination and prep area should be close to the waiting room and have a direct path to the operating rooms. Patient prep areas have a nurse station

Figure 8-8. Family/escort waiting area has appearance of library/lounge with slate-clad fireplace and wall of bookshelves. *(Design: Jain Malkin Inc.; Photographer: Philip Prowse)*

nearby (see Figures 8-1 and 8-2) where patients may be weighed and their vital signs recorded. The patient will be supervised by the charge nurse, who reassures the patient during the preparation process and answers questions.

In many facilities, the corridor leading to the patient prep area is institutional in appearance with portable medical equipment and gurneys stored there, all of which may contribute to the patient's anxiety. It is desirable to create a nonclinical ambience, devoid of medical equipment clutter, possibly using sheet vinyl flooring with inset geometric designs, painted accent walls, and artwork.

A pre-operative or prep area needs a minimum of two beds per OR, varying as the facility program dictates. Individual prep rooms should be at least 8 ×10 feet in size. As discussed previously, a large room with privacy curtains dividing beds should not be considered in light of recent emphasis on patient visual and auditory privacy, but some existing facilities will have this. Waiting for surgery (the anticipation of the procedure) is the patient's time of highest anxiety, therefore a chair for a family member should be provided.

Color-coordinated cubicle curtains can enliven the pre-op area. Don't be afraid of color: This area need not be bland. Research shows that views of nature greatly reduce stress. A back-lit film transparency placed in the lens of a light fixture over the bed meets this need. In Color Plate 5, Figure 3-118, large photo murals of nature relax patients prior to surgery.

In many facilities, the pre-operative holding area is used, later in the day, for recovering patients. If such is the case, each bed should be equipped with oxygen and suction as well as patient monitors.

Pediatric Patients

If the facility will serve a significant number of pediatric patients, a number of factors should be considered. It is important for the parent to be able to accompany the child through as much of the process as possible. Dedicated pre-op holding and recovery areas are required to ensure that parents will not be infringing upon the privacy of adult surgical patients, nor will adult surgical patients be disturbed by the crying of children.

Surgical Core

The information in this section is largely based on the 2010 edition of the *Guidelines for Design and Construction of Hospital and Health Care Facilities*. This document is revised every four years with the next edition to be published in 2014, unfortunately too late for reference in this book. This incidentally correlates with the three classifications (A, B, and C) of anesthesia used by AAAASF. Refer to Chapter 5, Plastic Surgery, for a description of these classifications.

American College of Surgeons Classification of ORs

The sizes of ORs stipulated in the 2010 *Guidelines* are based on levels of care defined by the American College of Surgeons. The italics indicate the ACS class descriptions, followed by the *Guidelines* sizes for outpatient ORs.

Class A. *"Provides for minor surgical procedures performed under topical and local infiltration blocks with or without oral or intramuscular pre-operative sedation. (Excluded are procedures that make use of spinal, epidural axillary, stellate ganglion blocks, regional blocks (such as interscalene), supraclavicular, infraclavicular, and intravenous regional anesthesia.) These procedures are also appropriately performed in Class B and C facilities."*

Class A operating rooms shall have a minimum clear floor area of 150 square feet, a minimum clear dimension of 12 feet, and minimum clear distance of 3 feet, 6 inches at each side, head, and foot of table. They may be accessed from the semi-restricted or unrestricted corridors adjacent to the surgical suite. These operating rooms are for surgery or procedures requiring minimal sedation.

Class B. *"Provides for minor or major surgical procedures performed in conjunction with oral, parenteral, or intravenous sedation or under analgesic or dissociative drugs." These procedures are also appropriately performed in Class C facilities*.

Class B operating rooms shall have a minimum clear area of 250 square feet with a minimum clear dimension of 15 feet, minimum clear distance of 3 feet, 6 inches on all sides of the table. They shall be accessed from the semi-restricted corridors of the surgical suite. These operating rooms are for surgery and procedures requiring moderate sedation.

Class C. *"Provides for major surgical procedures that require general or regional block anesthesia and support of vital bodily functions."*

Class C operating rooms shall have a minimum clear area of 400 square feet, a minimum clear dimension of 18 feet, and minimum clear distance of 4 feet on all sides of the table. They shall be accessed from the semi-restricted corridors. These operating rooms are for procedures that require general anesthesia or deep sedation.

Figure 8-9. One section of the waiting room focuses on a coffee bar and fireplace with comfortable Stickley arm chairs and views into courtyard with garden. *(Design: Jain Malkin Inc.; Photographer: Philip Prowse)*

Control Station/Nurse Station

The nerve center of the surgical core is the nurse station. It provides visual surveillance of all traffic entering the semi-restricted corridor and commands total visual control of the area, including OR doors and surgical core access. There will be another nurse station in the pre-op holding area and there will be one in the recovery room.

The nurse station must be large enough to allow adequate staff workspace to monitor activities. It should contain a built-in blanket warmer in the casework and a sink and a locked drug storage cabinet or medications closet. The area will contain a crash cart (emergency resuscitation), wheelchair, and gurney storage. Note that blanket

Figure 8-10. Light-filled atrium with horticultural garden and koi pond provide a delightful waiting experience for families and escorts of ambulatory surgery patients. *(Architecture and Interior Design: Shepley Bulfinch Richardson and Abbott, Boston, Massachusetts; Photographer: Peter Mauss©/Esto)*

warmers are often the size of a large refrigerator and need to be properly accommodated.

Unrestricted, Semi-Restricted, and Restricted Areas

According to the 2010 edition of the *Guidelines*, the *unrestricted* area includes a central control point (reception desk) established to monitor entry to the restricted areas. The *semi-restricted* area includes the peripheral support spaces of the surgical suite and has storage areas for clean and sterile supplies, work areas for storage and processing of instruments, scrub sinks, and corridors leading to the restricted areas of the surgical suite. Traffic here is limited to authorized personnel and patients who must wear surgical attire and cover head and facial hair. The *restricted* area includes operating and procedure rooms, and the clean core. Surgical attire and hair covering are required and masks must be worn where open sterile supplies are located and where contact with persons who have scrubbed may occur.

The path to the operating rooms should be direct and as aesthetically pleasant as possible, maintaining consistency with the aesthetic ambience of the prep area, which by now will have become familiar to the patient. Although the sterile (restricted) zone is far more limited in terms of allowable finish materials, color and detailing may still reiterate the theme. The sterile corridor functions as a transition, separating operating rooms from patient prep and recovery. It should never be entered in order to reach another destination. Surgical apparel must always be worn in this corridor, and unprotected street clothes are not permitted.

Scrub Area

Scrub sinks (with knee- or foot-activated controls) are located near the entrance to each OR (Figure 8-11). State codes establish the specific number of sinks per OR, which is usually two per OR for the first two and one additional sink for each additional OR beyond two. These should be positioned to prevent splashing of personnel or equipment. They are usually recessed in a niche lined with floor-to-ceiling ceramic tile or other stain-resistant material. A clock must be visible from each scrub sink, and the OR door should push into the room to prevent personnel from using their hands to pull it open.

Operating Rooms

Operating room design requires the consideration of many factors, as described below.

Size. There seems to be a rule of thumb for economic viability of an FOSC, which necessitates at least three ORs. With required support services, this translates to approximately 10,000 square feet. The sizes for Class A, B, and C ORs in the *Guidelines* were stated previously. It is prudent to size ORs larger than may have been anticipated in order

Figure 8-11. Scrub sinks. *(Courtesy of Boulder Associates; Photographer: Copyright © LaCasse Photography)*

Figure 8-12. Operating room with LED surgical lights and a ceiling-mounted equipment boom. *(Courtesy of HKS; Photographer: Copyright © Jim Roof Creative, Inc. 2012)*

to accommodate additional portable equipment such as microscopes for ophthalmic surgery, arthroscopes, lasers, video monitors, C-arm X-ray, and robotic devices that are becoming standard as ambulatory surgery takes on an expanded role. As time goes on, more procedures will be done on an outpatient basis and more complicated types of surgery will be performed in an FOSC.

Room shape should be as close to square as possible for convenient placement of mobile and ceiling-mounted equipment around the table. Figures 8-12 and 8-13 show typical ASC operating rooms. Operating rooms in an FOSC should be designed to the same exacting standards as hospital inpatient ORs. Precautions for infection control, fire safety, equipment performance, lighting design, airflow, gas shutoff, and electrical back-up power should all be carefully considered.

Planning Issues. Operating room features that affect turnaround time between procedures deserve careful examination. The typical inpatient OR may be used for three or four procedures per day, each of which may last two to four hours, whereas an FOSC OR may be used six or seven times per day for procedures lasting 30 to 90 minutes. In an FOSC, surgery generally terminates by 2 P.M. to enable patients to recover and leave by closing time. In this regard, the route between the operating rooms

Figure 8-13. Operating room with LED surgical lights and a ceiling-mounted support (boom) for specific pieces of equipment. *(Courtesy of Boulder Associates; Photographer: Copyright © LaCasse Photography)*

and sterilization and the manner in which instruments and sterile supplies are delivered to the room become significant. Some facilities have substerile rooms between ORs (see Figures 8-1 and 8-3) for flash sterilization to quickly supply the operating rooms. This is a matter of individual consideration, based on the surgical program and available space. Staff input on design of the OR is critical in laying out rooms so that gas lines, suction, electrical, and computer access are properly placed. Location of the sterile field should be part of this discussion.

Casework in operating rooms either should be recessed in the wall if freestanding or should have a sloped top to avoid a shelf that becomes a dust collector (see Figure 5-94). Operating room casework usually has glass doors for viewing the contents.

Equipment. The operating room has become an ultra-high-tech environment integrating voice recognition systems, robotics, and PACS, and there will be more blurring of the line between interventional radiology and surgery as vascular radiology, neuroradiology, and cardiology become more invasive. As an example, a coronary artery bypass graft (CABG), in the conventional procedure, involves opening the rib cage. But, when executed robotically, it can be performed laparoscopically through a small opening and the patient, in theory, can be playing golf just three or four days later, without the pain, loss of productivity, and rehabilitation required with the standard procedure. The *da Vinci Surgical System* by Intuitive Surgical® is used for these procedures (Figures 8-14 and 8-15). In these high-tech ORs, the pieces of equipment "talk" to each other. A nurse's desk for computerized charting also needs to be accommodated. Robotic surgery is usually performed in dimly lit rooms with walls that are blue or blue-green.

Ambulatory surgery centers associated with academic medical centers have been the first to embrace and invest in this level of technology. The Hackensack University Medical Center, at the end of 1998, opened a new ASC featuring 10 state-of-the-art laparoscopic surgery operating rooms. Each was equipped with video-laparoscopic surgery towers suspended from the ceiling by Berchtold Teletom® power booms, which neatly conceal electrical cables, gas lines, and video cables, removing the clutter of multiple cables and wiring as well as equipment from the floor, mounting it on articulating arms and shelves. In these ORs, various components of the electronic video equipment for laparoscopic operations are integrated through the use of a voice-activated robot called Hermes®. The surgeon wears a microphone and controls all of the equipment through various voice commands. The surgeon is assisted by a second voice-operated robot called Aesop®, that holds the video camera and points it in different directions.

At Hackensack, patients are assigned a day accommodation room where they change gowns and are interviewed by the nurse and anesthesiologist prior to walking to the OR. After anesthesia recovery, patients return to this same dayroom to be rejoined by their family. (*Note: The author was unable to update this information for the current edition of the book but it is likely Hackensack has continued to be an early adopter of technology*.)

Electrical Systems. The electrical system must meet standards established by the National Electrical Code, NFPA 70; Essential Electrical Systems, NFPA 99; Use of Electricity in Patient Care, NFPA 99; and state codes. The *Guidelines for Construction and Equipment of Hospital and Health Care Facilities* gives a brief description of requirements with references to the aforementioned codes.

The electrical system in any facility where general anesthesia is used is very complex and an electrical engineer experienced in healthcare design should be part of the design team. Code-mandated items include an alarm system, emergency power, ground-fault protection, nurse call and communication systems, and an isolated power system. All ORs must have an emergency communication system connected to the control station.

Electrical outlets in the OR should be mounted at waist height, when located on the wall. Outlets overhead are more practical as cords are less likely to become tangled.

Mechanical System. Air-handling systems (HVAC) in the OR and other areas of a surgical suite are very specifically regulated, and they require the technical expertise of a mechanical engineer experienced in healthcare design. The 2010 *Guidelines* incorporate the 2008 edition of ANSI/ASHRAE/ASHE Standard 170: *Ventilation of Health Care Facilities*.

Simply stated, airflow in an OR should be from “clean” to “less clean” areas. Air should enter the room at the ceiling, above the patient, and be drawn off at two or more widely spaced locations near the floor. Filtration, number of air changes per hour, volume, humidity, and temperature are specifically mandated. In some circumstances, where the potential for infection is high, a laminar airflow system may be used. This system sends a large volume of slow-moving, nonturbulent, filtered air down over the patient and the operating team, preventing any particles from settling on the wound.

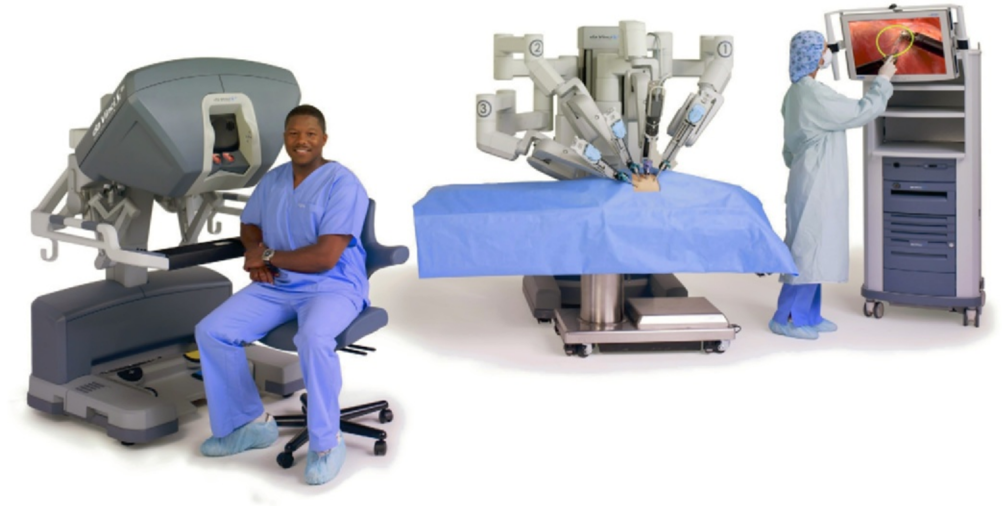


Figure 8-14. da Vinci robotic surgical system. *(Copyright © Intuitive Surgical 2013)*

An enhancement of this concept is the *Steriflo*® system by Krueger in Richardson, Texas. Forced sterile air, which is comfort conditioned to specific surgical requirements, creates a cube from ceiling to floor surrounding the patient and the surgical team. Contaminated air between the actual operating area and the four walls of the operating room impinges, but cannot penetrate, the curtain of sterile air and is immediately exhausted through the return air system. The curtain of sterile air is forced through pressure plenums and filtered downward through slot diffusers positioned in the ceiling around the operating table.

Operating rooms must maintain positive air pressure to keep contaminants from being sucked into the room when the door is open. Air inputs at the ceiling, with exhausts at the base, ensure that contaminants from the floor are not carried up to the sterile field.

Room temperature and humidity affect each other and therefore must be reviewed accordingly. Relative humidity

Figure 8-15. da Vinci robotic surgical system in use. The dark blue walls absorb glare and provide less visual contrast when looking away from monitors. *(Copyright © Intuitive Surgical 2013)*

higher than 60 percent with a temperature in excess of 72 degrees Fahrenheit can create condensation, while relative humidity lower than 50 percent at 72 degrees Fahrenheit can create static electricity.

Lighting. Recommendations for lighting levels have been established by the Illuminating Engineers Society in its publication, *Lighting for Hospitals and Health Care Facilities*. In an operating room, general room illumination is provided by flush-mounted lensed fluorescent or LED fixtures with dimmer controls. The lamp color should be at a color temperature (generally 5000 kelvin) to match the surgical light with a CRI (color rendering index) of 85 to 90. Ceiling-mounted surgical lights must have tremendous brightness in excess of 2500 footcandles to provide high color contrast for tissue definition, shadow-free lighting and excellent color rendition with a CRI of 85 or higher. Recommended illumination levels are 200 footcandles for

general ambient lighting and 300 footcandles at the surgical table. Surgical lights are typically LED, which are cooler and more energy efficient. The Berchtold Chromophare F is an LED surgical light that offers a choice of three color temperatures. Steris also offers an LED surgical light.

The quantity of light is of equal importance to the quality of light, with reference to issues of glare, contrast, color rendering, surface reflectance, and dimming capacity.

Videoscopy is often enhanced by the lowering of light levels. When using microscope illumination, fluorescents and operating lights may be dimmed. (The surgeon should be able to control room lights with a foot switch or voice command.) Auxiliary downlights, located where they will not be distracting, provide lighting for nurses and the anesthesiologist when surgical lights have been dimmed.

Medical Gases. Medical gases include oxygen, compressed air, vacuum (suction), nitrous oxide, and nitrogen (used for power instruments). These are centrally piped to each operating room and may be delivered by an outlet in the wall, through a fixed column extending from the ceiling, or via a movable track. Medical gases are used by both the anesthesiologist and the operating team; separate outlets are needed for each.

Oxygen and suction are also required at each recovery bed. The endoscopy procedure room needs oxygen, compressed air, and suction. The endoscopy workroom needs compressed air and suction. Refer to Chapter 3, Endoscopy, for details of workroom design for cleaning/reprocessing of scopes.

A gas scavenging system to "clean" room air of any anesthesia gases is required in any OR using inhalation anesthesia. The *Guidelines* list requirements for each area of the surgical suite.

Use of Lasers. Lasers have become standard equipment in operating rooms. Different types of lasers, and how they function, are explained in Chapter 5 under Ophthalmology, Dermatology, and Plastic Surgery. Otolaryngologists and gynecologists also use lasers for certain procedures.

The ability of lasers to cut precisely, vaporize tissue, and coagulate blood has revolutionized surgical techniques. Certain procedures that were routinely performed in an operating room may now be done in a physician's office, which illustrates that lasers are very much a part of ambulatory care. Valuable though they are, lasers do require thorough understanding and respect for associated occupational hazards.

Two major occupational hazards associated with lasers are exposure to the eyes and skin and toxic fumes, especially the CO_2 laser plume about which much has been written. Standard surgical masks are ineffective as a precaution against inhaling the minute particulate matter in the laser plume. The Association of periOperative Registered Nurses (AORN) and the National Institute of Occupational Safety and Health (NIOSH) have determined that laser and electrosurgical smoke is hazardous and may expose OR personnel to aerosolized infections, viruses, toxic gases, and vapors.

The laser smoke filtration system in Figure 5-103 suctions the laser plume and filters particles as small as 0.12 micron. It also helps to control the odor of vaporized tissue. This unit is designed for office-based surgery suites in physicians' offices. A leader in laser smoke evacuation systems is Surgimedics® (www.surgimedics.com).

The American National Standards Institute (ANSI) document Z-136.1 (may be purchased from the Laser Institute of America in Florida, www.laserinstitute.org) describes four basic categories of controls that should be employed in laser environments. These involve *engineering controls, personal protective gear, administrative and procedural protocols*, and *special controls*. Personal protective equipment includes goggles, clothing, gloves, and laser masks, depending on the type of laser and the amount of laser radiation emitted. ANSI document Z-136.3, also available from the Laser Institute of America, deals specifically with laser use in healthcare facilities. This is required reading for anyone designing facilities in which lasers will be used.

All windows in operating rooms or glazing in doors must be covered during laser procedures, as some laser beams can pass through glass. Appropriate warning signs must be placed on doors to ORs when lasers are in use. Nondefeatable entryway controls may be required on OR doors to prevent people from entering when lasers are in

use. Safety interlocks that disable the laser beam are standard on all laser systems. These allow an electrical connection to a door, for example, when it is opened during laser use to immediately put the laser into standby mode.

As infrared and ultraviolet laser beams are invisible, manufacturers must do something to make them visible. A red aiming beam is coaxially aligned with the invisible treatment beam to solve this problem. Some lasers have special power requirements (208- to 220-volt, three-phase power), but many function with standard current.

Equipment Storage. An equipment room convenient to the ORs should be provided for the storage of lasers. If they are stored in the OR, one has to plan well in advance to move them to the OR where they will be needed next. If they are all kept in one OR, dedicated strictly to laser surgery, scheduling and flexibility can become a problem. Since only one procedure can be done at a time, the other lasers in the room would be unusable. Other types of equipment might also be stored in this room, such as a C-arm X-ray machine (Figure 8-16). A compact wireless digital mobile X-ray, the *Mobilett Mira*, according to Siemens, provides image quality comparable to high-end stationary X-ray images (Figure 8-17).

Figure 8-16. ARCADIS® Avantic C-Arm X-ray unit. *(Copyright © Siemens Healthcare 2013)*

Accessory Items. Operating rooms will have two clocks with second hands (one for tracking elapsed time) and a monitor for viewing radiographs. An individual room may have a C-arm fluoroscopic X-ray unit with video monitor; there may be a number of ceiling-mounted monitors, a ceiling-mounted microscope, and a number of portable pieces of equipment, including an emergency resuscitation cart. Each piece of equipment has specific power requirements that must be carefully coordinated between equipment suppliers and the electrical engineer. A structural engineer should be consulted to ensure that all ceiling-mounted equipment is adequately supported. A Unistrut system above the finished ceiling is usually required.

Overhead Utilities. Adequate space must be provided above the finished ceiling to accommodate structural support, HVAC ducts, recessed fluorescent lighting, electrical conduits, and medical gas piping. The finished ceiling height in an OR should be 10 feet plus another 2 feet in the plenum above. It is sometimes difficult to achieve this height within the structure of the standard medical office building.

Interior Finishes. Finish materials used in the OR must be very durable and able to be cleaned with strong germicidal agents. Materials should be monolithic and free of seams. Frequent harsh cleanings tend to open seams, which then harbor microorganisms.

Floors. A high-quality cushioned sheet goods floor with heat-welded seams is ideal for ORs. Flooring must be monolithic and joint free. Attractive products are available that can be cut and inlaid with contrasting borders. Sheet goods must be installed with a self-coved, 6-inch-high base. Products should be "green" and low-emitting in terms of VOCs and installation adhesives. Flooring products must be able to be cleaned repeatedly with germicidal agents and should be resistant to staining.

The reason surgical scrubs (attire) are green is to neutralize the afterimage of blood, since green and red are opposite each other on the color wheel. After staring at the surgical field (red) when one looks away, the eye produces the complementary color (green). To avoid seeing green "spots," an 8 × 8–foot inset of green sheet vinyl set into the floor neutralizes the afterimage and is also attractive.

Walls. Largely for cost considerations, epoxy paint (specify dull sheen) has become common in recent years. A medium color value (less reflective for lasers) is desirable, rather than light or white walls.

Ceilings. Operating room ceilings must be smooth and washable. Gypsum board with a washable, nonreflective finish in a light to medium color tone is recommended. Ceilings in semi-restricted areas, such as clean corridors, central sterile supply, radiographic rooms, and minor procedure rooms, must be smooth, scrubbable, and capable of withstanding germicidal cleaning.

Pathology Prep Area

A small room with cabinet and undercounter refrigerator may be provided for storing tissue to be sent to a pathology lab. Prepared vials containing formalin to preserve the tissue are taken into the OR and later must be refrigerated until pickup. These can also be stored in a refrigerator in the soiled workroom. A portable unit, *CoreVision* by Faxitron® (see Figure 5-28), can be brought into the OR to send an image of a section of tissue to a pathology lab for immediate analysis during the surgery.

Endoscopy and Minor Procedure Rooms

Ambulatory surgical centers often have an endoscopy suite (see Figure 8-2 and 8-3). Specific design details are discussed in Chapter 3 under Internal Medicine. This room can be used for other types of minor procedures that require a clean, but not a sterile, environment. The *Guidelines*, § 3.9 "Specific Requirements for Gastrointestinal Endoscopy Facilities," defines an endoscopy procedure room as having a clear floor area of 200 square feet exclusive of fixed cabinets (see Figure 3-92).

Figure 8-17. Mobilett Mira wireless digital mobile X-ray. *(Copyright © Siemens Healthcare 2013)*

As this is contained within an ASC, the other requirements for handwashing, pre- and post-operative holding areas, and ancillary rooms will have been met. The decontamination and cleaning of endoscopes must be rigorous. Refer to layouts and details, and photos of reprocessor units, under Chapter 3, Internal Medicine, Endoscopy.

Workrooms

The movement of clean and soiled instruments and materials through the surgical suite should be as efficient and economical as possible and must be carefully studied during the programming stage of design. There must be a continual flow of clean disposable supplies, linens, and instruments into, and removal of soiled items from, the OR. Provision should be made for computers and monitors in workrooms to track instruments and manage a number of functions.

Soiled Workroom. Instruments leaving the OR go directly to a soiled workroom where they are decontaminated prior to sterilization. Here they are soaked, scrubbed, rinsed, and/or placed in ultrasonic cleaners to remove blood and debris. This room requires a clinic (flush) service sink, deep utility sink, built-in washer/sterilizer, countertop work surface, and storage for sorting soiled materials. A washer decontaminator that goes through the wall into the clean assembly workroom allows dirty instruments to be put in on one side and removed, after processing, on the other where they are put into peel packs for visualization or wrapped and labeled into kits prior to terminal sterilization. The lighting level recommended by the Illuminating Engineers Society is 100 footcandles.

Soiled Holding. This is an area for the collection, storage, and disposal of soiled materials, including linen, and hazardous waste.

Clean Assembly/Workroom. This room is used for inspecting, assembling, and wrapping instruments after they have been washed and decontaminated, and for terminal sterilization of medical and surgical equipment and supplies. This room requires a handwash sink, adequate countertop work surfaces, and sufficient storage to accommodate supplies. Access should be convenient to the ORs. Smooth and washable floor and wall finishes are required.

Sterilization. Sterilization takes place in the clean assembly/workroom but may additionally be done in a *substerile* area, which is a small room adjacent to an OR, or sometimes between two ORs (see Figure 8-1), with an autoclave for quick “flash” sterilization between procedures. Typically, there is a central location serving all ORs supplemented by decentralized sterilization (see Figures 8-2 and 8-3). It may be advisable to provide small blanket warmers in the substerile areas so that a warm blanket can be put around the patient as soon as he or she is settled on the operating table.

Whatever the configuration, the sterilization room will contain a large, high-speed autoclave, a peracetic acid sterilizer for heat-sensitive items (requires plumbing), dry heat sterilizer, sink, adequate countertop work surfaces, and storage of clean materials needed to restock the ORs. Cleaning, packaging, sterilization, and setup of surgical trays are done here. Ventilation issues should be examined carefully in a sterilization area. Wall finishes and flooring must be monolithic, smooth, and washable.

Clean/Sterile Supply Room. After instrument kits have been removed from terminal sterilization, they are allowed to cool before being stored in a clean environment convenient to the OR. Adequate open-shelf storage should be provided where humidity from the sterilizer is not a factor. Wire Metro shelving racks on casters work well for storage. The lowest shelf should be 18 inches off the floor.

Anesthesia Workroom. An anesthesia workroom is required where equipment is cleaned, tested, and stored. At least one compressed-air outlet and one oxygen outlet are needed at the work surface. A sink is required along with sufficient storage for separating soiled from clean equipment. All surfaces must be easily cleanable.

Medication Distribution Station. This room is used for storage and preparation of medications for patients. It requires a refrigerator and double-locked storage for controlled substances.

Housekeeping Room. The surgical core must have its own housekeeping room, even if one is located elsewhere in the suite. It will need a floor sink and storage for all cleaning supplies, materials, and equipment.

Other Requirements. The designer should consult the *Guidelines* for other details and a description of other

required rooms and spaces. The discussion in this chapter is intended to provide an overview.

Storage of Medical Gases

Storage of medical gases must be evaluated in terms of convenient access, separation from other areas (fire hazards), and security. A room near the service entry is generally convenient. Gas storage may be outside the facility if securely protected from vandalism. Building codes often require wall construction of two-hour fire rating around the room, one-hour duct protection, smoke-fire damper at air supply into the room, and a 90-minute rated door. Other requirements such as an alarm and automatic extinguishing equipment may be required, based on location and type of gases used. The room must be vented directly to the outdoors. Fire codes are very specific with respect to the storage and handling of medical gases. The designer is referred to NFPA 99 Standard on Gas and Vacuum Systems (2012).

Vacuum and Compressed Air

Vacuum (suction) and compressed air are provided by compressors located onsite. These may be remotely located, limited only by flow resistance in the supply pipe. Sometimes a basement, a rooftop, or an outlying utility pen may be utilized. These compressors are very noisy and should be properly installed to isolate vibration and noise.

Staff Areas

The design of staff areas may vary. The main factors to consider are outlined below.

Dressing/Locker Rooms. Facilities for medical staff to change into surgical attire should have adequate space for storage of scrubs in various sizes, caps, and shoe covers as well as receptacles for soiled linen and disposable items. A unisex locker area with private changing rooms is acceptable per the *Guidelines*, including at least one staff shower in addition to toilets and handwash stations. It is more common to provide separate male and female changing areas as in Figures 8-2, 8-3, and 8-4. The design should create a one-way traffic pattern so that personnel entering from outside the surgical suite can change and exit into the semi-restricted corridor (see Figures 8-1, 8-3, and 8-5).

Waste/Trash Disposal. A provision for fluid waste disposal (clinic flush sink) convenient to the ORs and post-anesthesia recovery unit is required. The one in the soiled workroom may be used provided, in addition, one toilet in the recovery area is equipped with a bedpan cleaning device.

Lounge. A staff lounge must be provided in facilities having three or more operating rooms. It allows surgical personnel to relax between procedures without having to regown. This area is not considered "clean" in terms of maintaining sterile conditions such as exist in the surgical core. Walls may have commercial vinyl wallcovering, and a suspended acoustical ceiling may be used. The type of furniture in this area is not specifically addressed in codes or guidelines; however, AORN recommends upholstered furniture and carpeting, provided a good maintenance program is enforced. Sometimes the lounge has carrels to enable physicians to do charting whether it is on a tablet or laptop. These functions can also be accommodated at the nurse station. The lounge should be a comfortable, softly illuminated room, with space for dining as well as lounging. Landline phones may be necessary, as well as a tackboard for posting notices of clinical or social importance to the staff. If natural light is available it should by all means be exploited. The staff lounge is a high-traffic area used throughout the day.

Post-anesthesia Recovery (Primary)

The patient's destination from the OR is the post-anesthesia recovery room (Figure 8-18). This should be immediately accessible from the central sterile corridor. Economies, with respect to staffing, may be achieved by designing the pre-op holding area immediately adjacent to the recovery room, with a single large nurse station overlapping the two areas (see Figure 8-2).

The *Guidelines* define the number of recovery stations as follows: "they shall be provided in accordance with the functional program with a minimum of one per operating room but, in the absence of an analysis by the authority having jurisdiction, the minimum number shall be as stated below:

Class A: minimum of one position per OR

Class B: minimum of two positions per OR

Class C: minimum of three positions per OR"

Figure 8-18. Recovery area. *(Courtesy of Boulder Associates; Photographer: Copyright © Ed LaCasse Photography)*

Each recovery area requires a minimum of 5 feet clearance between beds or stretchers, 4 feet between beds and adjacent walls to the side and foot, and at least 3 feet from the foot of the bed to the closed cubicle curtain. The number of pre-op and recovery beds is a practical matter related to the throughput of the operating rooms. Recovery room capacity may be adjusted higher or lower, depending on the program and the experience of the medical staff. There are numerous operational strategies for increasing turnover times.[7]

[7] C. Pallardy. "9 Ways to Build and Maintain Quick Turnover Times at Surgery Centers": Becker's ASC Review, July 25, 2013; accessed July 28, 2013 (www.beckersasc.com).

The level of asepsis control measures applied in this area is based on licensing and accreditation guidelines. A sheet goods monolithic flooring is recommended for the high volume of wheeled traffic and also to facilitate cleanup.

Indirect lighting is ideal, adjusting light levels lower over recovery beds and higher at the nurse station. The area should be colorful, but avoid busy patterns or bold colors, which may cause discomfort if a patient is nauseated. Cubicle drapes are probably the best vehicle for accent color, as they are easily changed. The color of fluorescent lamps in this area is a critical factor, as skin tone is an indicator of the patient's condition. A color temperature of 3500 Kelvins with a CRI of 85 to 90 is recommended.

The nurse station must have good visibility of all beds (Figure 8-19) and must have a handwashing sink, emergency resuscitation cart, and lockable drug cabinet. Wheelchair storage and staff and patient toilets also must be provided.

It is unlikely that an isolation recovery room for a single occupant would be required in an FOSC. However, occasionally facilities have private recovery rooms with toilets, as in Figure 8-1, which are licensed for extended stay up to 72 hours. In Figure 8-4, two private rooms are designated 23-hour stay.

Pediatric Recovery. When the FOSC accommodates children on a regular basis, a pediatric recovery area should be provided that is separate from, but adjacent to, adult recovery. Space for a family member must be provided near each crib or bed, which means that more area per patient may be required than for adult beds. Sound control is very important here, as it is unpleasant for adults to hear children screaming and crying. Pediatric recovery may receive the same interior finishes as the adult area, but could have design features to make the environment a little less clinical. Generally, this area would be monitored by the adult recovery nurse station. This can be accomplished by using glass walls to enclose each pediatric bed, allowing good visibility from the nurse station.

Recovery Lounge (Stage II)

As the patient becomes more alert, the staff evaluates his or her condition and, as soon as vital signs have stabilized and

Figure 8-19. Prep/recovery area. *(Courtesy of Boulder Associates; Photographer: Copyright © Ed LaCasse Photography)*

nausea (if any) has subsided, the patient would walk to the recovery lounge. This room accommodates the final stages of recovery in a more comfortable setting, where companions may sit with the patient. When the staff observes that the patient has been stable for at least half an hour, discharge instructions will be given to patient and family and the patient will be formally discharged. Adequate space is needed to accommodate family, and the second-stage recovery would optimally be near the family waiting area.

The recovery lounge, equipped with comfortable recliner chairs and lounge seating, should be immediately adjacent to post-anesthesia recovery. Observation by medical staff is still required, but it is more informal. The short duration of stay and the use of chairs, rather than beds, allow this area to be considerably smaller than post-anesthesia recovery. The number of chairs depends on individual program requirements. For example, patients undergoing ophthalmic surgery with a local anesthetic may proceed almost immediately from the OR to a recliner chair in secondary recovery. The dressing area and toilets will be immediately adjacent to secondary recovery.

The 2010 edition of the *Guidelines* provides for Phase II recovery if required by the functional program. A minimum of 50 square feet shall be provided for each patient in a lounge chair plus space for additional equipment.

There is no restriction on the types of interior finishes that may be used in the recovery lounge, other than what good sense would mandate with respect to flammability and maintenance. Upholstery on recliner chairs must be washable. Carpet or carpet tile is an acceptable floorcovering but for functionality a wood-grain sheet goods product may be a more suitable choice. Paint or commercial

vinyl wallcovering may be used on walls. This area can be designed like a residential "living room," with indirect lighting. Natural light and views are highly desirable.

ADMINISTRATION

An ASC will need private offices for the medical director, the director of nursing or the OR supervisor, and the business manager or clinic administrator. The director of nursing's office should be adjacent to the surgical core or to the recovery room, where he or she can oversee activity. Sometimes the office has a one-way glass window overlooking the nurse station in the surgical core.

RECOVERY CARE CENTERS AND SPECIALTY SURGICAL HOSPITALS

Overnight recovery care centers that provide extended observation following outpatient surgery exist in some states. These are defined as facilities that provide post-surgical care of the patient discharged from the post-anesthesia care unit with a defined length of stay based on each state's regulations, which is typically 23 hours although some are licensed for 72-hour care. Recovery-care centers make it possible to perform more complex and well-reimbursed procedures on an outpatient basis. While some ASCs may have a few private recovery rooms designated and licensed for 72-hour care, another option is a specialty surgical hospital. These are small-scale hospitals that may focus on specific types of surgery such as orthopedics, as an example. They are always owned by physicians. They provide a more intimate patient experience than a large hospital. As an example, the Stanislaus Surgical Hospital in Modesto, California (stanislaussurgical.com), on its website, boasts of "high-tech air filtration systems to reduce infection" for joint replacement surgery and, describes the patient experience as: "you will enjoy the quiet comfort of carpeted floors, wallpapered patient rooms, and a beautiful relaxing collection of art...private patient elevators and direct discharge to your waiting car or the inpatient nursing unit. We have our own chef and a highly-trained staff of food service technicians to ensure you have the proper nutrition and warm delicious meals including fresh-baked pastry and cookies."

Postsurgical recovery care represents one of the fastest growing trends of the ASC market and is especially suited to orthopedic and plastic surgery cases. Recovery care centers are almost all owned by physicians. The member organization is "Physician Hospitals of America" on whose website can be found (physicianhospitals.org) the locations of its members across the nation. Patients having elective surgery may prefer to go to an outpatient surgical setting in which they can also recover, especially since many of these have lower infection rates than hospital-based surgical facilities and they enjoy high patient satisfaction. The costs may be half of what they would be in a hospital for the same procedure but, at the same time, Medicare pays ASCs up to 50 percent less than they would pay a hospital.

Recovery care centers require facilities for sleeping and nutrition services, and a communication system enabling patients to summon assistance. The facility must be equipped to deal with emergencies. Other required components are visiting areas for family, including children and adolescents, adequate privacy for meetings between physicians and other professionals with the patient's family, and accommodation for translators or translation equipment.

TYPES OF PROCEDURES NECESSITATING EXTENDED CARE

Orthopedic procedures constitute the largest percentage of recovery stays followed by plastic surgery and gynecology.

SUMMARY

There are a number of models for designing ambulatory surgical centers. Each meets the goals of a specific program, and the final design of the facility is influenced by the available space, the shape of the building, the budget, and the personalities of the decisionmakers. Success, however, can only be achieved by meeting the universal goals of ambulatory surgery: low cost, convenience for patients and physicians, and a high degree of safety.

CHAPTER 9

Paramedical Suites

Two types of paramedical suites, physical therapy and pharmacy, will be discussed in this chapter.

PHYSICAL THERAPY

Patients requiring physical therapy may need rehabilitation following surgery, stroke, trauma, or a work-related injury, ranging from carpal tunnel syndrome to cervical problems associated with lifting heavy items or frequent twisting or bending movements. Usually referred by a physician, patients arrive for an initial evaluation, followed by a series of visits that may range from one to three times per week. For each patient, a routine is established that quickly becomes familiar. Some patients have to warm up by riding an exercise bike for 10 minutes prior to starting therapy and, after checking in with the receptionist, they proceed to the gym and set themselves up on the bike, often without the therapist greeting them. First-time visitors will wait in the reception room until called by the therapist.

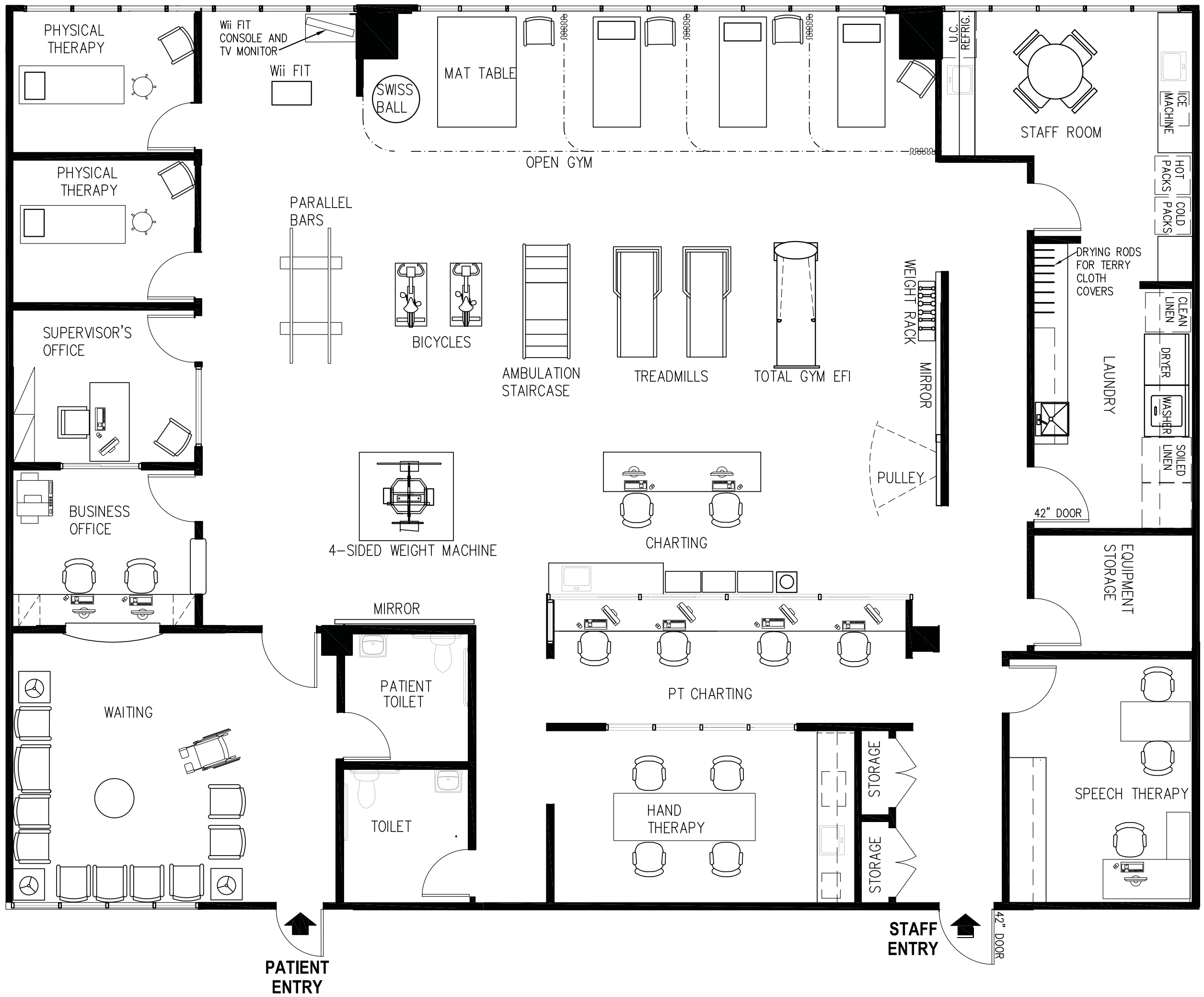
Patients are usually asked to wear shorts or other garments that expose the injured limb, which means that the therapist can often treat them in an open, nonprivate area, working on a massage table, bending or massaging a limb to achieve better flexibility or range of motion, perhaps applying electrical stimulation to a muscle and, at the end of the session, applying ice to reduce swelling.

The gym floor must have sufficient open space to be used as a gait lane to visualize patients' ambulation and also to provide room for patients to exercise with elastic ankle bands or straps or other devices. A quieter, or less active, part of the gym may have one or more small rectangular tables for a hand therapist who sits across from the patient (Figures 9-1 and 9-2). A nearby work area will provide space to fabricate braces to immobilize the hand. This requires storage for the Velcro® straps and other splint materials as well as a small device to heat the material so it can be molded.

Visibility by staff is essential for safety and efficiency in the physical therapy area. Therapists may work with several patients, alternating between them. They may be applying an electrical muscle stimulator to one person for 10 minutes, cervical traction to another for 20 minutes,

Table 9-1.
Analysis of Program
Physical Therapy

Waiting Room		16 × 20 = 320
Business Office		10 × 16 = 160
Supervisor's Office		10 × 12 = 120
Tech Work Area/Charting		8 × 16 = 128
Gym		20 × 40 = 800
Speech Therapy		12 × 14 = 168
Hand Therapy		10 × 12 = 120
Treatment Rooms (open bay)	5 @	8 × 10 = 400
Treatment Rooms, Private	2 @	10 × 12 = 240
Toilet	2 @	8 × 8 = 128
Laundry & Equipment Room		12 × 16 = 192
Break Room		10 × 10 = 100
Storage		8 × 8 = 64
Tel. Equip/Server Closet		4 × 5 = 20
Subtotal		2,960 SF
20% Circulation		592
Total		3,552 SF



PHYSICAL THERAPY

4275 SF

Figure 9-1. Space plan of physical therapy suite, 4,275 square feet. *(Design: Jain Malkin Inc.)*

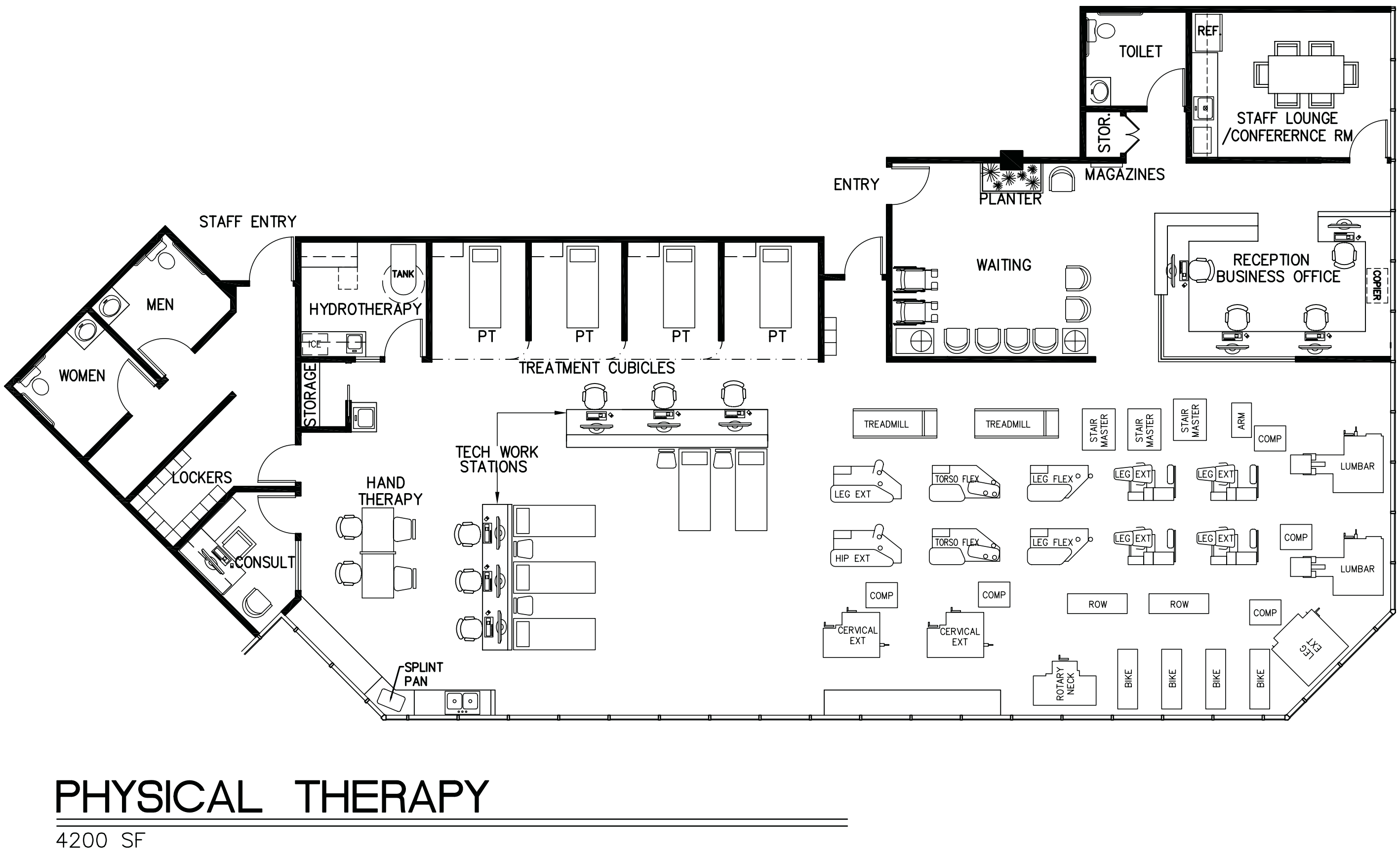


Figure 9-2. Space plan of physical therapy suite, 4,200 square feet. *(Design: Jain Malkin Inc.)*

setting up a patient on an exercise machine, and placing another in a hydrotherapy tank for 20 minutes. Once set up, each of these patients needs no further assistance until the 10- to 20-minute cycle has ended. Therapists continually circulate among patients in an open plan arrangement set up with physical therapy tables, exercise bikes and other equipment, large mat tables, gait lanes, and private physical therapy rooms or cubicles partitioned by a curtain (see Figure 9-1). The many activities going on simultaneously can make the treatment area very hectic. For this reason, natural light, ample window area, and views of nature are essential to both the therapists' and the patients' well-being (Figure 9-3). The open-plan workstations in Figures 9-3 and 9-4 work well.

Physical Therapy Modalities

There are eleven basic modalities of physical therapy:

1. Hydrotherapy
2. Heat or cold
3. Massage

Figure 9-3. Physical therapy treatment area. *(Photo: Jain Malkin)*

Figure 9-4. Physical therapy exercise area. *(Photo: Jain Malkin)*

4. Exercise
5. Ultrasound
6. Traction
7. Electrical stimulation
8. Transcutaneous electrical nerve stimulation (TENS)
9. Iontophoresis
10. Continuous passive motion
11. Mobilization

Hydrotherapy

Hydrotherapy involves immersion of a limb in water. The tank may be a portable whirlpool (Figure 9-5) for extremities or, something relatively new, a "dry" method called *Fluidotherapy®* that uses a physical agent (fine particles that acquire the characteristics of fluid) to transfer energy in the form of heat to soft tissues by forced convection (Figure 9-6). It performs the functions of heat, massage, sensory stimulation, and pressure. Whirlpools are often used for wound care. Practices that see a lot of diabetic patients are likely to offer this modality. Mobile whirlpool tanks (Figure 9-5) may be filled and drained with a hose. The patient sits in a high chair, such as that shown in Figure 9-7, and swings a leg over into the whirlpool. If an immersion tank is used, the flooring under it needs to be appropriate for spills and dampness.

Floor sinks must be provided for portable tanks, which have to be drained and filled for each patient. A hose connection to a nearby tap may suffice for filling the tank. Whirlpool rooms or enclosures are usually 6 × 8 feet in size and may be closed off on the open side by a cubicle drape. Depending on the location of walls and circulation in order to accommodate ADA access, larger spaces may be needed.

Heat or Cold

Heat is produced by a variety of methods, ranging from a simple electric heating pad to hot steam packs to soaking

Figure 9-5. Mobile arm, hand, and foot bath. *(Photo courtesy of Ferno-Washington, Inc., Wilmington, Ohio)*

the affected part of the body in hot water or placing it in hot paraffin. Figure 9-8 shows a hydrocollator (hot pack) unit that must occasionally have water added and at least once per month it needs to be drained and cleaned. It can be filled by a hose from a nearby faucet, but a floor sink is needed for draining. It plugs into a standard 120-volt AC grounded outlet. Figure 9-9 shows what the steam packs look like inserted in terrycloth covers. If these covers are not used, the steam packs must be wrapped in several layers of terrycloth towels.

A good deal of laundry is generated here. Suitable storage must be provided for clean linen, a large hamper for soiled linen, and a drying rack in a ventilated louver-door closet for drying wet towels until the linen service picks them up. A note of caution: A busy clinic can generate

Figure 9-6. Fluidotherapy®. *(Courtesy of copyright © DJO Global 2013)*

enough soiled linen to necessitate a very large wheeled acrylic cart approximately 3 × 4 feet × 5 feet high. This needs a large storage room with a 42-inch-wide door near the service/staff entry where it can be held for pickup, generally twice per week. This closet should be ventilated due to the damp linen. Some facilities wash their linen in-house. The washer and dryer would go in the workroom with the hydrocollator (hot pack) and chiller (cold pack) units and the ice machine (Figure 9-10). Allow space for folding laundry.

Figure 9-7. Bailey whirlpool therapy chair. *(Courtesy of Morris Group Co.)*

Figure 9-8. Hydrocollator unit used to produce hot packs. *(Courtesy of copyright © DJO Global 2013)*

Cold is normally produced by cold packs or ice, which is applied to the affected part of the body. Figure 9-11 shows a chilling unit. There is often more than one of these. Figure 9-12 shows what the cold pack looks like. These units have the same electrical requirements as the steam pack units. Both the cold pack and the steam pack units may be positioned immediately adjacent to built-in cabinetry in order to provide a large countertop area for wrapping steam packs. The average height of these units is 33 inches. Some clinics use a large ice machine while others use a box freezer (Figure 9-13) for freezing gel packs instead of ice; some use a small ice maker in addition to the frozen gel packs. The placement of all these items in the workroom/equipment room needs to be carefully planned for efficiency and flow.

A separate equipment room may be created for storage of small pieces of portable equipment when not in use, such as muscle stimulators, the ultrasound cart, and the TENS unit.

Massage

Massage is the oldest form of physical therapy. It is generally performed in private cubicles, which may be constructed of standard gypsum board partitions on three sides with a ceiling-mounted drape on the fourth side (see Figure 9-2), or treatment cubicles may be contained in one large room, each one separated from the others only by ceiling-mounted cubicle drapes (see Figure 9-1). A wall between treatment tables is far preferable. It can be very unpleasant to overhear clinical details of another patient's injuries or surgery or expressions of pain while trying to deal with one's own therapy. In either case, the treatment modules need to be approximately 8 feet wide by 9 feet long. Some types of treatment can be done in

Figure 9-9. Steam pack in terrycloth cover. *(Courtesy of copyright © DJO Global 2013)*

"open" bays with the option of pulling a cubicle drape, provided that private rooms also be available for those patients needing it. The types of manipulation done for postsurgical knee joint replacement, for example, do not generally require privacy. A physical therapy treatment table (Figures 9-14 and 9-15) is 27 to 30 inches wide and 78 inches long. It would be placed in the center of the room, with space for the therapist to access either side of the patient. The room may also have a chair, wall mirror,

Figure 9-10. Ice dispenser on stand. *(Photo courtesy of Hoshizaki America, Inc., Peachtree City, Georgia)*

Figure 9-11. Chiller unit for producing cold packs. *(Courtesy of copyright © DJO Global 2013)*

Figure 9-12. Cold packs. *(Photo courtesy of Chattanooga Group, Inc., Hixson, Tennessee)*

hooks for patient's clothing, and a shelf for creams and ointments that may be used during the massage. Various types of portable equipment, such as a muscle stimulator or ultrasound unit, may be wheeled into the cubicles as needed. The *Vectra Genisys® Therapy System* (Figure 9-16) is multimodality, offering ultrasound, electrotherapy, laser, sEMG and sEMG plus stimulation.

Subdued, indirect lighting is optimal for these rooms. One would not want to subject the patient to the glare of overhead lighting. The interior finishes and color of these spaces should be soothing and restful, not stimulating. Here's an important tip: The switching of lights needs to be carefully considered. Each private treatment room should have its own switch. The inability to dim lights or turn them off creates conflict among therapists and this lack of choice can be stressful to patients as well, some of whom may prefer dim light, depending upon the types of treatment. Refer to Chapter 12 for examples of suitable light fixtures. Fixtures placed in the ceiling should have a perforated aluminum "basket" that reflects light upward and minimizes glare.

It should be noted that some physical therapists prefer that at least 50 percent of the treatment tables be arranged in an open area and that the therapists' charting and workstations be similarly open, with an unobstructed view of the gym floor (see Figure 9-2).

Exercise

A good deal of physical therapy involves the use of gym equipment. A large exercise room should be provided for exercise equipment, some of which is wall mounted and some of which stands on the floor. Although windows and

Figure 9-13. Box freezer for gel packs. *(Courtesy of copyright © DJO Global 2013)*

Figure 9-14. Physical therapy treatment table. *(Photo courtesy of Hausmann Industries, Inc., Northvale, New Jersey)*

Figure 9-15. Manipulation treatment table. *(Courtesy of copyright © DJO Global 2013)*

a nice view make exercising very pleasant, considerable wall space will be required for positioning wall-mounted equipment such as stall bars, weights, and pulleys.

The room may also have gait bars (Figure 9-17), exercise bicycles (Figure 9-18), barbells, an ambulation staircase (Figure 9-19), pulleys (Figure 9-20), and a shoulder wheel (Figure 9-21), as well as other gym equipment and mat tables (Figure 9-22 and Color Plate 24, Figure 9-23). Note that physical therapy facilities sometimes have very sophisticated electronically integrated exercise equipment that can be calibrated to measure slight changes in a patient's progress (Figure 9-2). This equipment is designed to increase strength, flexibility, and range of motion and records resistance and other measures of muscle function, often printing a chart or graph for the patient's medical record or, in the case of EHR, uploading it to the chart.

The multipurpose series of incline body weight trainers by Total Gym® is comprised of compact units that actually fold up and are good for therapy spaces that are small because one can work many parts of the body on one machine (Figure 9-24).

Wall-mounted equipment must be located before construction begins, since the walls will require plywood

Figure 9-16. Vectra Genisys® multimodality therapy system. *(Courtesy of copyright © DJO Global 2013)*

Figure 9-17. Parallel or gait bars. *(Photo courtesy of Hausmann Industries, Inc., Northvale, New Jersey)*

reinforcement to support the additional weight. The room should have at least a 9-foot ceiling height and large mirrors, which must be positioned so that people can see themselves doing gait exercises. Carpet is the preferred flooring for the gym and treatment bays. Functionally, it softens the blow if weights are dropped and absorbs noise; visually, it softens the geometry of the equipment and it's a good way to add pattern to the space. Carpet should be dense, low pile, directly glued to the slab without a pad. Carpet tile is also a good choice. The type of carpet backing is important due to the weight of the equipment and items being repositioned from time to time. Refer to Chapter 11 for more discussion.

Consider the use of indirect lighting in the gym and exercise areas. It is especially appropriate when people are lying on their backs looking up at the ceiling. The glare

Figure 9-18. 770C upright bike. *(Courtesy of Cybex International Inc.)*

Figure 9-19. Ambulation staircase. *(Photo courtesy of Hausmann Industries, Inc., Northvale, New Jersey)*

Figure 9-20. Chest pulley weights. *(Photo courtesy of Hausmann Industries, Inc., Northvale, New Jersey)*

Figure 9-21. Shoulder wheel. *(Photo courtesy of Hausmann Industries, Inc., Northvale, New Jersey)*

Figure 9-22. Dual lift powermatic® mat platform. *(Courtesy of Hausmann Industries, Inc., Northvale, New Jersey)*

from standard fluorescent fixtures is unpleasant. Refer to Chapter 12 for examples of pendant and recessed fixtures that direct light to the ceiling, from which it reflects, to provide ambient illumination.

Ultrasound

Ultrasound involves an acoustic high-frequency vibration that is used to produce deep heat in muscle tissues. The ultrasound unit is small and can be wheeled on a mobile cart to a room as needed. It requires no special accommodation.

Traction

Traction can be applied to various parts of the body. The procedure removes pressure from the muscles, ligaments, and tendons of the area being treated to allow the return of proper nerve flow and blood flow through the area, as well as to promote normal joint mobility patterns. A traction table is shown in Figure 9-25. The electronic control unit is affixed to the end of the table.

Electrical Stimulation

Electrical impulses in milliamps are delivered into the muscle to elicit external control of the muscle. Ranges of control extend from slight muscle tension to complete and extended muscle contraction. Electrical stimulation may be used to fatigue a muscle for treating spasms, for muscle reeducation, to strengthen muscles, to stimulate debilitated muscles, and for pain management. Figure 9-16 features a neuromuscular stimulator on a mobile cart.

Figure 9-23. Loma Linda Rehabilitation Center. *(Interior Design: Jain Malkin Inc.; Architect: HMC Architects; Photographer: Ryan Beck)*

Figure 9-24. Total Gym® incline exercise system. *(Courtesy of Total Gym®)*

Transcutaneous Electrical Nerve Stimulation

Transcutaneous electrical nerve stimulation (TENS) is the procedure of applying controlled, low-voltage electrical impulses to the nervous system by passing electrical current through the skin via electrodes placed on the skin. TENS therapy has been shown to interrupt or break the pain cycle, which facilitates control of spasms, inflammation, and pain.

Iontophoresis

Iontophoresis is the process of driving medication topically through the skin by means of an ion transfer device. This is a small unit that may be stored in a cabinet.

Continuous Passive Motion

Continuous passive motion (CPM) is a technique for rehabilitating a joint or muscle group that has become inhibited, weak, tight, or otherwise injured. These devices would typically not be used in an outpatient physical therapy setting but would, rather, be used post-surgically to keep the limb in motion after a total knee replacement, for example.

Mobilization

Mobilization is a chiropractic-type manipulative therapy that mobilizes vertebral segments and other joints of the body to realign them to proper positioning and to restore normal joint motion. These procedures are sometimes called *adjustments*. A special segmented, adjustable table is used (see Figure 9-15) for these treatments.

Other Areas

A physical therapy suite will also contain a business office, a waiting room that accommodates wheelchairs and people on crutches, toilets that serve the disabled, one or more private offices for administration, a staff lounge, perhaps a laundry room with washer and dryer, convenient storage for clean and dirty linens, and one or more therapists' charting stations.

The charting station may be a large table with four or five chairs on casters for the therapists or, more commonly, a 24-inch deep countertop. If not actually within the large exercise room the charting office should have windows facing it so that therapists can keep an eye on patients while completing paperwork and also have a good view of all treatment areas.

A small men's and women's locker room/bathroom may be provided to facilitate patients changing into shorts prior to their treatment.

Environmental Design

All too often physical therapy and rehabilitation environments are drab with no attempt to create an uplifting ambience. This can be accomplished with an attractive pattern of carpet, the addition of a skylight, and accent walls as in Color Plate 31. Figure 9-23.

Work Hardening and Industrial Medicine

Work hardening is goal-oriented clinical treatment geared to return people to the work force in a timely manner following an injury. Real or simulated job tasks, coupled with conditioning, are included in the treatment plan for

each patient. A series of workstations allows systematic clinical evaluation of a patient's functional capacity and endurance, post-injury conditioning, and rehabilitation needs. The factory or workroom training module would be designed and equipped for tasks inherent in industries representative of the hospital's service area. Module task simulators may include a stud wall simulator, which is an open stud wall with predrilled holes at a variety of angles and heights permitting plumbing and electrical wiring simulations. A bending/range-of-motion simulator is fully adjustable for complete range-of-motion exercises. A shelf system is designed to evaluate the ability to lift or reach, required for certain industrial tasks. Weighted containers in assorted sizes and shapes are also provided.

The work-hardening environment in Figure 9-26 is particularly effective because equipment modules are placed in a simulated industrial environment where appropriate visual cues make the training experience more realistic. This concept has been highly regarded by employers who are motivated to rehabilitate injured workers quickly. As a preventive measure, training new employees to use muscles properly for specific tasks makes sense.

Industrial medicine (also called occupational medicine) practices fall into two broad categories. Both are geared to treating work-related injuries. Physical therapy/occupational medicine clinics, the first type, triage all types of injuries that might occur in the workplace, including lacerations, burns, and spine and joint injuries. Patients will need a referral from a primary care physician. The other type of industrial medicine practice, often run by an orthopedic surgeon, signs contracts with large employers to handle workers' compensation referrals. Before a patient can be treated, the visit must be approved by the claims adjustor. These can be very large facilities with multiple locations. This is an area where reimbursement is lucrative. These facilities often have a physical therapy component as in Figure 5-111.

Figure 9-25. Adjustable treatment table with traction device. *(Courtesy of copyright © DJO Global 2013)*

Figure 9-26. Work-hardening laboratory allows patients to practice industrial skills under the guidance of a therapist. *(Designer: David Guynes, Phoenix, Arizona; Photographer: David Guynes)*

Special Issues

Structural support for freestanding equipment as well as hydrotherapy tanks (if large) must be evaluated with

respect to floor load. Occasionally, specialized rehab equipment has such concentrated loads that the floor must be reinforced. Evaluating the final fixed positions of each piece of equipment, their individual and combined weights, against the structural system of the building and locations of beams, stairs, and sheer walls, is not only practical but essential.

All electrical outlets must be grounded, and codes require ground-fault interrupters on whirlpool tanks. Some therapy tables may require electrical power and these locations need to be carefully coordinated. Also look at optimal locations for light switches; do not leave it up to a draftsperson in the electrical engineer's office to do this because he/she will have no idea about the functional issues discussed in this text.

PHARMACY

This discussion will be limited to pharmacies located in medical office buildings. Since the pharmacy's primary (and in some cases, total) source of business is the tenants in the buildings, it is wise not to plan the pharmacy's space until the tenants and their respective specialties are known. If the medical office building is isolated and not adjacent to neighborhood foot traffic, the pharmacy's referrals will come exclusively from the medical office building. However, if the pharmacy was in business in the neighborhood before moving into the new medical building, a certain amount of outside business will follow the pharmacist to the new location due to loyalty or to prior business arrangements.

Thus, it is necessary to analyze the source and number of prescriptions, both new and refills. Once the tenant population is known, the volume of prescriptions can be analyzed. A general practitioner or internist will see 25 to 35 patients per day, and perhaps two-thirds of those patients will be given a prescription. Certain specialties tend to generate more prescriptions than others. When the estimated number of prescriptions (or "scripts") to be derived from the tenant population has been determined, one must speculate on what percentage of those scripts will end up at the building's pharmacy. If physicians in the building like the pharmacist, if the pharmacist provides a comfortable place for patients to wait while a prescription is being filled, and if the pharmacy is located so that patients have to pass it upon exiting the building, one may anticipate a certain percent of the building's scripts will be filled at the building's pharmacy. Maintenance drugs are often ordered through mail-order pharmacies under contract to insurance companies.

If the pharmacy is part of a group practice, it is anticipated that perhaps 40 percent of the group's prescriptions will be filled at its own pharmacy. If the pharmacy happens to be located in a medical complex, but it is in a separate building and the patient has to walk outdoors to reach it, perhaps less than 30 percent of the building-generated prescriptions will be filled there. Some patients will remain loyal to local pharmacies near their homes or use ones that will deliver. Pharmacies in supermarkets and discount superstores offer the convenience of grocery shopping while the script is being filled, further siphoning business away from the traditional pharmacy setting.

After the volume of prescriptions is determined, display space must be defined. If the pharmacy will sell prosthetic devices (crutches, braces, artificial limbs, colostomy supplies, and the like), a fitting room and a large storage room should be provided. Undoubtedly, a certain amount of display space will be required, even in a professional pharmacy, for toothpaste, special soaps, first-aid items, personal hygiene supplies, nonprescription drugs, candy and chewing gum, and perhaps a limited line of cosmetics.

One pharmacist can usually fill 50 prescriptions in a day, including compounding, packaging, and dispensing. If he or she can prepackage certain frequently used medications, scripts per day can be boosted to 70 per pharmacist. That is, certain physicians who are major sources of scripts may routinely prescribe certain medications in standard dosages. If the pharmacist knows this, he or she can, during slack periods, prepackage these items and store them on a shelf. When a patient requests them, only a label need be typed, and the script is complete.

Each pharmacist requires 4 to 5 feet of countertop work surface for compounding and another 2 to 3 feet of countertop for typing and labeling. Space is also required for a computer, printer, and fax machine. (Physician offices that do not phone in a prescription to a pharmacy may fax it because email is not secure.) Each workstation needs a phone. A full-size refrigerator and a built-in cabinet with a double sink should also be provided. Adjustable open shelving 8 to 10 inches deep is all that is required for storage of pharmaceuticals. Twelve lineal feet (6 feet high) of shelving is a minimum, with an additional 4 lineal feet per pharmacist.

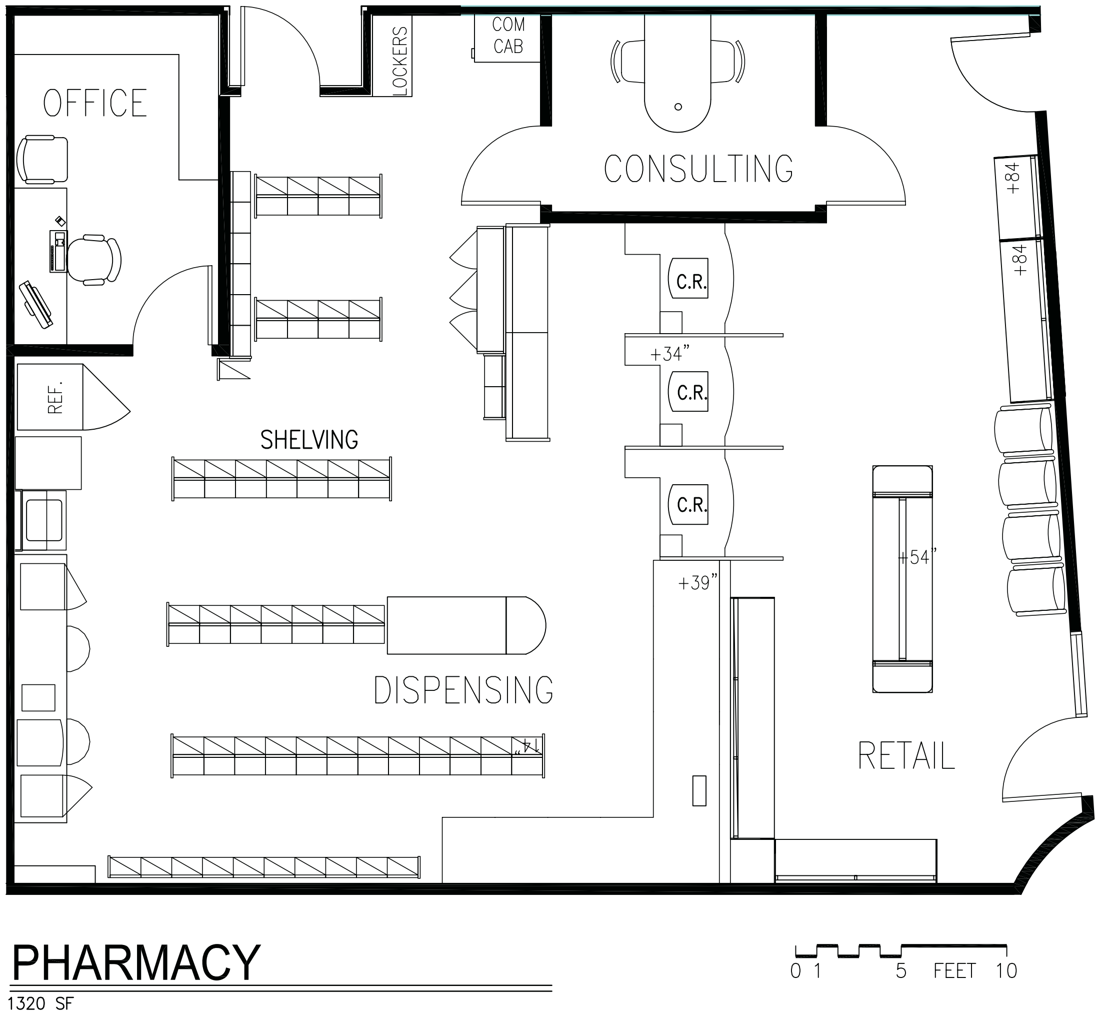


Figure 9-27. Space plan of a pharmacy, 1,320 square feet. *(Design: Jain Malkin Inc.)*

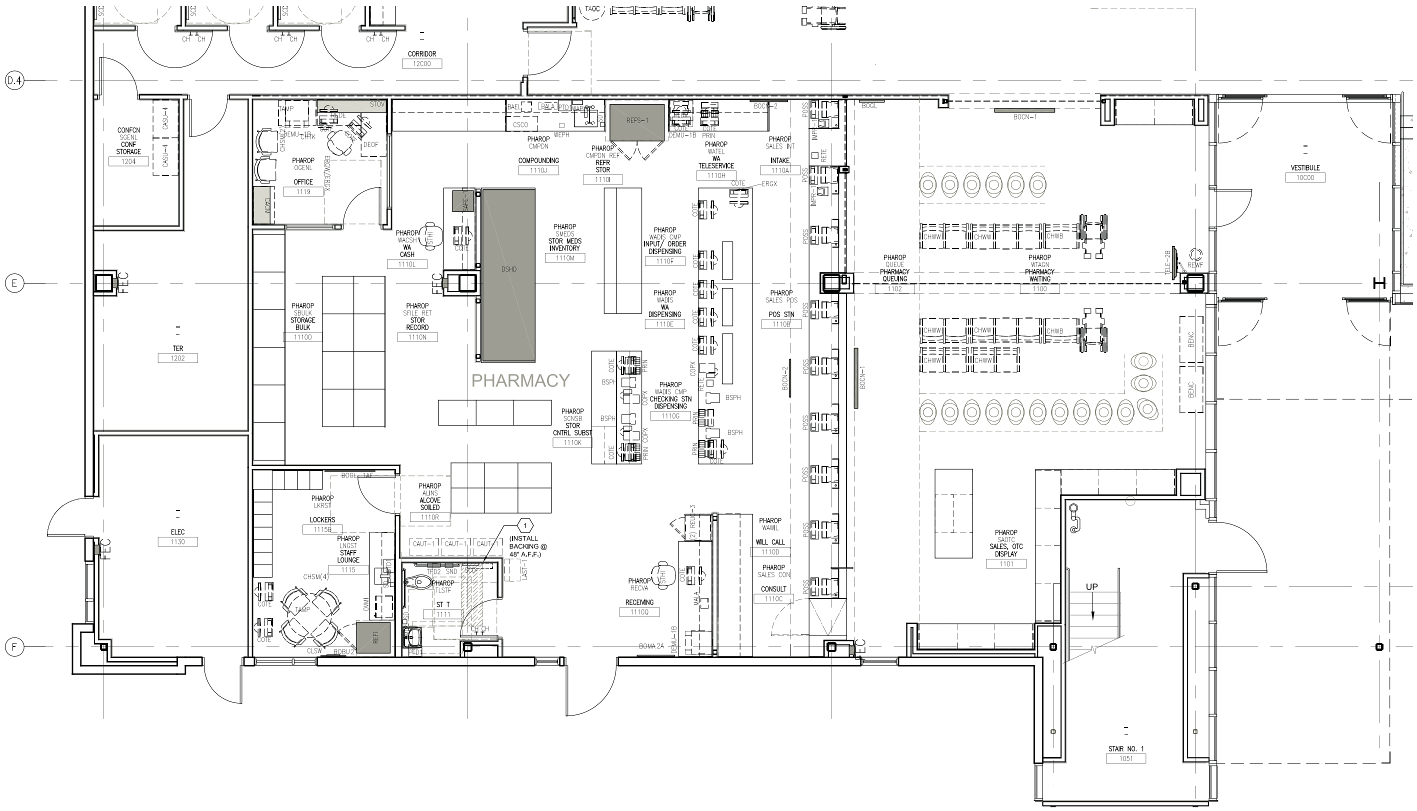


Figure 9-28. Space plan of a pharmacy. *(Courtesy of HMC Architects)*

The dispensing area may have a raised-platform floor (8 inches above the display and sales area floor) for better visibility, a required 5-foot-high security wall separating the dispensing and sales area, a bathroom, and a bulk storage room. Sometimes a small private office is included where a pharmacist can meet with vendors. The bathroom is a requirement in many states based on the reasoning that a pharmacist should never have to leave the store unattended to use a public restroom. A private consultation room is often provided. This can be used for giving vaccinations, flu shots, and also for consulting on medications. A professional pharmacy will occupy anywhere from 1,200 to 1,600 square feet of space (Figures 9-27 and 9-28). The rendering of the pharmacy plan in Figure 9-28 can be seen in Figure 9-29.

Figure 9-29. Pharmacy for Kaiser Permanente medical office building, Moreno Valley, California *(Courtesy of HMC Architects)*

CHAPTER 10

Practice of Dentistry

The modern dental office is truly a high-tech/high-touch environment. As a professional group, dentists have, for years, been well attuned to marketing and customer satisfaction. This may be due to the fact that, as the incidence of tooth decay and gum disease decreases, many dental procedures have become elective in nature—unlike medical procedures, which are generally not elective. In dentistry, with the exception of oral surgery, endodontics (root canal therapy), and sometimes periodontics (gum surgery), many treatments are done less for curing disease and restoring health than for *quality of life*. For this reason, cosmetic (aesthetic) dentistry has continued to be an aspirational desire for many men and women.

Historically, dentists were among the first to advertise, to use color-coordinated uniforms, open offices in shopping malls, and to attend seminars on office design, stress reduction, and the psychology of creating a positive experience for patients.

Some dentists have what is called a *values-driven practice*, in which the staff members have been trained to redefine their roles. The practice philosophy of “drill, fill, and bill” is replaced with one of bringing wellness to patients and improving the quality of their lives. Staff are trained to listen to patients, interpret behavior, and respond positively to confrontation and problems. Employees learn pleasant telephone manners and how to discuss financial arrangements without offending patients. Dental teams are aware of their self-image. They practice time management and stress reduction, and they set goals together. A values-centered staff makes it easier for patients to accept and want fine dentistry.

Progressive dentists with finely tuned management skills are a source of many satisfying design projects. These dentists want both their personnel and their physical environment to make people feel comfortable and confident about receiving care. To satisfy these dentists, the dental design specialist must be continually educated in changes in technology and in dental practice management. Fortunately, with the Internet, superb educational resources are available to anyone willing to spend the time visiting websites of the professional dental associations and dental practice management magazines, as well as various websites developed by dentists for the benefit of their colleagues offering advice on incorporating technology into their practices. Dentists, as a group, have historically embraced new technology, rather than feared or resisted it.

Author’s Comment: Every effort has been made to represent a wide variety of equipment manufacturers while, at the same time, looking at market leaders in each modality. With the limitation on quantity of photos and the overarching goal of familiarizing the design professional with equipment and instrumentation, choices were made in consultation with knowledgeable industry leaders. Many fine products each with unique features offer dentists a huge range of options to satisfy personal preferences.

An expression of thanks goes to Lee Palmer for his generosity in sharing his expertise and depth of experience in dental planning and equipment to help make this chapter thorough and useful to the widest number of readers.

Major Changes in Professional Practice and Technology

Much has changed in the way dentists practice, which makes this an exciting time to be learning about how

technology is impacting the flow and efficiency of the modern dental office. Electronic medical records (EMR) can be found in many offices, integrating computers into every treatment room. Many monitors now have the computer built into them and, with wireless keyboard and mouse, they can be positioned anywhere the doctor wishes. Flat screen monitors are in the ceiling above the patient for entertainment and also to be able to see the examination that the doctor or hygienist is doing in real time. Another monitor in front of the assistant is used for charting the findings. Advances in diagnosis make this even more important because now the doctor or hygienist can use an FDA-approved diagnostic camera and, with 97 percent accuracy, find decay inside the tooth, between teeth, or around leaking restorations. And this is done without radiation. Another camera, The *Spectra*®, by Air Techniques, uses fluorescence technology to highlight areas of plaque, calculus, and caries. Cariogenic bacteria appear red, while healthy enamel appears green on a monitor. These cameras reduce the reliance on X-rays for diagnosing decay.

New products and tools currently available that are destined to become mainstream are 3D cone beam computed tomography (CBCT), digital radiography, and a handheld X-ray device called *NOMAD PRO*™ that is carried from room to room. There are CAD/CAM systems that create electronic impressions (no more gooey mess in the mouth) and send images to a milling machine in the dentist's office to create crowns, inlays and overlays, thereby eliminating the need to have a temporary crown and the inconvenience of returning two or three weeks later for delivery of the permanent crown. This technology is expensive, however, and dentists will prioritize their purchases according to the specifics of their respective practices and a return on investment analysis. As an example, a dentist may decide not to own the milling machine (the "CAM" in the CAD/CAM designation) and, instead, send the digital impressions and design of the restoration to a milling lab for fabrication. In this case, the patient does have to return for another appointment but often the timeframe is days, instead of weeks. Dentists with mature practices who are thinking of retiring in a few years may not wish to make a sizable investment in technology but not having digital X-ray, for example, may make it harder to sell the practice to younger practitioners. Clearly, as dentists emerge from dental schools trained to use the latest technology, their expectations will have been set by exposure to the benefits of these advances.

LED dental lights are replacing halogen lights, thereby reducing heat and power consumption while improving illumination. LED lights are also commonly used now for curing dental materials and not only do they reduce cure times from 60 seconds to less than 5 seconds per cure, they are handheld and cordless. Small diode lasers, some now cordless and handheld like a pen, are proliferating for soft tissue procedures and will increasingly be found in every treatment room.

Screening for oral cancer falls to dentists as the first-line-of-defense health professionals to be able to identify, at an early stage, suspicious lesions and masses in the oral cavity and pharynx. Since 1996, when the CDC convened a major conclave to review and discuss this topic, followed by another such event in 2001, they have continued to produce recommendations and reports and keep the spotlight on this public health issue. These types of cancers are hard to treat and do not have good prognoses. Often the treatment is disfiguring. Those who have used tobacco and alcohol are more at risk as are younger persons and adults who have engaged in contact sports. A product like the Dental Oral Exam (DOE) by *DentLight* raises the bar on this type of screening and one would hope, as more dentists become familiar with this and other cancer screening modalities, that it becomes part of an annual checkup.

The Changing Environment of Diagnostic Dentistry

An optimal examination using all the technology currently available would start with digital panoramic and extra oral bitewing radiographs using minimal radiation and taking less than five minutes total time. Once seated, the exam would continue with the doctor looking at the X-rays with

the patient sitting upright in the dental chair. Next, the patient would be reclined to examination position and the doctor would begin the head and neck examination and proceed intra-orally for that part of the cancer screening with the *Dentlight* DOE filter. Afterward, the doctor would use the *SoproLife* or *SoproCare* intraoral camera (Acteon) or the *Polaris*® (Air Techniques) to chart existing conditions and then use the decay-disclosing camera *Spectra*® (Air Techniques) or the caries detection setting of the *SoproLife* or *SoproCare* to examine for active decay. With the *SoproCare* camera the examination could continue by documenting gingivitis, calculus, and plaque build-up. All of this is done without exposing patients to radiation.

Figure 10-1. Reception waiting area. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

Green Design and Sustainability

Numerous projects in this book have achieved LEED® certification, a process that is discussed in detail in Chapter 13. A very forward-thinking oral surgeon took this to new heights in designing his office in a high-rise office/residential tower in San Francisco. For details and photos, see "Unique Projects" at the end of this chapter.

HIGH-TOUCH PATIENT AMENITIES

Many adults dread a visit to the dentist as a result of painful and frightening childhood experiences. When they enter the treatment room, their blood pressure becomes elevated, muscles constrict, and stress hormones are released into their bloodstream in a classic "fight-or-flight" response. This prevents many from seeking anything other than emergency care for an abscess, root canal, or periodontal disease that may have progressed to an advanced state. These individuals do not seek elective procedures or cosmetic dentistry. However, if they have a positive treatment experience that is relatively painless and interventions are in place to relax them and to reduce stress, it is possible to change their negative childhood associations. The overall ambience of the office from the time they enter the waiting room is the first line of defense (Figures 10-1, 10-2, and 10-3; and Color Plate 32, Figures 10-149 and 10-150). First impressions do matter. Interesting ceiling design, indirect lighting, art glass, an open and welcoming reception desk, and color palette can do much to put people at ease (Figures 10-4, 10-5, 10-6; Color Plate 25, Figures 10-7a and b; and Color Plate 32, Figures 10-149 and 10-150). In the dental treatment room, amenities such as DVDs or videos are very effective as positive diversions (Figure 10-8 and Figure 10-9). Offering options and choices allows patients to feel more in control in a threatening situation.

There are no lengths to which dentists will not go to make patients feel comfortable and relaxed. Some of these amenities include an electric massage pad laid

Figure 10-2. A living room ambience focusing on a fireplace creates a comfortable waiting experience for patients. *(Design: Janice Thayer-Johnson, Kristen Harleman, and Susan Barrett; Photographer: Marshall M. Johnson)*

Figure 10-3. Casual furniture and residential-style accessories create a relaxed waiting environment for patients. Note the built-in hot and cold water dispenser. *(Design: Signature Environments, Inc., Seattle, Washington; Photographer: Marshall M. Johnson)*

on the dental chair, heated aromatherapy pillows, a warm blanket, hand or foot massages, pedicures, chair-side CD player with headphones, virtual-reality glasses, ceiling-recessed monitor with video movies, a glass of wine prior to treatment, hot towels and fruit juice at the end of treatment, the aroma of freshly baked bread for early-morning arrivals, and a great selection of magazines. Dental spas offer a number of massages, facial, and manicure options post treatment. Research shows clearly that having options and choices reduces stress

Figure 10-4. Check-in and reception, faculty dental practice. *(Design: Jain Malkin Inc.; Photographer: Steve McClelland Photography)*

Figure 10-5. Reception desk. *(Courtesy of Joe Architect; Photographer: Bob Soman Photography)*

Figure 10-6. Waiting area, Atlanta Dental Spa. *(Courtesy of Wilcox Design Group)*

Figure 10-7a. Water feature in waiting area, Atlanta Dental Spa. *(Courtesy of Wilcox Design Group and Atlanta Dental Spa)*

Figure 10-7b. Internal hallway, Atlanta Dental Spa. *(Courtesy of Wilcox Design Group and Atlanta Dental Spa)*

and one of those choices should be "no bells and whistles." Nevertheless, it is worthwhile to distract and entertain patients in the treatment room since a considerable body of research demonstrates that such diversions are highly effective in reducing stress, especially in a clinical setting.

Figure 10-8. Dental treatment room with flat panel monitor in ceiling. *(Audio/Video Specialist: Keith Aderman/ Mr. Hookup; Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

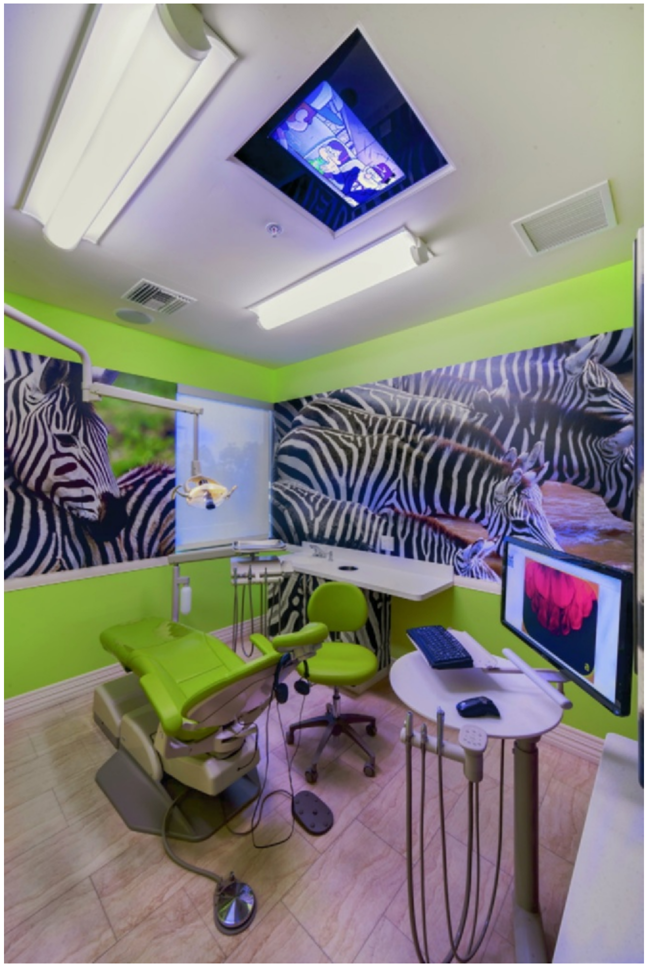


Figure 10-9. Pediatric dental treatment room. *(Audio/Video Specialist: Keith Aderman/Mr. Hookup; Photo copyright © Nathan Padilla Bowen)*

INTERVIEW QUESTIONNAIRE—AN IMPORTANT DESIGN TOOL

Dentistry allows for highly personalized practice methods, which must be set by the dentist before the space planner can begin. The interview questionnaire in the Appendix of this book is useful for documenting practice preferences and equipment. Prior to filling out the questionnaire, a general discussion should occur relevant to the doctor's long-term goals—perhaps a 10-year plan. Is the goal to bring partners into the practice, to get this one going and then open other locations, or to retire in 10 years and sell the practice? This information will influence the project budget, space allocation, room for growth, and equipment selections.

The information gathered from the questionnaire can be translated into an effective space-planning program. Occasionally, dentists moving into new offices will bring outdated dental equipment with them, which might necessitate a less-than-optimal treatment room layout. Others buy sleek, state-of-the-art equipment that allows the designer to create an efficient treatment room. This chapter will acquaint the designer with the equipment and general requirements for the practices of general dentistry (including prosthodontics and cosmetic dentistry), pediatric dentistry (pedodontics), orthodontics, periodontics, oral surgery, and endodontics. While guidelines will be given, remember that the organization of dental offices is somewhat less standardized than that of medical facilities, owing to the number of options in size and design of the operatory or treatment room. The equipment, the location of casework, and the preferred style of delivery of instrumentation (rear, over the patient, or side) will determine the size and layout of the treatment room. As an aside, the preferred term for operatory is now "treatment room" unless surgery is performed there, as in oral surgery, although many dentists still use the term "operatory."

Therefore, although there is an optimal design of a treatment room, other choices will also be presented. That which is common to all dental suites will be discussed under General Dentistry. Modifications required for other dental specialties will be discussed thereafter.

PLAN THE SPACE BEFORE SIGNING A LEASE

Dentists tend to do the same thing that physicians do—namely, to lease a space prior to engaging a space planner. While the dentist may know that he or she needs four treatment rooms to be functional, without a space plan, it will be impossible to know how that space will lay out

and if it will yield four treatment rooms of optimal size. This is affected by the shape of the space and the location of structural columns, as well as the overall dimensions of the area, and perhaps the desire to have north light in the treatment rooms. A wiser course of action is to meet with a space planner prior to committing to the space. If the configuration of the space results in an awkward layout, undersized treatment rooms, and poor adjacencies with respect to critical functions such as sterilization and overall flow through the office, it is better to recognize these conditions early rather than have to live with them for the next 10 years or more. Another space in the building may be available that would result in a better layout. As dentists know well, efficiency makes a tremendous difference, whether it is a convenient reaching distance while seated at the dental chair, the number of staff it takes to run the office, or the resulting stress inefficiency places on the dentist and chairside assistants as they move through a busy schedule.

Extraordinary Teamwork Required

The design and construction of a dental office require a level of team collaboration and coordination that has no parallel in the design of a medical office. A matter of inches can make a critical difference in the efficiency of a treatment room. The interior designer or architect's role is analogous to that of a symphony conductor, carefully timing and integrating all the instruments or, in this case, the work of the dental equipment planner, computer network specialist, audiovisual media consultant, electrical and mechanical subcontractors, and dental equipment installers. A good general contractor experienced at building dental offices is essential. The complexity of this effort cannot be overestimated—precision is everything.

CODES AND REGULATORY AGENCY REVIEW

A review of codes should start with the State Business and Professions Code if one exists. The State Dental Board and Public Health Department should also be consulted. Any or all of the above may have policies and procedures relevant to infection control, pharmaceutical control log, calibration of equipment, patients' rights, and so forth, some of which have no impact on the physical design of the office. If the dentist uses general anesthesia or a type of anesthesia that renders the patient incapable of self-preservation in an emergency (oral surgery, and possibly pediatric, or restorative/aesthetic dentistry cases), this triggers many code issues as the patient is deemed "at risk for loss of life-preserving protective reflexes." In some states, the use of general anesthesia mandates licensing by the department of health services, Medicare certification, or accreditation by a recognized agency. These issues are explained in detail in Chapter 5 under Plastic Surgery, headings *Office-Based Surgery* and *Accreditation, Licensing*, and *Medicare Certification*. See also Chapter 8, under Ambulatory Surgical Centers, heading *Storage of Medical Gases*, and Chapter 14, *Researching Codes and Reference Materials*.

Americans with Disabilities Act

The Americans with Disabilities Act (ADA) applies to medical and dental offices. Most architects and designers are very familiar with ADA regulations. Since there is no formal local enforcement of this national civil rights legislation, it is local building departments that review it during the plan check. Building inspectors can be quite rigorous about compliance to the point of taking out a measuring tape and not approving a door setback that is supposed to be 18 inches on the pull side, if it falls short by even an inch. The same is true for toilet rooms, *all* of which must be ADA compliant unless they have access only from the doctor's private office and that person is an owner of the building.

However, based on discussions with a number of architects and planners of dental offices, it seems that the ADA is interpreted differently by building departments even within the same region with respect to treatment rooms and task areas such as sterilization. For example, since a person in a wheelchair may not be able to perform the tasks required of a dental assistant in the treatment

room or sterilization area, the 36-inch clearance for a wheelchair on the assistant's side of the room may not be required, nor would the opening for room entry, in this case, be required to be 36 inches since the opening on the dentist's side would be 36 inches. Other jurisdictions require 36-inch clearance on all sides of the dental chair as well as wheelchair clearance under every sink in a treatment room. It has been reported to the author (but not verified) that OSHA has an interpretive newsletter that, in essence, states that task-oriented stand-up workstations at the ADA limit of a 34-inch height can injure the worker's back. As a result, in some jurisdictions sterilization workstations are approved at the 36-inch height.

Dentists are accustomed to packing a lot into small spaces. Small labs, or break rooms with doors opening into the room barely scraping the edge of the cabinet are no longer possible under the design restrictions of the Americans with Disabilities Act. All rooms must be wheelchair accessible and have an 18-inch wall area on the pull side of the door. The use of pocket doors solves some of these problems although the traditional type that slide into the wall are not aesthetically appealing and are a nuisance to access when needing repair. In recent years, sliding doors that travel on the face of the wall called "barn doors" have become increasingly popular as a design statement.

Building Codes and Construction Methods

Refer to Chapters 13 and 14 for relevant information on these topics. In most cases, these issues are the same for medical and dental offices.

Occupational Safety and Health Administration and the Environmental Protection Agency

To avoid redundancy, the reader should refer to Chapter 3, heading *OSHA Issues* for a discussion of standards affecting medical and dental offices. What follows is a discussion of items specific to dental practices. It should be noted that around the country a number of Occupational Safety and Health Administration (OSHA) compliance consultants are available to dentists and physicians to survey their offices for proper techniques and also to train staff. OSHA regularly inspects dental offices.

EPA Disposal Requirements

Although it is assumed that most dental practices are digital and film is no longer used, there are perhaps some practices that haven't yet made the switch.

Film Processing. The Environmental Protection Agency (EPA) is concerned with the capture and certified disposal of film-processing solutions or, at least, the fixer. This is in effect in almost all states, although some allow silver recovery systems to process fixer with disposal into the city sewer system. Of course, the darkroom will become extinct as digital imaging becomes even more widespread.

Amalgam and Mercury. In some states, old amalgam removed from patients and collected by traps in the office vacuum system must be disposed of through certified hazardous waste haulers. The amalgam also contains mercury, which is regulated as parts per million (ppm) in the air. More sophisticated gathering methods for amalgam and residual mercury are now available in central vacuum systems.

Lead from Film Packets. The storage of lead from intraoral X-ray film packets after processing and certified disposal is fairly common, but this does not affect design as several years' collection of wrappers can be compressed into a 1-cubic-foot box. Few offices being constructed today would still use traditional film.

Hazardous Waste and Sharps. There is a gap between what OSHA considers biohazardous (medical) waste within the working environment and what the EPA considers hazardous waste during disposal. OSHA mandates that any material or waste that has contacted saliva or blood be stored within the office in marked waste containers declaring it as biohazardous. This is ostensibly to alert employees not to reach into these waste containers unprotected or to handle the waste during disposal without proper barriers

in place. The EPA, however, does not consider the same waste, in general, as hazardous after it leaves the dental office. The concentration of blood and saliva is seldom significant enough to cause a health hazard. The problem lies in the misinterpretation of how to dispose of the waste. If it is red bagged, then the EPA and the waste haulers and landfill personnel must treat it as biohazardous medical waste. However, if it is disposed of properly, no special precautions are necessary during disposal.

Sharps can be stored in a type of sharps container called an Isolyser, which is filled with a high level of liquid disinfectant. Once the container is full, a catalyst powder is added and the solution becomes an impenetrable mass of polymer that seals all of the sharps from the environment. A label is applied over the original BioHazard emblem, declaring the waste as treated, and as solid waste, it can be disposed of like any other trash. Refer to the *Casework and Modular Cabinetry* sections in this chapter for ideas to accommodate sharps containers and waste collection neatly and out of view in the treatment room. The designer needs to check local codes to see if the office needs a separate storage area (usually a small room or closet near the staff or service entrance) for biohazardous waste until the certified hauler removes it.

OSHA

It should be noted that OSHA has both state and federal agencies. National OSHA standards may be interpreted differently by state OSHA agencies. Both must be consulted.

Hazardous Materials Standard. All materials an employee comes into contact with must be examined for known health or safety hazards and labeled if found to be dangerous. This involves mandatory recordkeeping of an inventory of hazardous products and a readily available book of Materials Safety Data Sheets (MSDS) for reference in case of spills or contact with hazardous materials. Offices must have a dedicated eyewash in any area in which hazardous materials are used (Figure 10-10). It must be placed where an employee can reach it within 10 seconds of occurrence, which generally means

Figure 10-10. GVR5022 vandal-resistant eyewash. *(Courtesy of Guardian Equipment)*

placing it in the sterilization area or possibly the dental lab. There has to be a minimum of one in a dental office in a centrally located area. A permanent eyewash station has only a cold-water line. The types of hazardous materials that may be found in a dental office are phosphoric acid, sodium hypochlorite, phenols, and hydrofluoric acid. In the dental lab, fumes from methyl methacrylates and ethyl methacrylates need to be exhausted to the outdoors, not the plenum. This requires a good ventilation fan.

Bloodborne Pathogens Standard. This standard mandates that employees be educated as to the methods of transmission of disease, proper use of personal protective equipment, proper handling of waste and sharps, and the results of accidental needle sticks. Universal precautions should be taken with all patients. An often overlooked design factor is the addition of a washer and dryer within the facility to launder barrier gowns. This also involves a storage area for clean gowns, which have either been laundered in the facility or sent out to a commercial laundry. A hamper is needed to collect soiled gowns until they can be laundered. Putting the washer and dryer or soiled-clothing hamper in the staff lounge is prohibited by OSHA. There must be a definite separation of food, cosmetics, and eye care products from items used in the clinical practice; likewise, one cannot take contaminated items into an area where food is prepared or consumed. A good location for the laundry area is near sterilization as the washer and dryer can be monitored during use. The hamper can be placed in the staff restroom if staff use this for changing clothing, or it can be an isolated hamper next to the washer/dryer. If laundry is sent out to process, the hamper can be placed in the hazardous waste holding room.

Nitrous Oxide Scavenging and Monitoring. OSHA mandates that effective scavenging systems be used during nitrous oxide sedation to prevent over-contamination of the air for dental personnel. Nitrous oxide leaks from the face mask, putting female employees of childbearing age particularly at risk of miscarriage, premature births, and infants born with low birth weight. Some states have mandated that an electronic monitoring system be installed to alert staff when the acceptable level ppm (parts per million) of N_2O has been exceeded. Proper placement of this monitoring system is a design factor, which will also impact HVAC design. A high number of air changes per hour is essential in all treatment rooms. Air supply and return should be carefully studied to ensure adequate circulation.

Government investigations determined that water from a dental hand-piece or syringe was considerably more contaminated than water samples taken from public restroom toilets when analyzed by an independent testing laboratory. As a result, many states have enacted legislation mandating that water used during treatment have no more than 200 colony forming units (CFUs) per milliliter of contamination. Dental equipment is designed to incorporate containers that can be filled with distilled water and mounted on the assistant's cart or on the dental console. In the operatory in Figure 10-11, distilled water is carried by tubing from the cabinet-mounted bottle to the instrumentation. In this case, the dentist uses a small countertop distiller. Water purification systems like *Sterisil*® (sterisil.com), shown in Figure 10-12, can be placed in a utility room with a dispensing sink on the opposite (corridor) side of the wall or it can be placed in a highly visible area of the suite, as in Figure 10-13, as a marketing tool to emphasize patient safety. This unit can be retrofitted into an existing office by filling bottles at the chair but, in new construction, it can be piped to each chair via food-grade plastic tubing inside PVC conduit from a central location. Looking at the purification unit, the water starts at the left chamber and moves to each successive tank to the right. It passes through a UV light and then is stored in a holding tank. The system needs to be sized to the number of dental chairs and, in addition, must take into account the needs of sterilizers and other items in the lab that require clean water.

There are several methods for achieving good water quality in the dental office. Whichever method is preferred, it must be FDA-approved and determined at the start of the project as it affects water supply design criteria.

1. Design equipment to no longer use public water and instead use distilled water, reverse-osmosis water, or a new replacement solution. Even daily and weekly

Figure 10-11. Distilled water reservoir for dental chair instrumentation. *(Photo: Jain Malkin)*

regimens for sterilizing or disinfecting the entire self-contained water system, using distilled water, do not guarantee that over-contamination will not occur with regular maintenance.

2. Some manufacturers have effected a solution by running the public water supply to the dental units

Figure 10-12. Sterisil® centralized water purification system. *(Courtesy of Sterisil, Inc.)*

through a device that meters in a product that kills microorganisms and prevents biofilm buildup.

Almost all states and municipalities now require a separate reduced pressure (RP) back-flow preventer on any public water line connected to a dental unit regardless of what devices the dentist has put in place to treat the water. This device is too large to put into the standard dental equipment junction box, so it must be mounted remotely. This can be either cost prohibitive or space prohibitive, in which case, the first solution listed above would be the most practical alternative, as it does not require city water to be plumbed to the dental unit.

Exposure to Radiation

The safe use of X-ray machines is generally regulated by the State Board of Health and assigned to a radiological health subdepartment. OSHA only inspects facilities

Figure 10-13. Centralized water purification system recessed into the wall. *(Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

to make sure they are following these regulations as they pertain to the protection of employees. OSHA, itself, has no specific radiology standards. Regulations affecting the design of dental suites follow.

1. Most states require that a health physicist review floor plans and potential locations of equipment to determine proper radiation barrier materials and acceptable locations for operating controls. The physicist will need to know the specifications of the X-ray equipment with respect to radiation emitted and the physicist's report must be submitted to the building department along with the construction documents.

2. The federal minimum barrier requirement for dental-type X-ray machines is a standard wall constructed with wood or metal studs and covered on both sides by one layer of ⅝-inch-thick gypsum board. An operator does not need to be behind an approved barrier as long as he or she is 72 inches or more from the source of the radiation and not in the primary beam trajectory. No one other than the patient can be in the primary beam trajectory, which means approved barriers must exist to prevent exposing staff or patients in adjacent areas during X-ray (Figures 10-14 and 10-15).

   Typically, the only lead barrier requirement is immediately behind a cephalometric X-ray head holder and only if the space behind it is routinely occupied, although some states have more rigorous standards. This may include lead lining in modular dental furniture systems and/or in stud and drywall partitions. When a secondary entrance to the room exists, a photoelectric eye deactivation of the X-ray beam may be required if someone tries to enter during an exposure. Through-the-wall X-ray cabinets may be required to have switches on cabinet doors so that the X-ray will work only when one set of doors is fully closed (Figure 10-16).

   A cephalometric X-ray device is generally found only in orthodontic and oral surgery practices, but may occasionally be found in general dentistry

Figure 10-14. Control station for X-ray. *(Design: Kui Tan; Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

Figure 10-15. Control area for cone beam X-ray, San Francisco Surgical Arts Inc. *(Courtesy of Dr. Nima Massoomi, DMD, M.Ed, MD)*

Figure 10-16. Through-the-wall digital X-ray cabinet. *(Photo: Jain Malkin)*

Figure 10-17. Vatech PaXReve 3D cone beam X-ray unit, San Francisco Surgical Arts Inc. *(Courtesy of Dr. Nima Massoomi, DMD, M.Ed, MD)*

practices as well. State guidelines often require that the X-ray machine operator be able to see the patient during the exposure of a panoramic X-ray because the patient is essentially trapped inside a moving machine and can be injured if he or she tries to exit unexpectedly during exposure (Figure 10-17). Some states have misinterpreted this requirement and mandated that the operator be able to see the patient during any X-ray exposure. It is important to check requirements with the state agency and then provide a location for the operator that allows viewing of the patient from behind an approved barrier or from a distance 6 feet away from the radiation source and never in the primary beam trajectory. The use of half-inch-thick glass in the operator viewing windows is probably the most common method for compliance. Refer to Chapter 6 for examples of protective barriers and resources. Nuclear Associates in Carle Place, New York, is a major supplier of lead-impregnated acrylic barriers.

3. Most states have laws that cover the design of the darkroom as well as the developing process and exposure. This edition of the book has dropped the detail of how to design a darkroom because they are rare in dental offices today.

NEW TECHNOLOGY TRANSFORMS THE DENTAL OFFICE

New technology is changing the fundamental way dentists practice, making it possible to achieve a level of integration and efficiency in practice management that is almost effortless once the proper software and hardware have been employed and networked. Think of the traditional series of documentation and communication steps that were required for charting treatment, scheduling visits, discussing costs, documenting insurance codes, preparing lab slips, recording payments, filing insurance claims, and sending out statements. The same information is written or typed over and over with much repetition and

little value gained. While there are still some small dental offices that have not yet gone digital, they are in the minority. The paperless office is the norm today.

The Paperless Office

In the paperless office there is total connectivity among all aspects of practice management and clinical care. Computers located at all workstations, including treatment rooms, enable a seamless transfer of information that starts with scheduling the patient and ends with electronically processing insurance claims. Recall appointments can be scheduled from the treatment room without having to rely on one pivotal person at the front desk as the chief appointment maker. In small offices, the person seated at the front desk often runs the show, sending out statements as well. When he or she is absent, the practice may come to a grinding halt. Cross-training enables support staff to do several jobs. Chairside assistants have become so comfortable with computers, that they can post procedures, schedule, and even accept payment right in the treatment room. This frees the front desk assistant to focus on sending marketing letters to patients and collecting accounts receivable and insurance, in addition to general overview of scheduling, posting payments, and handling in-office collections.

Multiple Applications for Treatment Room Computers

In a paperless office, any notes or letters from referring dentists are scanned into the patient's electronic clinical record, which is easier to access and takes less space to store, can be transmitted to other locations, and is less likely to be lost. Once the computer is in the treatment room, there is an array of peripheral items that can be added such as cosmetic imaging, digital X-ray, digital intraoral camera, and software for presenting complete treatment plans with estimates of cost, as well as patient education and entertainment programs. The real benefit is that patients are being better served: intraoral video cameras, digital radiography, and chairside microscope magnification improve the ability to find and treat problems earlier. In fact, dental operatories often have three monitors with specific placement varying upon the style of delivery of instrumentation. The assistant will have one behind the patient's head, the dentist will have a medical-grade monitor "shared" with the patient to the left of the patient's chest, and there will often be one in the ceiling directly over the patient's head for entertainment (see Figure 10-8, Figure 10-9, and Figure 10-18).

Figure 10-18. Pediatric dentistry treatment room. *(Design: Kathy Gordon; Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

Figure 10-19. Intra-oral camera Sopro 717. *(Courtesy of ACTEON North America)*

Figure 10-20. SOPROLIFE® intra-oral dental camera. *(Courtesy of ACTEON North America)*

The Technology Wave

Intraoral Video Camera

The intraoral video camera enables intraoral or extraoral visualization at magnification from 5 to 35 times, depending on the mode. It is the greatest visual tool for dentists since the mirror. The system consists of a hand-piece (which is actually a tiny lens) that looks like a pen and a computer monitor (Figure 10-19), although the images can be displayed on any monitors in the room. The computer system can produce hard copy or electronic images for the patient or insurance use. A built-in freeze frame makes it easy to create a "show and tell" presentation for the patient, and, with appropriate software, images can be captured and downloaded to the patient chart or placed in a digital "photo album." This software makes it easy to assemble case presentations by using the computer to search for images by type and then further refine the search by gender, age, tooth number, upper or lower, and so on.

The newest renditions of the intraoral camera such as the *Sopro* (acteongroup.com) have made it possible to go beyond human vision to see cracked teeth, broken amalgams, chamber pulp, surface slate, and tooth decay. Broken or leaking restorations can be documented and photos sent to insurance companies as proof of work that needs to be done. The *SOPROLIFE*® (Figure 10-20) has the ability to look at the collagen of the tooth structure and can find interproximal caries. The *SOPROCARE*®, has the capabilities of a regular camera and can see and document plaque, calculus, and gingivitis. The Iris USB intraoral camera by *Digital Doc*® (digi-doc.com) is another of the newest devices. *Spectra*® (airtechniques.com) uses fluorescence for early detection of caries, plaque, and calculus, identifying problems while it is much easier to treat them. In this process, LEDs project violet blue light onto the surface of the tooth that makes the cariogenic bacteria appear red on the monitor while the healthy tooth enamel appears green. These devices have very tiny LEDs and are a significant diagnostic tool that not only enhances the visibility of areas of the mouth that are

difficult to see but it also makes it much easier to educate patients about restorative treatment.

Extraoral cameras are used to photograph the full face or smile. These images can be uploaded to an imaging program to show how the face will change after dental treatment. They are typically used in orthodontic practices and also in cosmetic or aesthetic dentistry. If a digital camera is used, the image can be directly captured by a software program that morphs the face to show how it will change with the proposed dental treatment. Some dental offices have an imaging room where photos are taken and in which an assistant trained to manipulate the software can prepare cosmetic dentistry case presentations (see Figures 10-39, 10-75, and 10-121). The imaging area needs a countertop work surface to accommodate the monitor and keyboard and to provide a place for the assistant to work. This room may also contain a panoramic or combination panoramic/cephalometric X-ray.

Digital Impressions

No more gagging on impression trays with goop. The *iTero* does digital impressions with an intraoral digital scanner (see Figure 10-127).

Digital Radiography

The advantages of digital dental radiography are numerous. It eliminates the cost of film, chemistry, and processors. It eliminates the darkroom and the need to clean the processor roller rack as well as the need to dispose of the lead film packs and processor chemicals. In addition, it exposes patients to considerably less radiation, and issues of under- or overexposed film are resolved by being able to manipulate a digital image. Digital radiography is discussed in detail later in this chapter.

Handheld X-Ray

The *NOMAD PRO*™ handheld X-ray device (see Figures 10-42 and 10-43) works with digital sensors, film, and phosphor plates. It has integrated shielding and a backscatter shield. One device can serve three to four operatories, saving the expense of a wall-mounted intraoral X-ray between every two rooms.

Operating Microscope and Magnified Video Dentistry

Ceiling- or wall-mounted microscopes in the treatment room are used by anyone who desires to see better: endodontists, prosthodontists, periodontists, general dentists, and occasionally, dental hygienists (Figure 10-21). The operating microscope enables dentists to work at high-level magnification (2 to 21 times) coupled with coaxial illumination. Telescopic loupes (eyeglasses only) provide 2- to 4-power magnification. The microscope may have accessories added such as video cameras, digital cameras, 35-mm film cameras, and/or a dental assistant's

Figure 10-21. Endodontist using ceiling-mounted operating microscope that enables the doctor to sit erect during the procedure rather than bent over the patient's head. *(Photo: Jain Malkin)*

binoculars. Operating microscopes are being built into many offices today due to the significant ergonomic advantage of being able to sit up straight, looking forward at the microscope, rather than bending over the patient. This reduces head and neck injuries. *Seiler* (seilermicro.com) manufactures this type of microscope.

Another option that addresses ergonomic issues is magnified video dentistry. Lengthy procedures can be performed while sitting up straight and looking forward at magnified images on an eye-level monitor. Developed by *MagnaVu* (magnavu.com), some dentists (according to commentary on the vendor's website) feel it is easier to use than a microscope because it has better depth of field that can be set and not have to be adjusted continually. They also feel it is not as much of an obstruction between them and the patient (Figure 10-22). It does not require a computer, but images can be uploaded to a computer if desired. An additional feature is the *VELscope* oral cancer screening system attachment, which can be mounted to the device.

Figure 10-22. Magnified video dentistry system. *(Courtesy of MagnaVu)*

Networked Computer Systems

Networked multiple treatment room computer systems integrating clinical software, digital X-ray, and dental practice management software create a paperless office and a seamless transfer of information. In today's high-tech dental environment, a network specialist should be part of the design team.

Triple Monitors

Each treatment room will have three monitors for the patient and clinical staff explained previously.

Air Abrasion

Air abrasion is an alternative to conventional high-speed hand-piece (drill) dentistry; however, it is appropriate only for certain types of treatments. A small stream of particles (powder), under extremely high pressure, literally dissolves cavities. When the decay is removed, a small tooth-colored filling is inserted. Air abrasion can also be used as a diagnostic tool to probe hidden decay in lieu of "watching and waiting" for a potential problem to get worse. It is minimally invasive and eliminates the vibration and microfracturing associated with rotary hand-pieces. It is often used with a rapid curing light that cures composite materials or bleaches quickly, compared with conventional methods.

Cosmetic Imaging

With the widespread use of digital cameras, photo-quality ink-jet printers, and inexpensive image capture software, cosmetic imaging is taking center stage to help dentists demonstrate aesthetic treatment results to patients.

Cosmetic cases can involve extensive work and high fees. Dramatically changing someone's smile is professionally, as well as financially, rewarding compared with routine dentistry and discounted fees paid by dental plans.

Lasers

Lasers have been developed for both hard and soft tissue. They can be used to treat periodontal disease in a process called root planing. After tartar is removed using an ultrasonic scaler, the *NdYAG* laser is used to reduce bacteria associated with periodontal disease. A diode laser enables cosmetic dentists to sculpt the gum line. Not as common is the *ErbiumYAG* laser that was developed for hard tissue. These may be used for removal of tooth decay and cavity preparation as well as resin restorations. Lasers are also used in oral surgery and for cleaning out root canals in endodontic practices. Endodontists apply the light energy of lasers to treat targeted tissues without affecting the surrounding tissue to gain access to the infected nerve and to clean and disinfect the root canal. It is also useful to seal off blood vessels and nerve endings to reduce postoperative swelling and pain. Used for dental caries, current research shows no differences in postoperative results compared with cavity preparation in the conventional air turbine/bur technique, except that laser treatment usually does not require local anesthesia. Some dentists prefer electrosurgery to lasers. For dentists who use lasers, there are no special space or design accommodations that need to be made. They are portable and can be moved from room to room. As the beam is narrowly focused in the mouth, it doesn't pose any environmental safety hazards; lasers are often used in treatment rooms without doors. The patient and clinical staff must wear goggles to protect their eyes and a sign must be posted when lasers are in use. Most states require that lasers be licensed like X-ray machines. The NdYAG and ErbiumYag lasers may require dedicated outlets or air supply at full line pressure and possibly water connection.

Chairside Patient Education/Entertainment

Patient education includes viewing images taken by the intraoral video camera, looking at digital X-rays, and watching DVD presentations on specific dental procedures or conditions. Many patient education programs are available to run on the computer network. While the assistant is readying the treatment room or while waiting for the local anesthetic to take effect, the patient can be educated so that the dentist's time can be optimized by not having to explain the procedure. They also support the hygienist by eliminating repetitive treatment explanations. Many of these programs can be used in the waiting room or the treatment room to stimulate a desire for cosmetic dentistry.

Once the initial dialogue with the patient has ended and treatment begins, entertainment can be very useful in distracting patients to reduce anxiety. This includes videos of calming nature scenes (desert, tropical rainforest, beach and surf) as well as satellite TV and music, all of which can be controlled by the patient with a remote-control device.

CAD/CAM: Computer-Aided Restoration with Digital Impressions

The Chairside Economical Restorations of Esthetic Ceramics (*CEREC*) by Sirona and the *E4D* by D4D Technologies use computer-aided design/computer-aided manufacturing (CAD/CAM) to produce fillings, veneers, onlays, and crowns right in the office (Figures 10-23 and 10-24). Instead of several return appointments and temporary inlays or crowns, it can all be done in one appointment, although it involves more "chair" time. The CAD device takes an exceptionally accurate electronic "impression" (no gooey impression material in the mouth), and the computer creates the 3D restoration. This eliminates having to send the impressions to a lab and waiting several weeks for return of the crown. The conventional material for crowns is porcelain fused to metal, whereas CAM (computer-aided milling) is all ceramic. Today, dentists have the capability of sending the laboratory a digital color photo of a patient's mouth with the standard tooth-matching color guide included in the photo as a visual reference to correct for differences in color reproduction on the monitor and/or printer receiving the image at the lab.

Figure 10-23. CEREC® CAD/CAM system. *(Images courtesy of Sirona Dental GmbH)*

Figure 10-24. E4D CAD/CAM system. *(Printed with permission of E4D Technologies, E4D + E4D NEVO are requested trademarks of E4D Technologies, copyright © 2013. All rights reserved.)*

The E4D is a newer entry into the market formerly dominated by CEREC. A high-speed laser wand captures numerous images from multiple angles to build, in seconds, a virtual model or digital impression which can be sent wirelessly to the E4D unit in the lab (Figure 10-25),

where a milling center can manufacture the crown in the office or send the scan data to an outside lab to design, mill, and complete the restoration, shipping it to the dentist in several days. This results in a metal-free restoration and gives dentists the option of doing the work in-house or sending it out. The cost of the equipment has to be analyzed with an eye to return on investment. Two other major systems are *iTero*™ (cadentitero.com) and *3M*™ *ESPE*™, both of which produce models that must be sent to a lab to produce the restoration. The E4D NEVO is the newest entry, reducing the size of the unit on casters in Figure 10-24 to a laptop (Figure 10-26) that can easily be moved from room to room. The cart can remain in a central location or both the laptop and the cart can be used. Most dentists prefer to do chairside design of restorations. The software does most of this with the doctor just making small adjustments. With in-house milling of restorations, an auxiliary or assistant learns how to use the system along with the dentist. The dentist does the prep and the assistant does the rest.

The milling machine may be placed in the lab or in a central location (Figure 10-27). Sizes vary with manufacturer. There is noise associated with it when it is in use, which may dictate where it is located.

Teeth Whitening

Increased awareness of beautiful smiles and white teeth has created demand for whitening or bleaching. This was formerly accomplished (and still is) at home by use of a bleaching gel that is injected into clear plastic molds, custom-made to fit the individual's teeth. Additionally, dentists can bleach teeth in their office by numerous methods, some of which have space implications.

Water Systems

Dentists do not use piped-in city water chairside in their treatment rooms due to awareness that microorganisms breed easily in standing water, which inadvertently exposes patients (especially those on Monday morning after water has been standing in the pipes all weekend) to health hazards. Manufacturers of dental equipment now routinely provide a container for water mounted near the

Figure 10-25. Dentist using E4D CAD/CAM restoration system. *(Printed with permission of E4D Technologies, E4D + E4D NEVO are trademarks of E4D Technologies, copyright © 2013. All rights reserved.)*

Figure 10-26. E4D NEVO laptop CAD/CAM system with milling unit. *(Printed with permission of E4D Technologies, E4D + E4D NEVO are trademarks of E4D Technologies, copyright © 2013. All rights reserved.)*

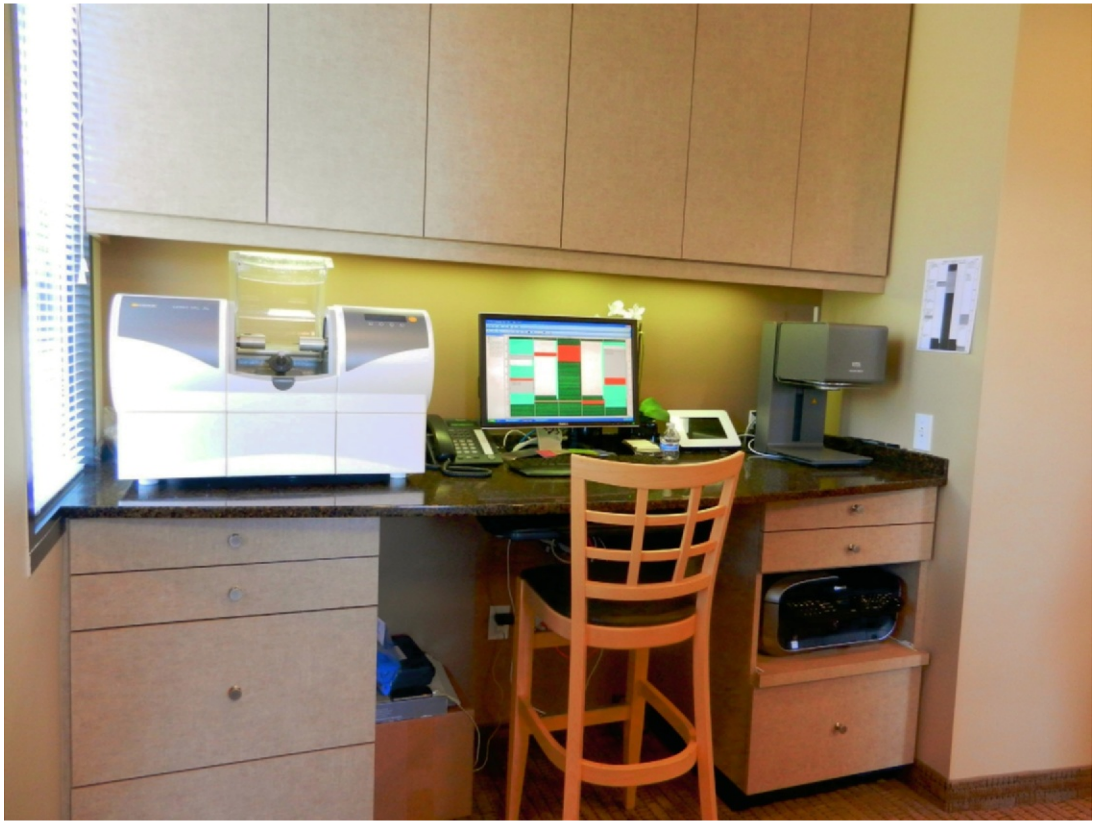


Figure 10-27. CAD/CAM milling station. *(Photo: Jain Malkin)*

assistant's and/or dentist's hand-pieces. One of the biggest issues is the pathogen-laden biofilm or slime that forms even inside dental hand-pieces, tubings, three-way syringes, and other items that use water. These risks are discussed in great detail in the Centers for Disease Control (CDC) document on infection control in dental settings, which every designer of facilities, and, more importantly, all dental personnel should read.[1] Additionally, minerals in city water can also adversely affect the performance and longevity of hand-pieces, scalers, and syringes, which is why most practices continue to use distilled or demineralized water and also treat it with agents to kill microorganisms. Refer to the discussion of water quality earlier in this chapter.

[1]William G. Kohn, DDS and others, "Guidelines for Infection Control in Dental Health-Care Settings—2003," *MMWR*, Dec. 19, 2003; 52(RR17); 1–61, (www.cdc.gov/oralhealth/infectioncontrol/guidelines/).

Sterilization Procedures

Sterilization techniques for instruments coming into contact with mucosal tissue during treatment must be processed, sterilized, and stored according to a high standard of asepsis. The aforementioned CDC *Guidelines* suggest that all dental instruments be wrapped or bagged prior to sterilization and remain sealed until used. The Dental Board in each state or the Board of Public Health regulates asepsis. There are a number of states where it is not mandated by law that instruments be sterilized or packaged, but that number is diminishing as state regulators react to the CDC *Guidelines* by enacting legislation. The American Dental Association (ADA) has endorsed CDC regulations and made them the "standard of care," which has led many states to amend their practice acts accordingly. Reading these *Guidelines* for sterilization makes one aware of the gravity of following strict procedures because the consequences can be life-threatening, exposing patients to serious diseases.

Consumers would be surprised to learn how lax regulations have been with respect to sterilization of instruments and hand-pieces. There is no agency inspecting dental offices in this regard, although OSHA does make visits to verify that staff are not exposed to certain types of risks. Expect more regulation in the future, especially if dentists begin to seek accreditation by national agencies, as many medical facilities must do in order for them to be eligible for Medicaid and other third-party reimbursement.

Modular Cabinetry/Dental Furniture

Modular casework offers infinite possibilities for accommodating the numerous pieces of equipment that are part of a high-tech treatment room, allowing for placement according to the practitioner's preference. Built into these

units are dispensers for drinking cups, several sizes of gloves, and a tissue box, as well as the sharps container (Figure 10-28). The goal is to have everything out of sight when the patient enters the room and to open retractable and other doors and drawers after the patient is reclined in the chair (Figures 10-29, 10-30, and 10-31).

Dental furniture, compared to custom casework or millwork, can be written off over a maximum of five years while custom cabinetry is considered a capital improvement under IRS law and must be amortized over 39-1/2 years.

Vacuum

There is a growing trend toward waterless (dry) vacuum systems because they save electricity, water, and sewage treatment costs. Many municipal water agencies require new offices to use dry vacuum systems; however, there is a heat load issue with dry vacuums which means the room needs more air exchanges. Some of these units are as large as a water heater (see Figure 10-63). Storage of old amalgam (silver fillings removed from patients) collected by traps in the office vacuum system must now, in many states, be disposed of through certified hazardous waste haulers. More sophisticated gathering of amalgam and residual mercury is available. It is likely that in the future amalgam recovery systems will be universally mandated (Figure 10-32). Allowing 2 cubic feet of space alongside the vacuum system will enable this to be added in the future. They go "in-line" between the trunk line of the vacuum to the treatment rooms and ahead of the pump or vacuum collection tank. Choice of vacuum system affects space requirements for the unit as well as piping requirements; consult the doctor's dental supplier for accurate information.

Safety Regulations

These have been discussed in detail earlier in this chapter and include standards issued by OSHA and the EPA regarding disposal of hazardous waste and sharps, the Bloodborne Pathogens Standard, the Hazardous Materials Standard, and tighter regulations for asepsis to prevent cross-contamination.

Figure 10-28. Modular casework for dental operatories. *(Photo courtesy of A-dec, Inc.)*

INFECTION CONTROL

People in a dental setting, whether staff or patients, are exposed to a wide variety of infectious microorganisms in the blood and saliva of patients. Proper infection control procedures used in the treatment room, sterilization, and dental laboratory prevent cross-contamination.

While much attention has been focused on HIV/AIDS, the dental team is much more at risk for hepatitis B and C. In 1988, OSHA began enforcing mandatory compliance

Figure 10-29. Modular casework detail. *(Photo courtesy of A-dec, Inc.)*

with CDC/ADA recommendations developed to protect dental staff and patients from the risk of contracting HIV or hepatitis B virus from one another. As it is difficult to determine whether a patient is a carrier of one of these dangerous viruses, each patient must be considered potentially infectious and the same universal precautions should be implemented. The dental team is required to wear protective eyewear, masks, gloves, and uniforms or gowns to create a protective barrier between themselves and contact with blood, saliva, debris spatter, or aerosols. Head covers are recommended during invasive procedures that are likely to result in splashing blood or other body fluids. Laundry service or in-office washers/dryers are now the only options available to the dental practice for cleaning of barrier garments since OSHA forbids employees from taking or wearing home contaminated garments to launder them.

All surfaces within the treatment room must be able to be thoroughly cleaned and disinfected. The design of cabinetry should be simple and easy to clean, with few crevices. Wallcoverings, if used, should be smooth. Although in the past some treatment rooms have been carpeted, the aforementioned CDC *Guidelines* cautions against it in favor of a seamless hard-surface floor which will be easier to clean.

Dentists must cover any surfaces that may be contaminated by blood or saliva, such as the handle of the dental light or the X-ray head, with clear plastic film. This wrapping should be changed between every patient. Surfaces that cannot be covered or removed for cleaning and sterilization must be scrubbed and disinfected between each patient.

OPTIM 33 TB

Developed by SciCan (scicancanada.ca), *OPTIM 33* TB wipes (and spray) are a great product for disinfecting all types of hard, nonporous environmental surfaces, such as equipment, handles of dental lights, cuspidor, computer keyboards, X-ray machines, and noncritical medical devices. The wipes are biodegradable and gentle enough to use on the face yet, in just one minute, they extinguish a wide variety of microbiological pathogens such as viruses, including polio, salmonella, *E. coli*, and a variety of bacteria. Even TB can be extinguished in three minutes.

Select Finishes Carefully

Interior designers specializing in healthcare design are familiar with many attractive interior finish materials that have the illusion of texture but, in reality, can easily be cleaned. There are exquisite fabrics that have all the maintenance and durability properties of vinyl upholstery, yet are actually woven textiles that have the appearance of natural linen or other fine fabrics. Some of these can even

Figure 10-30. Rear-delivery modular casework for treatment room. *(Photo courtesy of A-dec, Inc.)*

Figure 10-31. Modular casework detail; note foot pedal control. *(Photo courtesy of A-dec, Inc.)*

be cleaned with bleach. Even vinyl upholstery fabrics now have fabric-like texture and patterns that have the illusion of woven textiles.

Upholstery fabrics, window treatments, wallcoverings, and flooring must be selected with asepsis in mind. Flooring in treatment rooms or operatories may be smooth sheet vinyl (the solid vinyl simulated woodgrain products are an attractive option). Many dentists prefer carpet for its acoustic properties but this is not a good option in patient care areas according to the CDC. In other areas of the office, such as circulation spaces, select carpet with a backing that prevents moisture from leaching up through the floor or, in the opposite direction, from the top through the backing into the slab or subfloor. Refer to Chapter 11 for more information on carpet backings suitable for dental and medical offices. Carpet should be

Figure 10-32. Amalgam separator. *(Courtesy of Air Techniques, Inc.)*

directly glued to the slab. This provides a very firm surface on which to roll chairs.

Walls may be painted or have commercial vinyl wallcovering. If paint is used, it should be non-VOC and in an eggshell, no or low-sheen finish. Many manufacturers offer washable and durable paint finishes that have a matte finish. Think about the texture of the walls. Paint, especially accent colors, looks best on smooth walls with little texture. Consider mesh blinds as an easy-to-clean window treatment. PVC mesh is offered in different densities and a range of neutral colors (and woven patterns) in the form of a roller shade or a pleated Roman shade. These fabrics are designed to control sun without blocking the view as well as to cut heat gain on southern and western exposures. Two manufacturers of these sun shade products are Mecho Shade (Phoenix, Arizona) and Solar Shade (Santa Ana, California). Chapter 11 provides a detailed discussion of appropriate finish materials for medical and dental offices and also discusses furniture.

Treatment Room Furniture and Equipment

Dental patient chairs, operator's stools, and equipment are designed with asepsis in mind using vinyl upholstery with a seamless, easy-to-clean design (Figure 10-33). High-speed evacuation (vacuum system), dry, oil-free compressed air, and proper patient positioning (made easier by having the right chair) all help to control cross-contamination. Sterilization of hand-pieces and air/water syringe attachments is required between each patient. This amounts to a lot of "spare parts," for each piece of equipment in each treatment room. Ample storage must be provided for disposables, and space for special waste containers must be planned in the treatment room. These containers are lined with plastic bags that can be sealed before being removed for disposal.

No Routine Inspection of Asepsis

Contrary to what many individuals believe, OSHA does not regulate asepsis in regard to patients. OSHA's

congressional charter limits it to issues affecting employees and their ability to carry out their tasks without exposure to hazardous products or serious injury on the job. State dental boards and the public health department regulate asepsis in most states. In general dentistry, pedodontics, orthodontics, and endodontics, the goal is not to create a sterile field, it is to prevent cross-contamination. Obviously, there are oral surgery and periodontal procedures of an extensive and invasive nature where creating a sterile field is necessary and desirable, and some of those practitioners employ laminar-flow ventilation systems in their operatories. Refer to the *Sterilization* section for more specific information on procedures for processing dental hand-pieces and other tools.

GENERAL DENTISTRY

Office Circulation Patterns

Traffic flow within a dental office is from waiting room to treatment room, where the dentist greets the patient. After an interview about goals and objectives or dental problems, X-rays will usually be taken for new patients and, for return patients, at certain intervals. Intraoral X-ray is usually available in all treatment rooms. It may be a handheld portable device. Panoramic, cephalometric, and cone beam 3D X-ray are always located in a central area. For subsequent visits during the course of treatment, X-rays may or may not be required. The patient should be able to enter the operatory and sit down on the right side of the chair (for a right-handed dentist) without walking around the chair or through the assistant's work area. At the end of the procedure, the patient walks to the reception area, repairs makeup, or combs hair at the vanity niche in the corridor or in the restroom, books a future appointment if required, and pays for services. Proper flow prevents exiting patients from interrupting the reception of incoming or new patients.

If the dentist does aesthetic/cosmetic procedures, an imaging area may be provided where an assistant or treatment planning coordinator can take a digital photo of the

Figure 10-33. Adjustable-height dental chair. *(Courtesy of Midmark Corporation)*

Figure 10-34a. Dentist and auxiliary working from rear delivery casework. *(Photo: Jain Malkin)*

patient's smile, download the flash card into the computer, and prepare a case presentation or "photo album" demonstrating with "before and after" images how the patient's smile can be improved through aesthetic dentistry.

The dentist's circulation is from private office to treatment room and between treatment rooms or operatories. He or she should be able to enter the operatory without having to walk around the chair or through the assistant's work area, wash hands, and position him or herself on the patient's right (if he or she is right handed), as in Figure 10-34a. The assistant's path is from the treatment rooms back and forth to sterilization, laboratory (Figure 10-34b),

Table 10-1.
Analysis of Program
General Dentistry

No. of Dentists		**1**		**2**
Waiting Room[a]		12 × 14 = 168		16 × 18 = 288
Business Office/ Reception		12 × 16 = 192		12 × 16 = 192
Treatment Coordinator		8 × 10 = 80		8 × 10 = 80
Operatories[b]	3 @	10 × 11½ = 345	6 @	10 × 11½ = 690
Lab		8 × 10 = 80		8 × 10 = 80
Sterilization Alcove or Room[c]		6 × 12 = 72		8 × 12 = 96
Tech Closet[d]		4 × 4 = 16		4 × 4 = 16
Staff Lounge		10 × 10 = 100		10 × 12 = 120
Toilets	2 @	8 × 8 = 128	2 @	8 × 8 = 128
Hygiene Operatory		10 × 11½ = 115	2 @	10 × 11½ = 230
Pan/Ceph Alcove		6 × 8 = 48		6 × 8 = 48
Soiled Holding/ Laundry		6 × 6 = 36		6 × 6 = 36
Housekeeping Closet		8 × 8 = 64		8 × 8 = 64
Private Office[e]		10 × 10 = 100		10 × 14 = 140
Storage		5 × 6 = 30		6 × 8 = 48
Mechanical Equipment Room		6 × 8 = 48		6 × 8 = 48
Tel. Equip./Server Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		1,658 SF		2,340 SF
20% Circulation		331		468
Total		1,989 SF		2,808 SF

[a]Number of persons by 20 SF each.
[b]Size of operatories varies with doctor's practice preference for delivery of instrumentation and location of casework.
[c]Size depends on whether prefab modular system or custom casework.
[d]Tech closet may be smaller if equipment rack is recessed into casework as in Figure 10-55.
[e]Shared in two-doctor office.

and central X-ray room. The assistant also travels back and forth from the reception area to escort patients in and out of treatment areas.

Depending on the treatment room layout, the chair-side assistant (also called the auxiliary) may have to walk the greater distance in order to reach his or her work areas since it is more important for the dentist to have the shortest route (Figure 10-35). However, the operatories in Figures 10-36, 10-37, 10-38, and 10-39) have two entrances, one for the assistant and one for the dentist. This makes it easy for the assistant to enter and leave the room without walking behind the chair. Since the dentist and assistant are working in such confined areas, it is critical that these spaces be well planned and efficient. As with a medical office, a dental office should have a private entrance/exit for the staff and dentists so that they do not have to pass through the waiting room.

The Dental Assistant

The dental assistant or auxiliary performs many duties. Among them are cleaning the operatories, seating patients in the dental chair, preparing tray set-ups; taking X-rays; sterilizing instruments, loading anesthetic syringes, pouring impressions, mixing materials, charting conditions and treatment, handling suction hand-pieces and air/water syringes, and assisting the dentist in dozens of restorative and surgical procedures.

Dental assistants may have different levels of training. A certified dental assistant (CDA) is the first level of training, a registered dental assistant (RDA) is the next level, and, with additional training, an extended-function certificate can be added to the RDA license (RDAEF). Extended-function assistants are able to perform tissue retraction, remove sutures, take impressions, change periodontal packing, and sometimes, depending on state practice laws, perform the more routine aspects of completing a procedure, thereby freeing the dentist to move to the next patient. In a state with an RDAEF program, the doctor may need more treatment rooms because the assistant is using a room to perform part of the treatment functions while the doctor is using another.

Figure 10-34b. Dental lab. *(Photo: Jain Malkin)*

The Dental Treatment Room or Operatory

This is the most important room in a dental office. Although analogous to the physician's examination room, it is far more critical to a dentist's practice than the medical exam room is to a physician's, as the physician has ancillary rooms for diagnosis, testing, and treatment, but the dentist has only the operatory. In terms of economics, the physician has the opportunity to enhance his or her income from laboratory tests and the use of medical aides to give injections, administer ECGs and EEGs, or perform various therapies. But the dentist has only the treatment room, the laboratory, and X-ray studies from which to derive income. Each treatment room should be thought of as a profit center. For this reason, many time-and-motion studies focusing on treatment room efficiency have been published in dental journals.

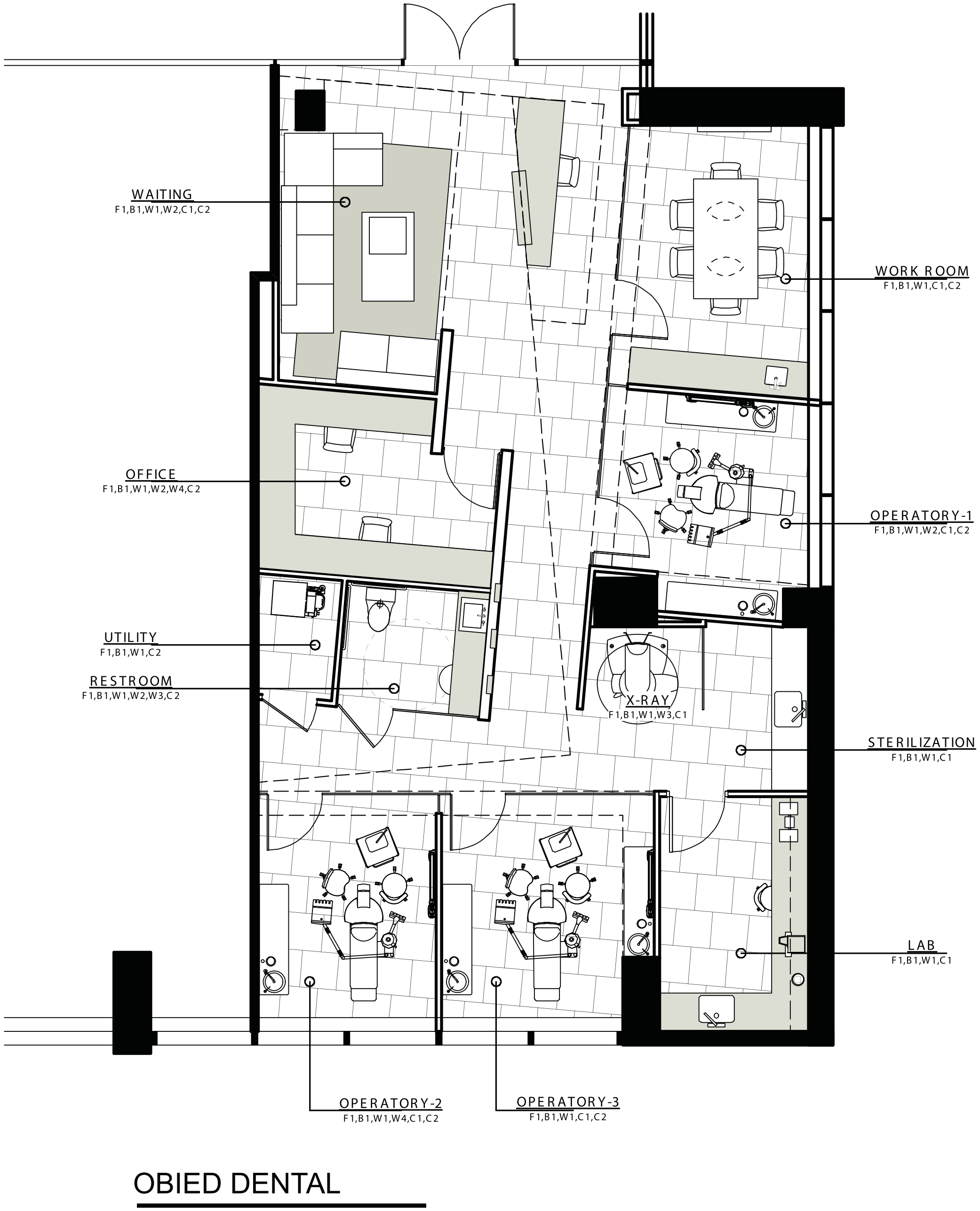


Figure 10-35. Space plan for general dentistry suite. *(Courtesy of FORMA Design, Inc.)*

Over the years, changes have evolved as a result of these studies. Patients now recline in a contoured chair with the dentist working from a seated position at the side of the patient. If right-handed, the dentist will be seated to the right of the patient and work in an area that could be designated as from 9 o'clock to 12 o'clock, imagining the area behind the patient's head as 12 o'clock and the feet as 6 o'clock.

Most dentists use an assistant, which is called *four-handed dentistry*. Some dentists use two assistants, which is called *six-handed dentistry*. While Figure 10-37 illustrates the optimum traffic flow pattern for an operatory, the structural features of the space, the location of windows, and other immutable factors have an impact on the layout of the space and may yield compromises in circulation.

Design for Flexibility

A right-handed dentist will work to the patient's right and a left-handed dentist to the patient's left. Traditionally, operatories were designed for either a right-handed dentist or a left-handed one. Today, flexibility is the key. New equipment is designed to accommodate change. In a practice composed of right-handed and left-handed dentists, an ambidextrous operatory can be achieved with the proper purchase of equipment. The equipment shown in Figures 10-40 and 10-41 has a patient monitor (and may have dynamic instruments) mounted on an arm that swings around the toe of the chair to deliver these items to the other side (see Figure 10-45). In an ambidextrous operatory, the X-ray head may be mounted on the rear wall or, as is more common, on the side wall, which may take the form of a through-the-wall cabinet that allows it to swing between two treatment rooms (see Figure 10-16) or a handheld device (Figure 10-42). The assistant's cart/delivery can be ordered with a swing-away bracket to transfer the hoses to the other side of the cart when assisting from the right side of the chair.

Size of Treatment Rooms

Treatment rooms may be as small as 8½ by 8½ feet (Figure 10-44, Plan A) or as large as 10 by 11½ feet, but 100 square feet is the average size. A room the size of that

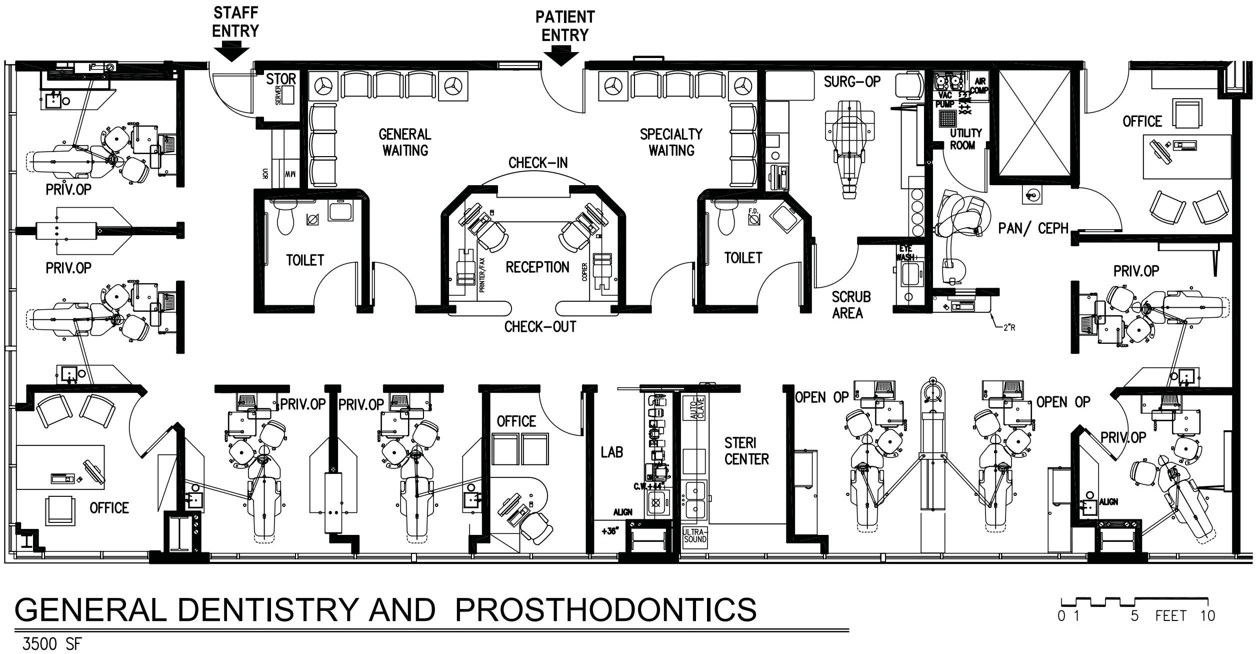


Figure 10-36. Space plan for general dentistry and prosthodontics, 3,500 square feet. *(Design: Jain Malkin Inc.)*

in Plan A is not recommended. Figure 10-37 shows the minimum distances between the dental chair, cabinetry, and perimeter of the room. There was a time when dentists worked alone and preferred small operatories so that, while seated (or standing), they could reach everything they needed. Now that dentists use a chairside assistant and the trend is toward longer appointments (it is more efficient to do a lot of work at one sitting), many dentists feel more comfortable working in a larger treatment room. However, the size is related to the use and location of fixed cabinets and to the number and locations of sinks and/or mobile carts.

Figure 10-44, Plans A through H, are but a few of the possibilities. The total number of options is related to the number of possible combinations of the following elements:

Dentist's Instrumentation. Instruments may be delivered *over the patient*, or *trans thorax* (Figure 10-44, Plans A and D and 10-45), from the *side* (from a mobile cart, mounted onto a fixed cabinet, or wall-mounted on an adjustable arm as in Figures 10-41 and 10-44, Plans B, C, and G) or from the *rear* (sharing a mobile cart with the assistant as in Figures 10-40 and 10-44, Plan E) or mounted to a fixed cabinet behind the patient as in Figures 10-34 and 10-44, Plan H).

Assistant's Instrumentation. Instruments may be delivered *over the patient*, from the *side* (post-mounted on an articulating arm as in Figure 10-46, attached to a post-mounted cuspidor, or chair-mounted Figure 10-44, Plan G), or from the *rear* (a dual-purpose cart shared with the dentist as in Figures 10-34, 10-40, and 10-47, or built into fixed cabinetry as in Figure 10-44, Plan H. Ninety percent of all instruments and materials that a doctor handles are passed to him or her by the dental assistant. If the assistant's work area is not efficiently designed, it will affect the doctor's productivity and stress levels.

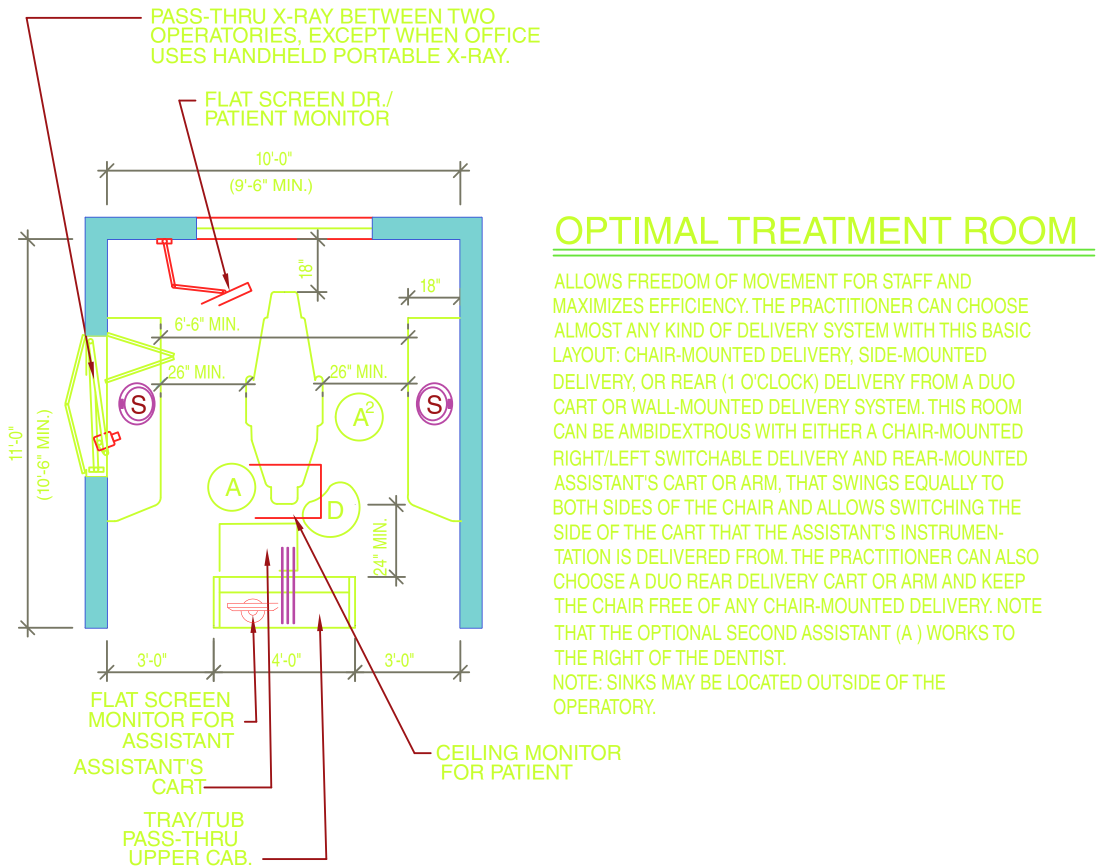


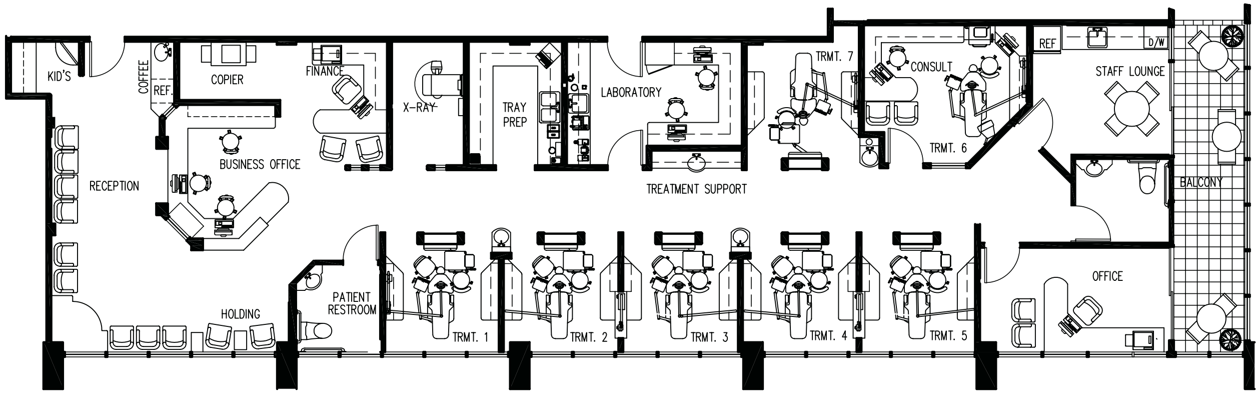
Figure 10-37. Optimal treatment room layout. *(Design: Jain Malkin Inc.)*

Work Surfaces. These may be mobile carts, fixed cabinets, or shelves that slide out of fixed cabinets to hold the tray of instruments and medicaments used during the procedure. For example, if the assistant's instrumentation is being delivered post-mounted over the patient, the assistant will need an additional work surface, which would probably be a mobile cart placed near the head of the patient. Mobile carts can be selected with both instrumentation and a work surface combined (Figure 10-48).

Number of Doors. A treatment room may have one or two entrances but two is more common. A solid-core hinged door helps to block the sound of high-speed drills, but is rarely used because it makes it difficult for the dentist and assistant to rotate quickly between operatories. Thus, many treatment rooms have no doors to facilitate movement. The ADA limitations on door sizes, clearances, and swings make it almost impossible to legally put a door on a treatment room. An exception is using an ADA pocket door on the doctor's side and a 30–inch-wide hinged door on the assistant's side (opening into the room) as the assistant's opening is ADA-exempt.

Number of Sinks. Treatment rooms rarely have sinks. Often one sink that functions for both the dentist and the assistant can serve two operatories as in Figures 10-28 and 10-49. In some regions, water and sewer fees are so high that it is more practical to use fewer sinks, placing them where they are convenient for several individuals, without compromising infection control. The dentist and assistant must wash their hands upon or before entering the room. The CDC and OSHA have recommended using alcohol-based hand cleaners between glove changes unless hands are visibly dirty, which means a centrally located sink for hand-washing may suffice, but this is an individual practice preference. Some dentists may prefer a foot-lever faucet, but many use a single-lever faucet. Infrared faucets that activate when hands are placed underneath are another option for enhancing asepsis. Some modular casework manufacturers have placed a toe-kick faucet control in the base (see Figure 10-31). Operatories may have an additional sink for the assistant in order to save steps and keep the assistant out of the dentist's path (see Figure 10-41). Regardless of number, operatory sinks may be quite small and are usually round or oval in shape as they take less space than a square one in an 18-inch-deep countertop.

Casework. Casework may be custom built (usually clad in plastic laminate) by local cabinet shops, but first it must be meticulously designed and detailed, often necessitating several iterations of construction drawings and shop drawings. It is difficult for a local shop to be able to precisely accommodate little drawers for various items, swing-away



PROSTHODONTICS
2540 SF

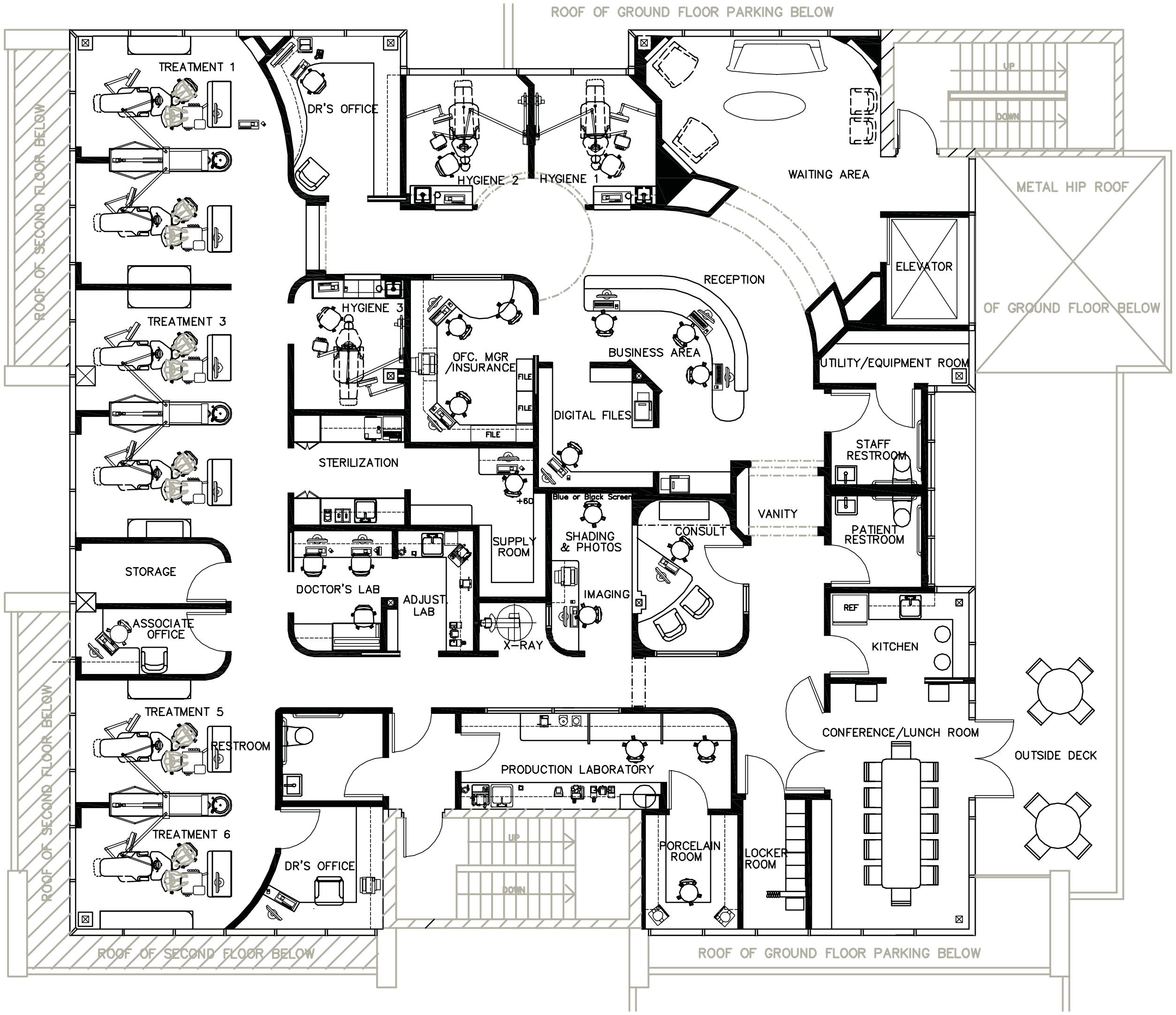
Figure 10-38. Space plan for prosthodontics suite, 2,540 square feet. *(Design: Jain Malkin Inc.)*

shelves and dispensers for gloves, drinking cups, and tissue boxes, unless it specializes in dental casework and is very familiar with these requirements, which include accommodation of utilities.

In most cases, this type of casework requires a stud and gypsum board partition (wall) in which conduit carries electrical wiring and computer cables. While this used to be considered a less expensive option than manufactured modular casework, there are other financial considerations. There is a considerably longer depreciation schedule for writing off tenant improvements compared with modular casework, which is considered furniture and can be written off over a five-year period. In addition, there is a great deal of coordination when relying on a local casework fabricator. Casework has a long lead-time item; final measurements can't be taken until the partitions have been completed. The coordination of electrical and other utilities with the casework is the stuff that will invoke "Murphy's Law." And it all has to come together at the last minute. The dental equipment dealer has to wait until the casework is delivered to the job in order to fit the equipment and connect all the elements. Electrical, medical gas, and mechanical subcontractors also have to coordinate their work to bring wiring and utilities to outlets built into the casework. In short, it's not a smooth linear process with the assurance of perfection at the end of the road.

For dentists who wish to pursue this option, companies such as Greeno (Fresno, California) offer a variety of inserts to customize standard casework for the dental treatment room. These include recessed sharps containers, through-counter waste chutes with bag holders, and glove and tissue box dispensers. Sometimes, the shape of a treatment room or the practitioner's desire to create a totally unique design will necessitate custom casework.

Cabinets need only be 18 inches deep and, if they are going to be used as work surfaces while seated, should be at 33- or 34-inch heights. The most common use for upper cabinets in a dental operatory is for cassettes and tub storage and for boxes of disposable gloves, face masks, and patient bib towels. The depth of drawers must be carefully planned to accommodate the supplies that will be stored there. Most items used in treatment will be brought into the room on barriered tray or sterilized cassette and procedure tub set-ups. Unwrapped instruments to be used in the oral cavity may not be stored in drawers in the treatment room; they must be wrapped and packaged to maintain sterility.



ESTHETIC/COSMETIC DENTISTRY PRACTICE

4044 SF

Figure 10-39. Space plan for esthetic/cosmetic dentistry, 4,044 square feet. *(Design: Jain Malkin Inc.)*

Figure 10-40. Modular treatment room casework, *The Preference Collection*™ features 12 o'clock wall with chairside assistant's monitor and keyboard; radius arm on dental chair enables flat screen monitor to be positioned on patient's left when taking the X-ray image and on patient's right when explaining it to the patient. Note dental light is attached to the casework. *(Photo courtesy of A-dec, Inc.)*

Figure 10-41. Dental treatment room. *(Photo courtesy of A-dec, Inc.)*

Figure 10-42. NOMAD PRO™ handheld X-ray device. *(Photo courtesy by Photographic Solutions, Inc., on behalf of Aribex, Inc.)*

Figure 10-43. NOMAD PRO™ handheld X-ray device. *(Photo courtesy by Photographic Solutions, Inc., on behalf of Aribex, Inc.)*

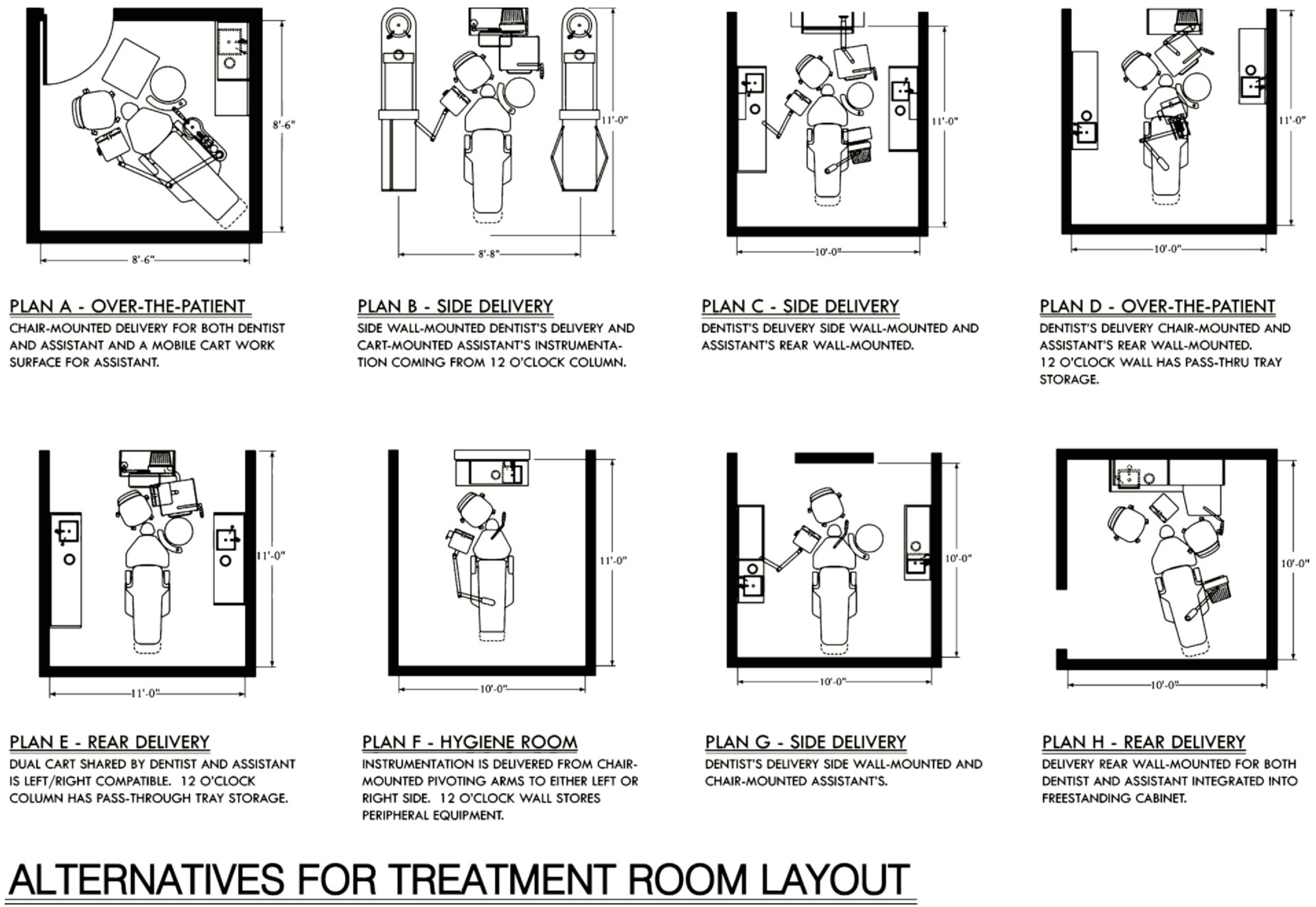


Figure 10-44. Alternatives for treatment room layout.

Casework Fabricated by Specialty Shops. In various regions of the country, there are casework fabricators that specialize in dental offices. They bridge the gap between basic casework from nonspecialty shops and prefabricated modular casework sold by dental equipment dealers by offering dentists a truly custom appearance and style as well as extraordinary craftsmanship and the knowledge of functional issues.

Modular Casework. Prefabricated casework takes the place of stud and gypsum board partitions, integrates utilities, and also accommodates whichever style of delivery the dentist and assistant prefer. These systems offer flexibility in accommodating monitors, computers, and sundry equipment items now part of a high-tech treatment room (see Figures 10-28, 10-29, 10-30, 10-40, 10-46). Other niceties include wire management to conceal computer cabling, built-in clock/timer, slide-out drawers and shelves, doors with windows, through-the-wall tray storage, built-in accessory control panels, dispensers for gloves and tissues, and foot- or knee-activated control of faucets. Hollow "columns" allow easy access to wiring and other service items. Task lighting is prewired and built-in.

In addition, one can eliminate X-ray and light mounts since they can be mounted on the modular casework as in Figure 10-40. Overall construction of the suite is facilitated by prefabricated casework as all it requires is an open room with utility stub-ins. One can predict with certainty where the cut-outs, raceways, and connection points will be in the casework. This cuts construction costs and time somewhat, but modular systems are not inexpensive.

Another consideration is that the "walls" and casework can move with the dentist to a new location. Aesthetically, it has a much more open appearance because the units are not full height. Some dentists like this, while others find there is a lack of acoustical privacy with a patient in one operatory being able to overhear the other patient's conversation. However, if space is at a premium, modular units add one operatory for every five fixed-wall treatment rooms as illustrated in Figure 10-50.

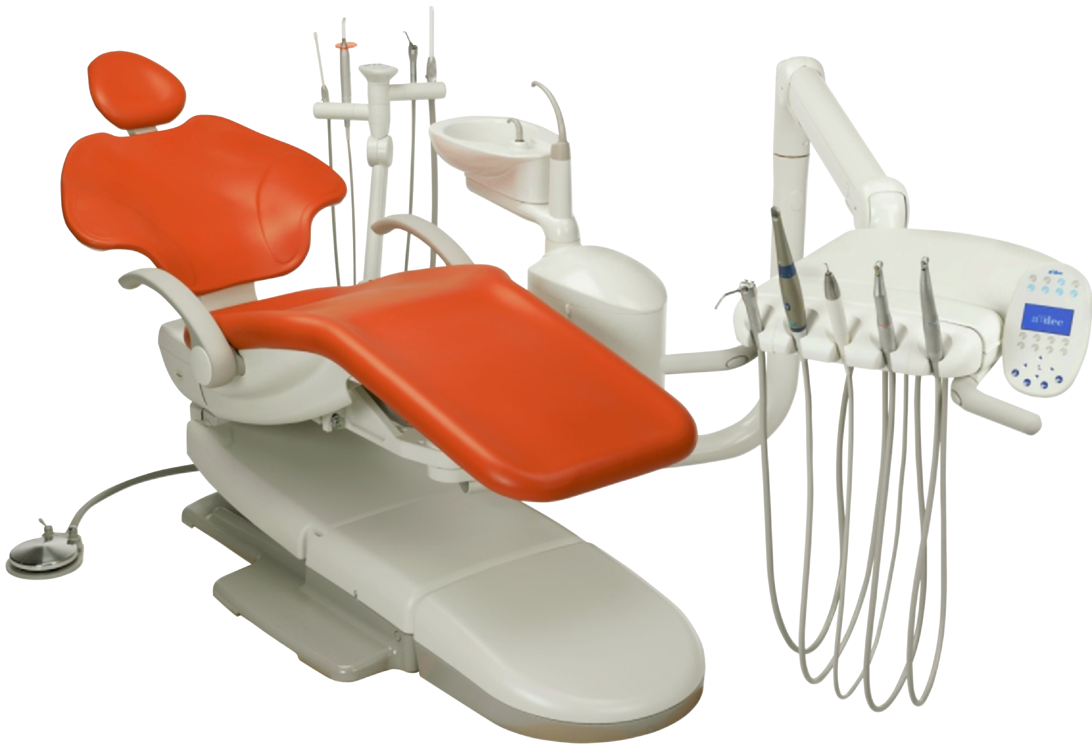


Figure 10-45. Dental chair with cuspidor and dental instrumentation that swings around the toe of the chair. *(Photo courtesy of A-dec, Inc.)*

Number of Treatment Rooms

There is no rule governing the number of operatories per dentist since the dentist's temperament and practice methods dictate size and design. A dentist who works slowly or does a lot of restorative work with long appointments may be comfortable with two treatment rooms. A dentist with many short appointments will need four treatment rooms in order not to lose time during the change of patients and preparation or cleanup of treatment rooms. *A rule of thumb is three operatories per dentist in a general practice*.

Optimal Treatment Room Layout

The critical distances shown in Figure 10-37 are based on ergonomic data regarding proper positioning of both the

Figure 10-46. Dental chair with delivery of instrumentation over the patient. *(Photo courtesy of A-dec, Inc.)*

dentist and the assistant to avoid back strain, fatigue, bending, twisting, turning, and reaching beyond limits. Everything the dental team needs is within easy reach. The operatory in Figure 10-37 also accommodates a dentist who prefers either over-the-patient or side delivery of instrumentation.

Instrumentation. There are four categories of instrumentation.

1. Hand-Piece Delivery System. This describes the drills (rotary tools) with burs/diamonds that are used to cut and shape teeth.

2. Evacuation System. Blood, debris, and water are removed from the mouth, usually by suction. The vacuum system may be a “wet” system that empties into a waste pipe, or a dry system described previously. The evacuation system typically has high-speed suction for rapid debris removal and a low-speed saliva ejector positioned in the patient’s mouth. Both are the responsibility of the dental assistant.

Figure 10-47. Rear delivery of instrumentation for dentist and assistant from a dual-purpose cart. *(Photo courtesy of A-dec, Inc.)*

Figure 10-48. Mobile cart with instrumentation. *(Photo courtesy of A-dec, Inc.)*

3. Handheld Instruments. These tools include probes, scalers, and forceps.

4. Three-Way Syringe. Used by both the dentist and the assistant for spraying water, compressed air, or a combination thereof. The assistant will have his or her own three-way syringe for drying or moistening preparations as well as for washing debris from the patient's mouth.

Methods of Delivery. The dynamic instruments (drills, suction, syringes) can be delivered to the oral cavity of the patient by four methods. There are advantages and disadvantages to each method of delivery listed below, and each has its proponents. Most practitioners will continue to work in the manner to which they have become accustomed, even if another method seems more efficient.

The dentist's hand-pieces may be delivered chair-mounted, side-wall-mounted, rear-wall-mounted, or cart-mounted. Regardless of which of these four options is selected, the assistant's instrumentation may be delivered rear-wall-mounted, chair-mounted, or cart-mounted.

Chair-Mounted System (Dentist). Dynamic instruments are delivered either over the patient's chest or from the patient's left or right side (Figure 10-51). The systems are mounted on an arm, which is attached to a post. The post may be attached to the floor or to the chair. If the latter, as the chair is adjusted up or down, the relative position of instruments with respect to the oral cavity remains constant. Statistics show that over-the-patient delivery is the most popular system, favored by nearly half of all practicing dentists but decreasing as more dentists consider rear delivery.

Advantages. Functions for two- or four-handed stand-up or sit-down dentistry; requires minimal floor space; offers ambidextrous option; reduces eye fatigue as minimal adjustments in focus are necessary. Hand-pieces are presented with easy access to the oval cavity and little hand-piece tubing pullback; maximum flexibility in positioning instruments. (Tubing pullback occurs more often with coiled tubing than with noncoiled tubing.)

Disadvantages. Instruments are in patient's view; assistant's access to dynamic instruments is reduced.

Instrumentation is placed near the patient's left shoulder if the dentist is working on the patient's right.

Advantages. Requires the least amount of operatory space; single utility location; provides left- or right-handed operation.

Disadvantages. Limitations in instrument positioning; requires the addition of a work surface; may require a separate utility location; instrumentation located close to the patient.

Side-Wall-Mounted System (Dentist). Dynamic instruments are wall-mounted (see Figure 10-44, Plans B and C), built into a side cabinet, or placed on a mobile cart that pulls out from the side cabinet.

Advantages. Good patient access to chair; dynamic instruments out of patient's view; mobile carts permit flexibility of movement; wall-mounted units require minimal floor space; easy-to-position hand-piece controls.

Disadvantages. Reduces auxiliary's access to dynamic instruments; placement of umbilicals must be properly planned; may require a wider operatory; dedicated to left- or right-hand positioning; requires separate utility location.

Figure 10-49. Dental treatment room with modular casework serving two treatment rooms. *(Photo copyright © Nathan Padilla Bowen)*

Rear-Wall-Mounted System (Dentist). Dynamic instrumentation is delivered from the 12 o'clock position, behind the patient's head, from a fixed cabinet (with the systems built into the face panel of the cabinet), from a wall mount, or from a mobile cart, which may or may not be shared with the assistant (called a dual cart if shared). Rear delivery can also be accomplished with what is called a *12 o'clock column* (see Figure 10-40), which refers to the modular casework.

Advantages. Good patient access to chair; keeps dynamic instruments out of patient's view; dual cart gives assistant excellent access to dynamic instruments and a good work surface; ease of installation; requires minimal floor space. Accommodates left- and right-handed positioning; single utility connection for dual cart.

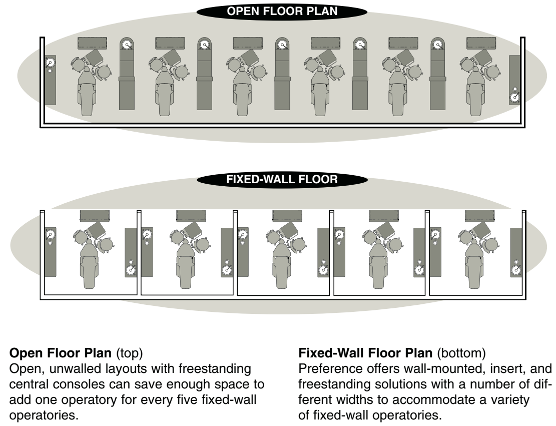


Figure 10-50. Diagram illustrates the space-saving feature of rooms divided by modular casework, as opposed to fixed walls. *(Illustration courtesy of A-Dec, Inc.)*

Disadvantages. Limited to sit-down use; integration into fixed cabinet may increase installation time or cost; hand fatigue due to hand-piece tubing pullback; requires more body movement; requires a deeper operatory.

Rear-Wall-Mounted System (Assistant). Instrumentation is placed at the 1 o'clock position (see Figure 10-30).

Advantages. Instrumentation is out of patient's view; provides a large work surface; supports left- or right-handed operation; provides easy access to and optimal positioning of instrumentation; supports peripheral operatory equipment and makes it easy to see the practice management monitor if placed behind the patient.

Disadvantages. Requires separate utility connection if dentist does not use rear-wall system; requires a deeper operatory; requires rear wall upon which to mount it.

Cuspidors. Cuspidors have the potential to create cleaning and asepsis problems, but they are favored by some practitioners and may be found in hygiene rooms as well as treatment rooms. They are available with or without attached assistant's instrumentation (suction, three-way

syringe, and saliva ejector). Vacuum drain cuspidors are available for use with central vacuum systems.

Location of Computers and Ergonomic Considerations. There is general agreement that the ideal treatment room needs one computer and three monitors. The third monitor may be mounted in the ceiling for patient viewing in a reclined position. The computer is usually located somewhere in the vicinity of the assistant with a monitor not visible by the patient for the assistant to chart on, bring up management information, and record treatments. This computer can also be used to capture digital X-ray images and intra- or extraoral photographic images from digital cameras. The second monitor is placed in as ideal a position as possible for patient viewing while sitting upright in the patient chair. This is used for patient education with DVDs of prepared topics, for screening of patient X-rays, for explanation of their personal conditions and possible treatments (using photographs), and sometimes just for entertainment purposes. The overhead monitor is usually slaved to the chair monitor and allows the same functions when the patient is reclined for treatment. This additionally allows patients to watch the actual examination of their oral conditions if they so desire.

Variables for Monitor Placement. Ergonomics are really important in the dental treatment room and yet dentists are often unaware of these issues when deciding where to place monitors. In theory, the dentist should focus on the oral cavity and, by merely looking up, be able to see the display on the monitor, pointing out problem areas to the patient (see Figures 10-22, 10-40, and 10-49). Therefore, if the patient's monitor is placed on the left side, either near the foot of the chair (see Figure 10-40, right side) or post-mounted (see Figure 10-51), it is positioned where it is convenient for both the patient and the dentist (assuming the dentist is right handed, or the reverse, if not). If it is post-mounted or on a radius arm that moves around the toe of the chair (see Figure 10-40), one has the flexibility of reorienting the monitor. The patient monitor should be 22 inches in size so that it can be viewed from a distance. One must be mindful of patients who wear bifocals and their ability to see images clearly or read text from a specific viewing distance.

Figure 10-51. Chair-mounted delivery of dynamic instruments. *(Images courtesy of Sirona Dental GmbH)*

Figure 10-52. Open hygiene bay in pediatric/orthodontic dentistry practice. *(Courtesy of Joe Architect; Photographer: Chipper Hatter)*

Another option for a patient monitor is in the ceiling, immediately over the patient chair. Since the chair is laid almost flat while the dentist is working, this makes it quite easy for the patient to view educational or entertainment programming (see Figure 10-8, Figure 10-9, Figure 10-18, and Figure 10-52). A competent audiovisual consultant or dealer can design a bracket to securely mount the monitor and handle all the installation. There needs to be a flange or a trim piece around it to provide a finished edge on the ceiling, whether it is gypsum board or acoustic tile.

Practice Management Monitor. The primary computer, used by the assistant, is best located at the rear of the chair in what is called the 12 o'clock position (see Figure 10-9 and Figure 10-34a). This enables the assistant to see exactly what the dentist is seeing in the oral cavity, and it also has practice management software, providing full access to the patient's chart, notes, and radiographs. The monitor should be positioned so that the dentist can also view this information. During the procedure, the assistant will input data with a light pen, touch pad, pen and tablet, or wireless infrared keyboard and mouse. A second input device to the side of the dentist enables him or her to access information or manipulate X-rays without having to verbally ask the assistant to do it in the patient's presence. This also enables the dentist to review the treatment plan or read previous appointment notes discreetly on the assistant's monitor.

Other Ergonomic Considerations. An additional concern is eyestrain. Every time the dentist's eyes move from the oral cavity to the monitor, the pupil has to dilate or constrict (and this happens less rapidly with increasing age) to differing light levels and the focal length of the eye must adjust to the distance; eye muscles have to bend the lens. These physiological factors should be considered when placing objects in the treatment room. Note also, in considering ergonomics and back strain, that touch-pad programmable dental chairs are available to enable the dentist to quickly adjust the chair by presetting it for different positions. The chair in Figure 10-53 features a quick-release dual articulating headrest that enables the dentist to precisely position the patient for easy access to the oral cavity.

Audio and Video Possibilities

According to numerous studies, anxiety affects over 70 percent of dental patients. While some patients experience only mild levels of anxiety, others are absolutely terrified of the dentist. Anything that mitigates that fear can be a significant factor in determining which dentist a patient chooses to see. *The author is indebted to Keith Aderman, a technological wizard in this subject area, for writing this section of the chapter*.

Operatory Televisions

As a result of being one of those individuals who experienced frightening dental visits as a child, Keith Aderman, professionally known as "Mr. Hookup" (www.mrhookup.net), has developed a specialty of designing and installing audio video entertainment systems in dental offices, primarily to address the fear factor. Typically, each operatory is equipped with two TVs: one screen faces the patient when sitting upright and the other is in the ceiling for viewing while in the supine position. During treatment, the patient can watch satellite, cable TV, or movies on Blu-Ray discs or various forms of digitally stored media. For upright viewing, the picture is duplicated on a second screen in front of the patient, which is normally shared with the computer. There is much research supporting the use of positive distraction to relax patients and enable them to avail themselves of the dental care they need while minimizing fear. Now that flat screen televisions are so inexpensive, having a television to watch before and during treatment is an economical, yet a very effective, way to make the experience more palatable. For the dentist, the return on investment can be huge.

Both the ceiling and the front TVs can share a common entertainment source, or by remote control, the front screen can be switched to the computer for X-rays, patient education, charting, or intraoral camera use. For the ceiling, a flat screen television is securely mounted either on or in the ceiling, directly over the patient's head. Many mounting solutions are available for mounting TVs, including special brackets intended specifically for dental offices, where the TV is built into the ceiling in place of a 2×2–foot ceiling tile. It should be positioned so that it is viewable while the patient is fully reclined, without being blocked by the dental light (see Figure 10-8 and Figure 10-9). The TV must be securely anchored to the structure of the building for safety reasons. Never rely on the ceiling grid or drywall to hold the weight of the TV. The ideal position is usually straight up from the patient's nose as the chair is fully flat. For ambient light, fluorescent or LED lighting fixtures typically flank the TV to the left and right (Figure 10-54). As the office is being built, it is important for the general contractor to be aware of how and where the TVs will be mounted, so that the ceiling can be laid out accordingly, and the structure provided for the TV.

Figure 10-53. Dental chair with quick-release dual articulating headrest. *(Courtesy of Pelton & Crane, copyright © 2013)*

A second screen, in front of the patient, is necessary for upright viewing. Its purpose can be shared between entertainment and computer use. Because of the low cost, many offices are now using 32- or 40-inch high-definition LCD or LED televisions mounted to the toe-wall of the operatory in lieu of smaller monitors (see Figures 10-8 and 10-146). High-definition televisions have a resolution compatible with both computers and high-definition entertainment sources. When a smaller screen is used it typically needs to be mounted on an articulating arm, so that it can be pulled closer for reading text or looking at a digital X-ray in detail, then pushed out of the way when it's

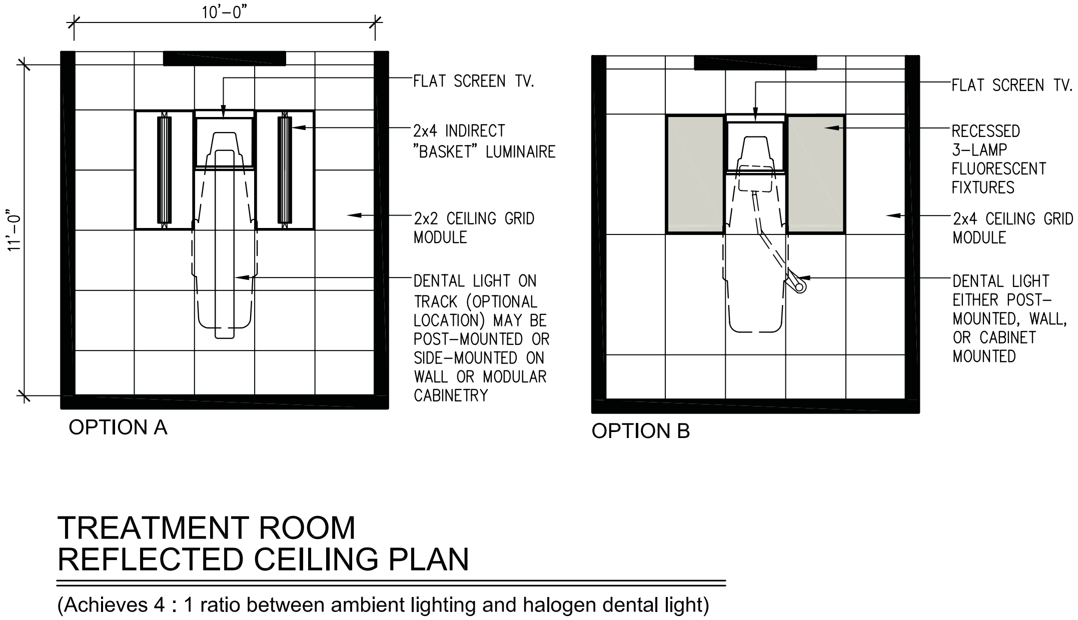


Figure 10-54. Treatment room reflected ceiling plan.

not in use. Moving the monitor will require an additional barrier strip for each patient. When the monitor is pulled in close to the patient, it is easy to point at something on an X-ray or intraoral camera image. With a larger screen, the screen is farther away and usually mounted on a static bracket, with pointing accomplished using the mouse as a pointer. Either method is effective.

For entertainment, high-definition televisions work best when connected to either a high-definition digital cable box, or a high-definition satellite receiver. Changing channels on the cable box or satellite receiver changes channels on both ceiling and front TV simultaneously. A Blu-Ray disc player is another popular option for programming, although it requires significantly more effort on the part of the staff to load and unload movies, skip through all of the trailers at the beginning of the movie, and to keep all of the discs accounted for. Satellite and cable companies will require a dental office to have a commercial account, which includes licensing fees for public viewing. If movies are played on discs or other recorded formats, a yearly Public Video Screening License (PVSL) is necessary to be legal.

Since the cable box, satellite receiver, or Blu-Ray player are centrally located in the office, and therefore not within line-of-sight for remote control operation, an infrared sensor is necessary to pick up the commands of a remote control in the operatory, and send them to the components located in a central media cabinet. The sensor requires wiring to link the operatory to the tech closet, along with other infrared components back in the tech closet.

Stereo headphones provide the patient with high-quality sound, while not bothering the doctor or staff. An in-line volume control on the headphone makes quick and easy adjustment of the volume very convenient, and within the technical grasp of almost any patient.

Background music plays an important role in the dental office as well. With higher-quality, natural-sounding speakers, strategically placed throughout the office, the music system not only provides a more relaxing environment, it acts as a camouflage for private conversations and unpleasant sounds, such as the dental drill. While those who work in a dental office may become inured to the sound of the dental drill and tend not to hear it anymore, it's a sound as offensive as fingernails on a chalkboard to many patients. An individual volume control in each room keeps the sound level appropriate for each area. This is very important because each room has different acoustic qualities. The source of the music is also critical. It is not ideal to play AM or FM radio stations through office speakers. Not only is it annoying to listen to commercials but it is illegal to play copyright-protected music from the radio without paying a licensing fee to American Society of Composers, Authors, and Publishers (ASCAP), and/or to BMI. It is also illegal to play copyright-protected music from a CD player, iPod, or other type of player, unless properly licensed. However, many programming services are available for businesses that include licensing fees. Legitimate music programming for public listening is available through satellite providers, cable companies, online services, or distributed tapes, and discs. A wide variety of formats are available without commercials or verbal interruption. Typically, the playlist is expanded beyond the limited playlist of public radio stations, keeping repetition at a minimum.

Selecting the least expensive speakers and amplifier are a mistake. Speakers designed for paging are the least

suited since the midrange frequencies are exaggerated. A low-quality system irritates the listener more than it pleases, especially over an extended period of time. In contrast, a pleasant-sounding system will keep the doctor and staff in a better mood, soothe nervous patients, and effectively camouflage unwanted sounds from one area to another.

Central Tech Closet

A central tech closet should be provided for the office electronics, including the computer server, the phone system, the alarm system, and any entertainment components. Within the closet, rather than having shelves built by a cabinet maker, it is best to use a professional equipment rack (Figure 10-55). It is likely less expensive than custom-built shelving, and much better suited for the purpose. The closet needs to be at least 24 inches wide, 27 inches deep, and full ceiling height, to accommodate the rack. The equipment rack sits on the floor on casters so that it can be pulled out for servicing the equipment from behind, then pushed back in once the work is completed. Since equipment racks are usually 7 feet tall, the door to the closet needs to be large enough to allow the rack to be pulled in or out without obstruction. Adjustable steel shelves in the rack accommodate the central data panel (where all computer jacks terminate), the data switch, a modem and router, the server, a pull-out keyboard and mouse, the music system components, entertainment source components, such as cable boxes, satellite receivers, or Blu-Ray players for each operatory and/or reception TV, possibly surveillance equipment components, and a built-in monitor. The monitor is shared between the server, TV source equipment, on-screen music choices, and the surveillance system. In offices where the aesthetic is conducive, the rack may be exposed rather than hidden in a closet. Placing it in a prominent location with a glass door makes it a high-tech conversation piece, especially with colored LED lights illuminating the components from behind the glass. The rack cabinet may contain thermal management components, such as thermostatically controlled fans, but needs to be in an area that can exhaust the heat from the components.

Figure 10-55. Central tech closet displays office electronics. *(Audio Video Specialist: Keith Aderman/Mr.Hookup; Photo copyright © Nathan Padilla Bowen)*

Telephone Systems

There are primarily three types of telephone systems. Most businesses use a conventional business system that uses a central switching unit (KSU) to switch between phones, and direct calls to and from outside phone lines. The system uses proprietary phones in each location with special keys for selecting lines, extensions, or features. The system is ideal for intercom calls between different areas of the office, as well as making outside calls. There are many features, including music-on-hold, integrated voice-mail, and special ringing patterns for different lines and different extensions. It is best to discuss specific needs with a telephone installation company to find the system that best suits needs and budget.

Voice-Over-Internet-Protocol (VOIP) telephones are another option. VOIP phones don't use a central switching unit; each phone has an Internet address, and can be programmed to talk with other phones with specific Internet addresses. Voice-mail is available. Special phone service is required for VOIP phones. For reliable operation a "T-1" phone connection is recommended. The advantage of using a VOIP system is that long distance is very inexpensive. The T-1 line, however, is not inexpensive.

The third option for telephones is to use basic "non-KSU" telephones. This type of system has no switching processor, and is somewhat limited to four phone lines maximum. There is no music-on-hold. Voice mail, with limited capability, is available on some models. The phones can be purchased at an office supply store and may not require a professional for installation.

Pre-Wiring During Construction

During construction, before the drywall is installed over the framing, it is an ideal time to run wiring throughout the office. Since some of the pathways will be obscured once the drywall is placed, planning is critical. The following wiring must be considered and installed before drywall is installed:

1. ***Computer network wiring***: Today, with faster computer networks, it makes more sense to use Category 6 data wire instead of the conventional Category 5E standard. Category 6 wire will easily handle gigabit network speeds, whereas Category 5E will be pushed to its limits at that speed. The cost difference is minimal, since it's mostly labor based. A Category 6 cable is required for each computer, printer, or Ethernet-based device on the network. This includes a digital Panorex, or CBCT. As the project is nearing its completion, the cables are terminated with data jacks, and a central panel is installed in the tech closet. The panel has a jack that corresponds to each location, which patches into a data switch.
2. ***Computer monitor wiring***: In the past, most computers were connected to the monitor with a Video Graphics Array (VGA) cable (that's the 15-pin connector you see on the back of most computers and monitors). VGA connectors are still common on smaller monitors but are starting to be phased out on larger ones—especially on large-screen TVs. For larger screens, an HDMI cable between the PC and the screen is preferable. HDMI cables are limited in length to about 65 feet, without using special techniques, but the image quality is noticeably better than VGA since it's digital instead of analog. HDMI cables link both video and sound. Computers with dual monitor outputs are available with an HDMI output for the second monitor, making the connection to the monitor simple. The primary monitor, usually at the 12 o'clock wall for the doctor or assistant, may use VGA, while the front monitor uses a digital format. Digital formats include HDMI, DVI, or Display Port. DVI and Display Port can be inexpensively converted to HDMI, although they may not include audio.
3. ***USB wiring***: USB jacks are sometimes mounted in the wall or in cabinets as a convenient location to plug in a digital X-ray sensor, or a digital intraoral camera. The jacks prevent uncomfortable leaning or stretching to plug into a computer, and can prevent damage to an X-ray sensor by keeping the cord in a more protected area. Check with the manufacturer before determining whether convenience jacks are

feasible, and to determine the maximum length of cable allowed.

4. ***Audio/video cabling for entertainment***: Most high-definition entertainment formats now require an HDMI connection between the source equipment and the TV. It is now mandated as the standard for Blu-Ray disc players, and soon to be mandatory for cable boxes and satellite receivers. Since the source equipment is usually centrally located in a tech closet, the distance is often too long to run an HDMI cable between the source and TV. For runs longer than 65 feet, HDMI is converted to a signal compatible with Category 6 data cable, with an accessory called a "balun." There are balun transmitters, and balun receivers. The better-quality baluns allow cables as long as 300 feet or more.

5. ***Cable/satellite wiring***: A type of coaxial cable referred to as RG-6 is used for either satellite systems or cable TV. For satellite, RG-6 cables are required from the dish on the roof to the tech closet and to each satellite receiver. Different systems require a different number of cables from the dish to the tech closet, however, to be safe, there should be four cables coming from the dish. Cable TV needs an RG-6 cable from the service entrance for the building (often referred to as the Minimum Point of Entry, or MPOE), to the tech closet. The cable can be used to carry both TV programming, Internet service, or in some cases, telephone service offered by the cable company. Whether or not there is a subscription to TV programming from the cable company, it is a good idea to run RG-6 coaxial cable from the MPOE to the tech closet. RG-6 cables should also be run to each TV from the tech closet, in case the TV were connected without using a cable box, or if the cable box were located in the same room as the TV. RG-6 cable is relatively inexpensive.

6. ***Infrared control cable***: Cabling for infrared signal transfer is required between a TV, and it's entertainment source, if the source component is not within line-of-site from the TV. Category 5E cable is ideal for this application.

7. ***Headphone cables***: If wired headphones are to be used for operatory televisions, a cable must be installed between the TV and the base of the chair. The cables need to have at least three conductors. Wireless headphones are another choice, but there are issues with reliability and/or interference between the headphones in each operatory.

8. ***Telephone cabling***: Each telephone, fax machine, and credit-card verifier will need a telephone connection although some credit-card verifiers use an Ethernet connection instead of a phone line. Four-pair Category 5E wiring is most commonly used for this purpose.

9. ***Speaker wiring***: Speaker cables are required for each volume control and speaker. The cables run from the tech closet to each volume control, then from the control to the speaker. Depending on what type of system is being used, the size of wire can differ. Sixteen-gauge speaker cable is a safe bet for almost any type of system. Wire gauge numbers can be confusing, since the larger the number, the smaller the wire. For instance, 18-gauge cable is smaller than 16-gauge.

10. ***Interoffice communication wiring***: Visual communication systems as offered by companies such as Amtel, Porter, Simplified Systems, or Kelkom are less common than they were a few years ago, since software-driven systems for the computer are starting to take their place. However, a number of these systems do offer a computer-based option (Figures 10-56 and 10-57). The wiring for most of these systems is proprietary. Check with the dental vendor or the manufacturer for wiring requirements.

Special Wiring Requirements

Some structures, or municipalities, require special fire-rated cable, referred to as "plenum-rated" cable. Some areas even require all low-voltage cabling to be installed in metal conduit. Either of these requirements will significantly affect the cost. Check with the contractor before budgeting for low-voltage cabling.

Figure 10-56. Communication system "Direct-Line."™ *(Photo courtesy of Amtel Systems Corp., Chester Springs, Pennsylvania)*

Figure 10-57. Communication system control panels. *(Photo courtesy of Kelkom Systems, Redwood City, California)*

Competent System Design Essential

Competent design and installation of TVs, source equipment, and wiring by a professional audio/video (A/V) contractor is mandatory. Computer network wiring and telephone wiring is often installed by the same contractor. This is not a task for the hobbyist or "do-it-yourselfer," considering the safety factor and complexity of the system. Licensed, insured consultants for both media and IT should be added to the project team as soon as space planning begins. As the office is being space-planned, many decisions must be made by the dentist from the wide variety of dental software, equipment, and instrumentation available. Dental software must be carefully chosen and computer systems skillfully designed and integrated, to be maximally effective. One should be able to control which data appear on which screen. Increasingly, developers of dental software are recognizing the need to design solutions for multiple monitors. *Dentrix®, EagleSoft, PracticeWorks®*, are three of the most popular software systems. A newer software program, *XLDent™* has been designed for a paperless environment incorporating workflow, online check-in, notification of patient arrival sent to staff, clinical records, automatic texting and email appointment reminders, as well as a variety of sorting and filtering abilities. Patient records can be accessed from tablet PCs and smart phones. *ImageXL™*, by the same vendor, is an open architecture program for storing digital images from any peripherals (works with all brands of panoramic machines, sensors, PSP scanner, and cameras) and seamlessly integrating them into the patient's chart. Compatible with all dental practice management systems, the images are organized and stored in one database.

Each practice management software program has different features that will appeal to individual dentists. The rapid growth of a couple of Apple practice management programs has stimulated vendors to write imaging programs in native Apple OS. An excellent website resource for dentists making decisions about software and the integration of technology into the treatment room is hosted by Dr. Larry Emmott, who lectures frequently on technology (www.drlarryemmott.com). His website has many practical tips for dentists. Also look for articles by IT specialist Paul Hinman in *Dental Products Report* on the paperless dental office and other topics.

Adapting Older Treatment Rooms

Dentists who buy new treatment room equipment can purchase casework and dental chairs that integrate new technology, but those with older equipment have to find a way to adapt their treatment rooms, which means that they

may have fewer opportunities to place computer monitors where they are ergonomically most effective.

Lighting

Good lighting is mandatory in a dental operatory. It is critical to use full-spectrum fluorescent (or LED) lamps with a color rendering index of 90 or more and color temperature (measured in Kelvins) of 5500, sometimes referred to as "Natural Daylight." Refer to Chapter 13 for more details on the technical aspects of lighting and for photos of lighting solutions. The indirect "basket" recessed fluorescent luminaire referred to in Figure 10-54, offers more brightness at the same wattage as the conventional fluorescent. Lithonia's *Avante* series and Focal Point's *Luna* series are two options for this type of lighting. Today's focus on energy conservation and sustainability has created a great many offerings in LED lighting solutions. The fixture by Cree® works well in any treatment room for ambient light as a replacement for the more common fluorescent 2 by 4-foot fixtures on either side of the dental chair. Also available in 2 by 2-foot sizes, it can be used in corridors, business offices, and elsewhere. Lithonia makes retrofit solutions for fluorescent parabolic (Model VTLR) and prismatic acrylic lensed (Model VTLRT) fixtures and also offers other LED luminaire fixtures that lay into ceiling grids. There is a caveat, however, when selecting LED fixtures by different vendors (refer to the discussion in Chapter 12). Read the specifications carefully. The Cree® fixture, as an example, is high quality and offers longer lamp life, a color rendering index of 90 (versus 80) and high consistency in color temperature (degrees Kelvin) throughout the life of the lamp. These are important considerations especially in dental operatories where color is so important. Refer to Chapter 12 for explanations of color rendering index (CRI) and color temperature. With LEDs, lamps are available 3,000, 3,500, or 4,000 degrees Kelvin. In dental operatories, 4,000 Kelvins or higher is desirable; as this number decreases, the color spectrum is warmer, with more red, which is not desirable. LED lighting fixtures are available in all styles: pendant, downlights, accent lighting, and suspended uplighting. Again, the warning: Do not think they are all alike, except for price. LED lighting is more expensive than fluorescent but the lamps have a 50,000 to 65,000-hour life (another of the variables). Vendors with more expensive options often have a better product. LED technology has been continually improving but issues, such as long-term consistency of color temperature and accurate assessment of lamp life, are a work in progress.

Fluorescent lamps are also a good option but again, they are not just a commodity separated by price. If the dentist is in a medical office building that maintains light fixtures and re-lamps them when needed, chances are that the least expensive lamps will be used and these are cool white color temperature. They will cast a blue-gray color on everything in the office, including skin tones. Worse yet, if the maintenance staff find a better price on lamps the next time a few burn out, it may be a different brand or slightly different color temperature and the lamps within one fixture may be two different colors. It is strongly recommended that proper lamps be purchased even if the dentist has to bear the cost. An example of a high-efficiency fluorescent lamp is the Osram Sylvania 800XP XL supersaver T8, which has an extended life of up to 84,000 hours that match LEDs for long life.

The illumination should be free of shadows, and a *brightness ratio* of 4:1 should be maintained with the operating light or at least a minimum 10:1 ratio. The operating light may slide in a track mounted in the ceiling (Figure 10-41), or have a stationary ceiling mount, as in Figure 10-146, or it may be post-mounted to the dental chair (see Figure 10-51) or side-mounted on the wall or modular casework (Figure 10-40). The quartz halogen light delivers a concentrated 1,200 to 2,500 footcandles of illumination at the oral cavity.

The work counters and visual background of the room must receive 600 to 650 maintained footcandles measured at 30 inches from the floor to achieve a 4:1 brightness ratio with the 2,500-footcandle operating light. Two three-lamp, recessed fluorescent luminaires arranged on both sides of the chair (see Figure 10-54) may meet this requirement, as may three 2 by 4-foot recessed luminaires arranged side by side, if a TV monitor is not desired overhead. Note, in this diagram, the center light fixture has

been removed to be able to place a TV monitor in the ceiling directly over the patient's head. A 2 by 2-foot fixture could be aligned next to it for additional illumination. The reflectance of the floor, walls, and ceiling has an impact on the amount of perceived illumination, as do the ceiling height, the size and shape of the room, and the location of upper cabinets, if any. It is difficult to achieve this level of illumination with restrictive energy codes that mandate the allowable number of watts per square foot throughout the office, which is another reason to consider LED sources of illumination. The same desired level of illumination can be achieved with far fewer watts when comparing LEDs to fluorescent and/or halogen sources and they minimize heat gain.

The transition to LED sources is happening swiftly in many industries and some predict it is just a matter of time before more conventional types of lamps are phased out. Of course, having natural light in the operatory helps a great deal. A competent electrical engineer or lighting designer should be consulted for design and calculation of footcandle levels. The type of lens on the fixture, reflectors inside the fixture, and special characteristics of the lamp all affect its brightness. It is worthwhile to pay a premium for extended-life lamps that have the specific spectral distribution needed by dentists. These are listed in Chapter 12. Bear in mind that sometimes a lamp may provide excellent color rendition but at the cost of lower lumen output so all these characteristics must be balanced. Both the *Sylvania Octron 950* and the Lumiram *Lumichrome*® have 5,000 Kelvins (cool) color temperature and very high color rendering index making them good choices for operatories. It is worthwhile to buy a couple of different types of lamps to do a mock-up evaluation in an operatory before making a final decision.

For private treatment rooms with full-height walls, indirect fluorescent lighting around the perimeter of the room is aesthetically pleasing and keeps glare out of patients' eyes. However, the number of lamps must still yield the 4:1 brightness ratio or at least a minimum 10:1 ratio. Some of these fixtures have reflectors that enhance brightness. This lighting option requires a ceiling height of 9 feet and will most likely require an additional luminaire (fixture) recessed over the patient's head.

Hand-piece fiber-optic illumination requires bright rooms to prevent "optical bounce," a term that refers to the continual opening and shutting of the iris of the eye due to extreme brightness differences. Optical bounce causes headaches and eyestrain as the dentist shifts focus from a bright mouth to an overly dark room.

Operatories should not have busy wallcoverings with intense colors because the rooms are small, and reflection of the colors will make it difficult to match shades of teeth. Soft colors and patterns with little contrast reduce eye fatigue and make the room seem less confining. Many dentists prefer a northern exposure for shade matching in natural light.

It's important to remember to consider the color temperature of all lamps in the office since light in the treatment rooms and light in the adjacent corridors flow into each other. If there is a disparity among the types of lamps and their color temperature, it creates visual disharmony. This doesn't mean that the corridor light should be 5,500 Kelvins as that would be very white and "cold," but a compact fluorescent wall sconce at 2,700 Kelvins (very pink) in the corridor would be a poor choice.

Dental Lights. Many dentists use halogen dental lights that deliver 2,500 footcandles to the oral cavity, however, LED lights have become increasingly popular and they create less radiant heat. Although there are a variety of vendors, a few of the more well-known products are Pelton & Crane's *Helio 3000*, which allows one to switch between 5,000 degrees Kelvin and 4,200 for shade matching; A-dec's offering (Figure 10-58) which, like others, has a cure-safe mode that removes blue light; Welch Allyn's (see Figure 3-58) and Midmark's products (Figure 10-59) which at 22 watts, delivers 2,500 footcandles with numerous levels of intensity, and color temperature that goes from 5,700 Kelvins to 4,000 Kelvins in composite safe mode.

Design Considerations

In addition to functional requirements, the treatment room should meet certain psychological needs of the patient. A window is always desirable to give patients a psychological escape and a pleasant view. In lieu of a window, a

photograph of a landscape may be installed. A small-scale mobile suspended from the ceiling, which the patient can see while reclined in the chair, is a diversion provided there is no monitor overhead. Other amenities in the operatory include a hook for a handbag (located where the patient can see it) and a tissue box. Artwork, of course, can be framed with glass or Plexiglas to provide a cleanable surface.

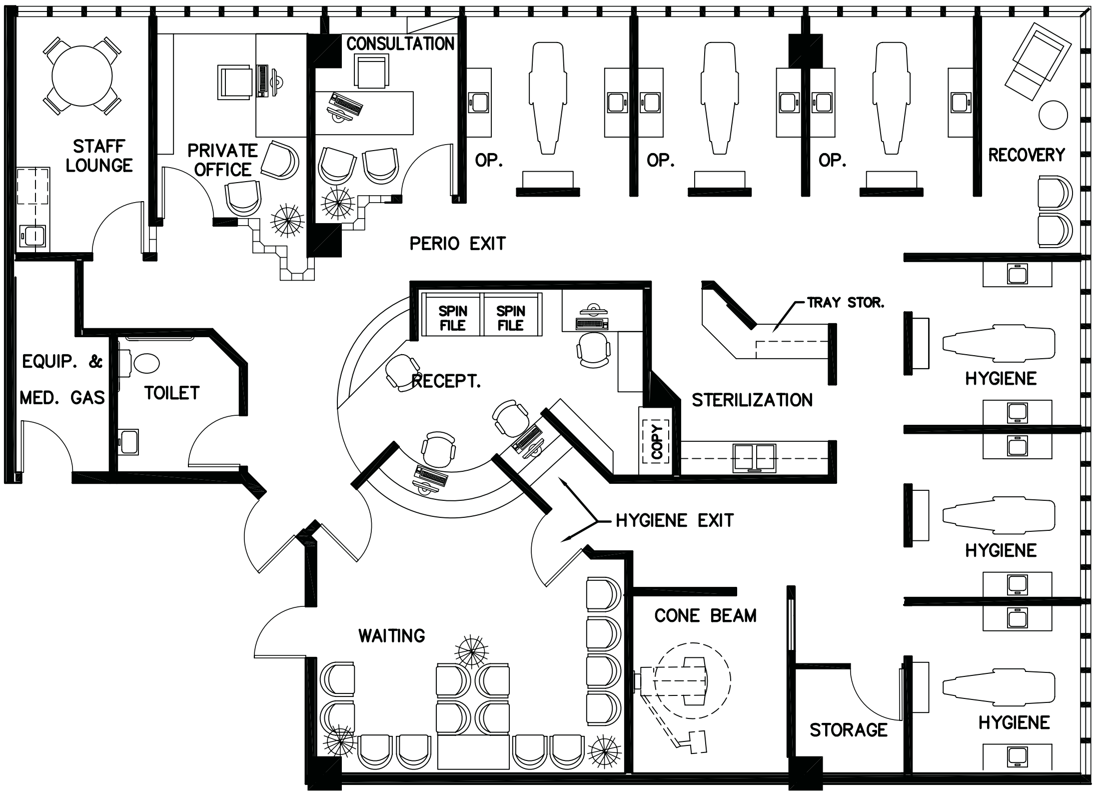
Color as a Functional Tool. The dental chair and fixed casework and mobile carts should be selected in colors that coordinate with the room's interior design. Light, neutral colors used for cabinetry and dental units make them blend into the background and be less obtrusive. But there is a more important functional issue that should inform color selections in a dental treatment room: reflectance. The previous section on lighting explained the optimal 4:1 ratio between ambient light and the bright halogen or LED light at the oral cavity. It is increasingly difficult to achieve this ratio with energy restrictions on watts per square foot,

Figure 10-58. LED dental light. *(Photo courtesy of A-dec, Inc.)*

Figure 10-59. LED dental light. *(Courtesy of Midmark Corporation)*

Figure 10-60. Operatory bay for orthodontics. *(Courtesy of Joe Architect; Photographer: Raul J. Garcia Photography)*

which means that dark colors (which absorb light) should be avoided in favor of those that reflect light (see Figures 10-8, 10-46, and 10-60). This also avoids eyestrain since strong contrast forces the focal length of the eye to adjust rapidly. In practical terms, this means that the dramatic black or charcoal gray treatment room casework sometimes favored by dentists who want to make a design statement is creating a visually stressful environment in which to work (see Figure 10-49). It's also harder to see dirt on dark surfaces and, therefore, to clean it. Select colors carefully for a treatment room, considering the color reflectance on patients' teeth. Vision research indicates that there should ideally be little contrast among the casework color, the walls, and the floor. A dark floor with light walls and casework creates eyestrain. If carpet is used as flooring, select a medium to light value with a pattern that camouflages soil and spills.



PERIODONTICS SUITE

2370 SF

Figure 10-61. Space plan for periodontics suite, 2,370 square feet. *(Design: Jain Malkin Inc.)*

Acoustics. There are many hard surfaces in the treatment room and few opportunities to absorb sound or stop its reverberation. Carpet and an acoustic ceiling tile with a high noise reduction coefficient (NRC) are the best solutions. One can achieve both noise reduction and high reflectance at the same time by selecting products like Armstrong's *Ultima*™ or *Optima*™ both with *DuraBrite*™ high-reflectance surface and an NRC of 0.85 to 1.00. High reflectance means that it maximizes the brightness of the ambient light. Acoustic tile is available in many textures and patterns such as raked sand, leaves, and geometric designs that provide visual interest for patients.

Installation Sequence. The flooring material should be in place and all construction complete before dental equipment is installed.

Hygiene Treatment Room

The hygienist performs many duties. He or she takes and processes X-rays, performs dental prophylaxis, instructs patients on proper brushing and flossing techniques, discusses nutrition in regard to prevention of dental caries, and maintains the patient recall system.

Many dentists dedicate one or more treatment rooms to hygiene, while others schedule a hygienist perhaps two or three afternoons per week and use one of their standard treatment rooms. Figures 10-39; 10-44, Plan F; and 10-61 depict a hygiene room. A hygiene room almost always has a sonic or ultrasonic scaler and many times has a separate or combined air polisher unit. Additionally, some practices are installing irrigation devices for irrigating below the gums after the scaling and root planing. Check with the practitioner and dental supplier about requirements for these units. The hygienist often uses an

intraoral camera and uses the computer-based patient charting system. He or she may also have a microscope in the room to check plaque samples for various bacterial infections. A dedicated hygiene room may be smaller than a standard treatment room because the hygienist works alone without an assistant, and it has considerably less equipment and instrumentation than a standard treatment room.

Since the goal is positive reinforcement of good dental hygiene, this room should be attractively designed so that a good impression lingers after the patient departs. The hygiene rooms in this University-based practice are reached by walking through a "Zen" garden with plants recessed into the slab, boulders, and a bamboo fountain (Figure 10-62).

Figure 10-62. Japanese garden water feature in hygiene area of dental office. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

Utilities

The planning and design of utilities to serve dental treatment rooms and operatories requires considerable experience and coordination. Having previously reviewed issues such as a safe water supply, the variables involved in hand-piece delivery of the dentists' and assistants' instrumentation, and the options of fixed or modular casework, these will not be discussed again here. What follows are some technical considerations.

Special Plumbing and Electrical Requirements

The many variables in laying out an operatory and in selecting equipment demand close attention to the proper location of plumbing and electrical service. The space planner should work closely with a qualified dental equipment dealer in order to coordinate the location of utilities. In fact, dealers will typically provide engineering services to specify and lay out utility requirements. As these are the individuals who will service the equipment after it is installed, it is wise to consider their advice.

In the treatment room, one can provide for current and future technology by coring the floor from the toe of the chair to the 12 o'clock wall and installing a 2-inch-diameter conduit to carry the many cables and wiring needed for equipment, computers, and monitors. If a 12 o'clock wall is not used and equipment is placed on the sides of the room, the conduit will run from the chair laterally to those locations.

Dental units now have a self-contained water supply separate from the building's water supply. However, each treatment room or area where there is a sink should have shutoff valves for building water, and compressed air, so the equipment can be isolated for repair without shutting down other treatment areas. The ideal location for these shutoffs will vary according to the type of delivery system being provided, therefore, consult with the dental equipment supplier.

A central water control (solenoid valve) that will turn off all water throughout the suite should be located in the equipment room where it can be serviced. Since most of these systems have integrated filters, they must be

accessible for changing. This assembly is usually supplied by the dentist's dental equipment supplier and comes ready for the plumber to install on the main water line serving the suite. It is low voltage activated and comes with a 120- to 240-volt transformer and remote switch panel, which should be located near the staff exit so that they may turn off all the water to the suite at night as they exit. This is usually a combined panel that also remotely turns off the vacuum pumps and air compressor.

Gas

Gas is used to heat certain impression materials. A portable propane or butane heater or torch is generally used for this purpose.

Central Suction

The suction at each treatment room comes from a central vacuum system usually located in an equipment room as close as possible to the treatment rooms. It should not be located overhead because of the additional power required to lift up any liquid being aspirated against gravity, which would reduce the overall efficiency of the system. This does not preclude running vacuum piping overhead to treatment rooms from a pump located basically at the same floor level as the treatment rooms. While this is less desirable than running vacuum piping under the floor in question, it may have to be used in some instances. The vacuum pump shown in Figure 10-63 will accommodate up to five high-volume evacuators (HVEs) plus up to six saliva injectors, all in simultaneous use. The vacuum system is sized according to the number of HVEs and saliva ejectors that might be in use at any one time. The space planner is advised to check with the manufacturer to verify the recommended maximum distances for vacuum piping and diameter of vacuum lines so as not to reduce efficiency. Additionally, it is desirable to enclose the vacuum pump and air compressor in a sound-insulated cabinet or room, as they can be quite noisy. The equipment room may look like that in Figure 10-64.

Quality vacuum systems provide consistent high-volume flow even when multiple users are online. They not only evacuate the fluids building up from treatment, but aspirate potentially infectious aerosols from in and around the oral cavity. The "wet seal" vacuum pump (Figure 10-65) is not as common due to the growing trend toward waterless pumps (see Figure 10-63). As these usually require a different size piping than wet-seal systems, it is hard to make this change except in new construction. Dry or waterless vacuum systems can potentially save

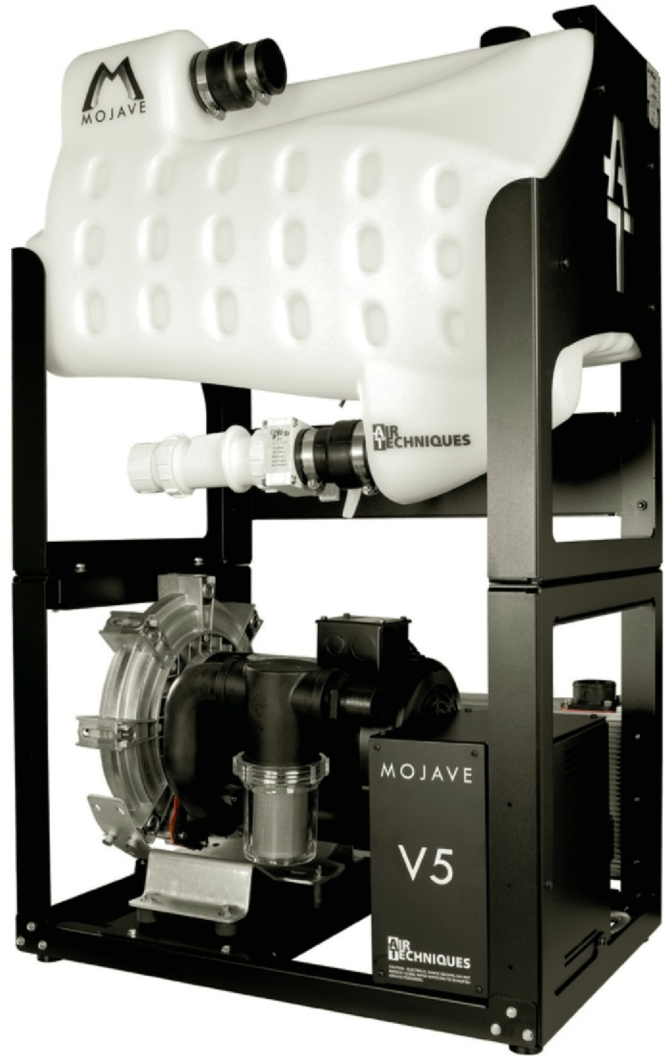


Figure 10-63. Dry vacuum system. *(Courtesy of Air Techniques, Inc.)*

Figure 10-64. Dental equipment room. *(Courtesy of Air Techniques, Inc.)*

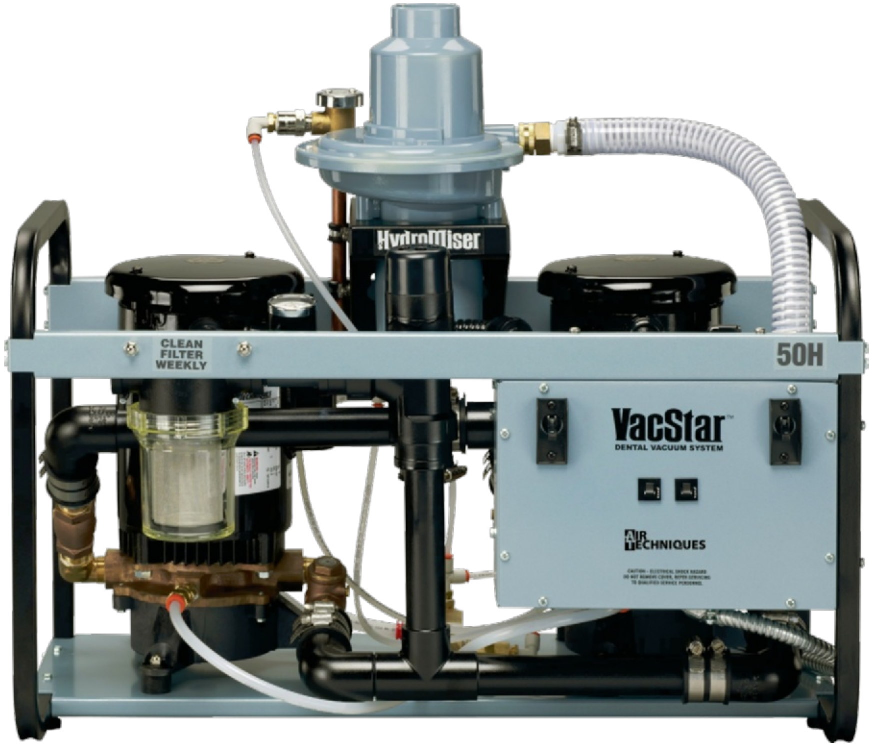


Figure 10-65. Wet vacuum system. *(Courtesy of Air Techniques, Inc.)*

one-quarter million gallons of water annually in a single dental office and, since sewer charges are usually linked to water consumption for billing purposes, the more expensive dry systems will almost always pay for themselves in three to five years of utility savings. Take note of a requirement for installing an air/water separator device on the waste output side of wet seal and some dry systems to separate the liquid discharge from the air discharge. This may be combined with a water recycling device with some manufacturers, but in any case this device must be vented outside of the building to an unoccupied area with a 2-inch inside diameter (i.d.) pipe separate from any sewer vent lines. The purpose of this is to vent scavenged nitrous oxide and contaminated air outside of the building.

Compressed Air

As with vacuum systems, compressed-air systems must be sized according to the number of users. The unit in Figure 10-66 is appropriate for 10 simultaneous users. Air compressors need more sound insulation than do vacuum pumps, and they can generally be located at a

Figure 10-66. Air compressor system. *(Courtesy of Air Techniques, Inc.)*

Figure 10-67. Remote-control panel for vacuum, air and water. *(Courtesy of Air Techniques, Inc.)*

greater distance from treatment rooms than can vacuum pumps; however, it is common to find both located in the same equipment room. Some manufacturers offer a sound-reducing cover for the air compressor that purports to reduce noise by 70 percent. The best air compressors are oil-free, because oil-lubricated compressors distribute oil aerosols through the air syringe, which may jeopardize dental techniques that require an uncontaminated air stream.

It is important to monitor the amount of moisture in compressed air because a humid condition promotes the growth of bacteria and fungi, which increases the risk of infection when sprayed into the patient's mouth through the air syringe. Moisture can also prevent cohesion of composite restorative materials, cause permanent failure of hand-pieces (drill turbines), and cause water vapor damage to equipment. Figure 10-67 shows a remote-control panel for switching on the compressed air, the vacuum pump, and the moisture monitoring system. Twin-headed compressors are popular as they allow the office to continue to operate when one compressor head fails to function. Both vacuum and compressed air are regulated under the Uniform Fire Code and details of specific design requirements can be found in that code or NFPA 99.

Emergency Power

Backup generators may or may not be needed in general dentistry offices, depending on the reliability of electrical service. Severe shortages of electricity in some regions of the nation have created rolling blackouts that wreak havoc with computer systems and leave patients stranded, so to speak, in the middle of a procedure. State professional practice acts and local building codes generally dictate in what types of situations emergency power is required. For example, in most jurisdictions, oral surgeons would require emergency power. Generators cannot be used if they are not located on the ground floor, but high-capacity battery back-up may be used; however, one must be careful about what else is on that circuit. If planning for this option, a unit the size of a 3-foot cube will fit in a 4 by 4 by 8-foot-tall room, which, by the way, needs good ventilation as it produces heat. It is wise to check state codes.

Equipment Room

One must think about where to locate the hot-water heater, telephone terminal panel, electrical subpanels, medical gases, air compressor, vacuum pump, and provision for natural gas, if required. If the dental suite is located in a medical office building, occasionally there is a central mechanical equipment room on each floor to serve tenants. This may allow the air compressor and vacuum pump to be housed in a remote location and piped to the dental suite, eliminating equipment noise and saving the tenant rent on square footage for a utility room within the suite. The

building may also have provision for natural gas, saving the tenant the cost of running a gas line into the building.

Analgesia and Anesthesia

The use of *analgesics* (medication that decreases sensitivity to pain but that does not put patients to sleep) is common in dental practices. Local anesthetics, injected into the tissue, make dentistry painless and require no special accommodation in the treatment room. However, analgesia that involves a mixture of nitrous oxide (N_2O) and oxygen (O_2) requires special consideration such as scavenging and monitoring, discussed previously in this chapter under OSHA Standards.

These gases may be stored in portable tanks that are wheeled into the treatment room as needed (Figure 10-68) or may be centrally located in a medical gas closet either inside or outside the suite and piped to each treatment room. The nitrous oxide conscious-sedation system in Figure 10-68 has a clean-air scavenging system mask. One tube of the mask brings the fresh gas supply to the patient, and the other tube allows the exhaled nitrous oxide to be removed from the treatment room by the central vacuum system. This reduces the concentration of nitrous oxide in the treatment room. The sedation system can be wall- or cabinet-mounted (Figures 10-69 and 10-70) or flush-mounted to a panel in the wall, as shown in Figures 10-71a and b. As an alternative, the gas cylinders may be in a portable cabinet with a flowmeter on the face panel (Figures 10-72a and b).

The use of *general anesthetics* (medication that puts patients to sleep) is confined mainly to oral surgeons, although intravenous sedation (also called conscious sedation) may be used by periodontists when doing implant surgery and, occasionally, by cosmetic or restorative dentists for lengthy and complex reconstructive procedures.

Storage of Medical Gases

Building and fire codes are very strict regarding where and how medical gases are to be stored. For information

Figure 10-68. The Nitronox E Stand conscious-sedation system. *(Courtesy of Porter Instrument Division, Parker Hannifin Corporation)*

Figure 10-69. Cabinet-mounted sedation system flowmeter, Ultra DC™ *(Photography: Accutron, Inc.)*

on the design of medical gas storage closets, consult Chapter 8 under the heading *Storage of Medical Gases*.

In addition, tanks should be stored in a place that is easily accessible for servicing. Locating them near the private or staff entrance to the suite (Figures 10-73 and 10-76) allows easy exchange of tanks without the service person walking through the rest of the office.

Figure 10-70. Cabinet-mounted sedation system, Digital Ultra™ flowmeter. *(Photography: Accutron, Inc.)*

Figure 10-71a. Digital Ultra™ Flushmount flowmeter. *(Photography: Accutron, Inc.)*

Figure 10-71b. Sedation system digital flowmeter. *(Courtesy of Porter Instrument Division, Parker Hannifin Corporation)*

Figure 10-72a. Portable cabinet for gas cylinders with flowmeter on face, Newport Flowmeter System™ *(Photography: Accutron, Inc.)*

Figure 10-72b. Portable cabinet for gas cylinders with flowmeter on face. *(Courtesy of Porter Instrument Division, Parker Hannifin Corporation)*

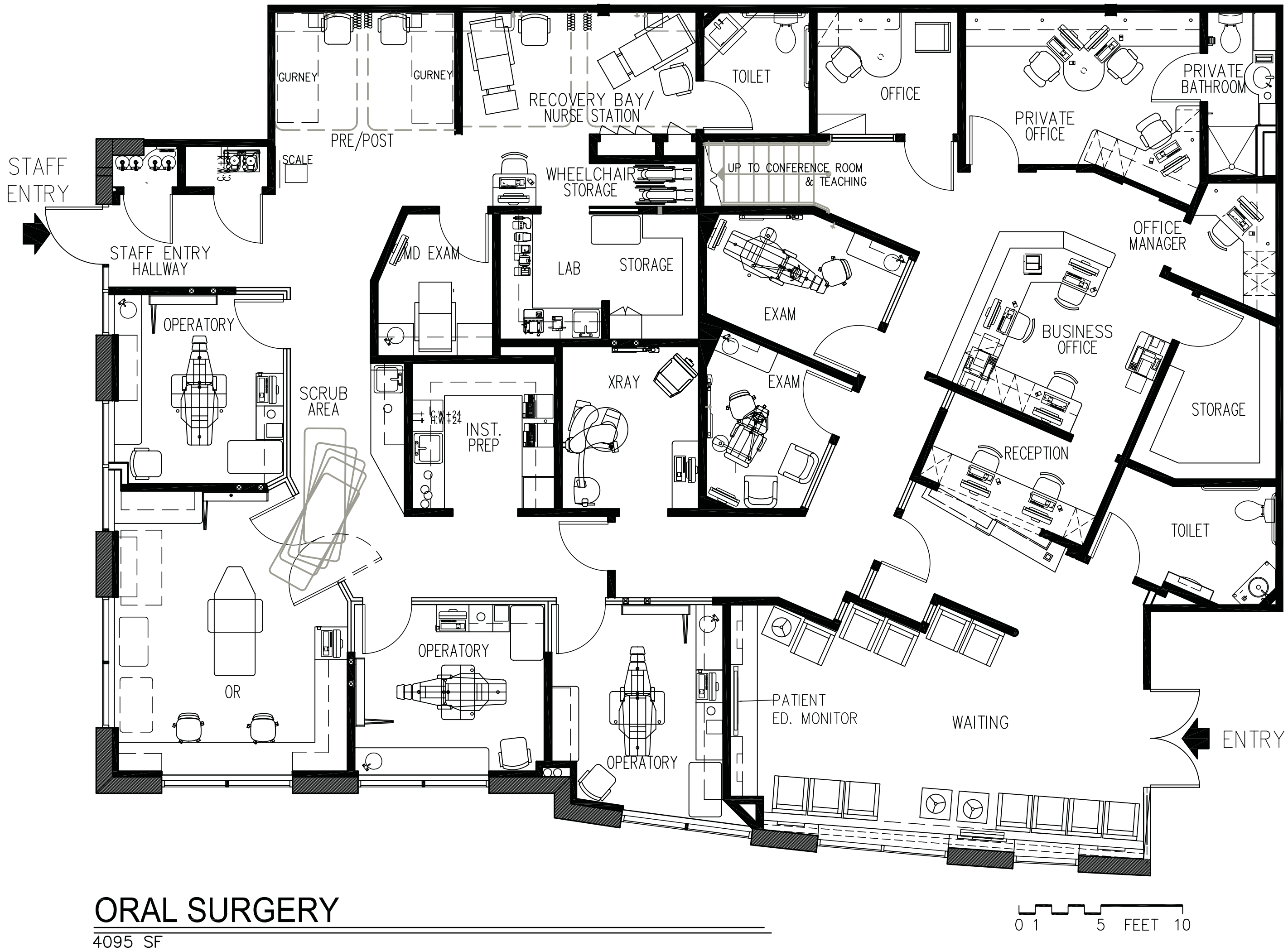
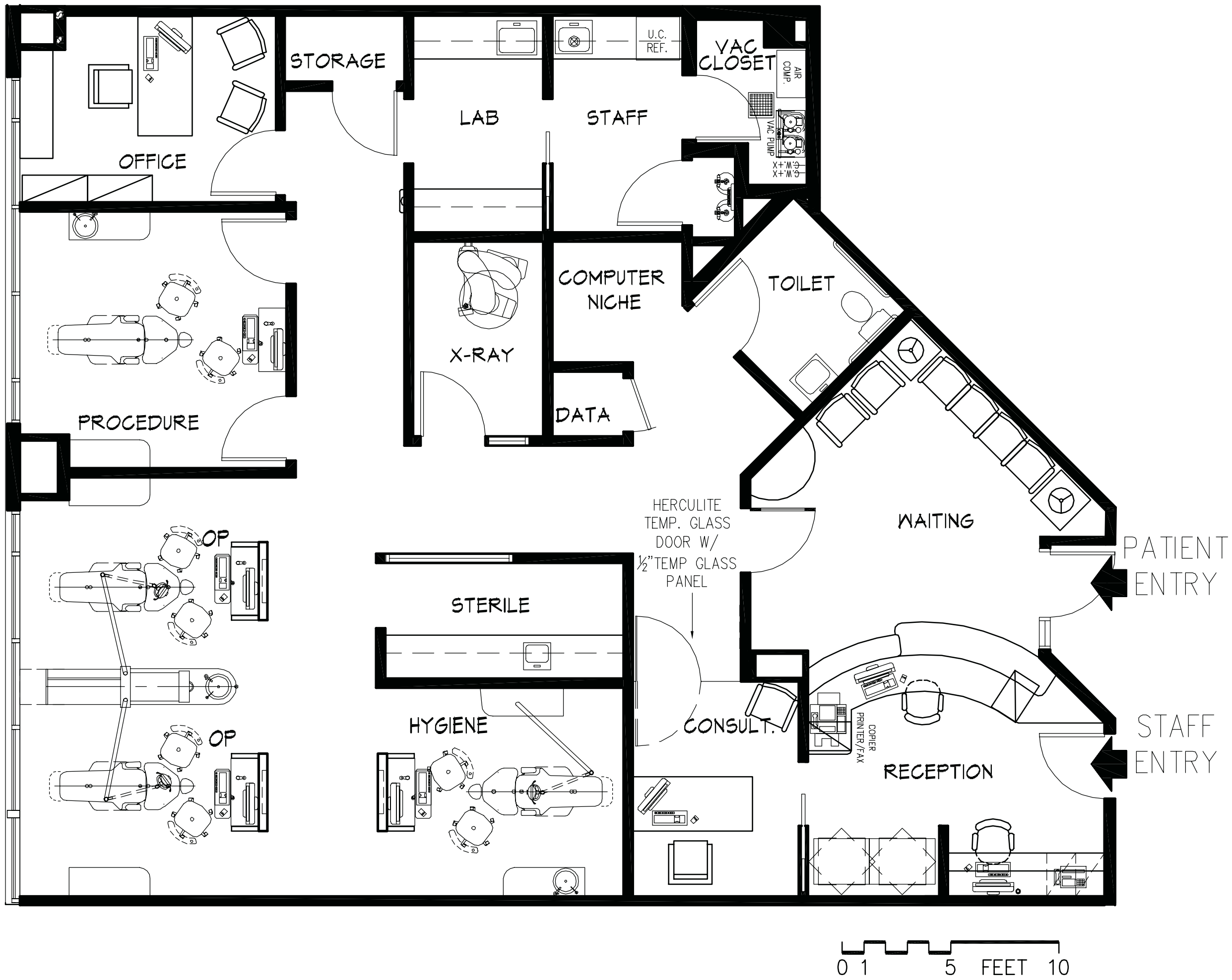


Figure 10-73. Space plan of oral surgery suite, 4,095 square feet. *(Design: Jain Malkin Inc.)*

The Uniform Fire Code (UFC) requires that medical gases be stored in dedicated areas without other storage or uses. These enclosures may be a one-hour fire-rated exterior room, interior room, or gas cabinet constructed in accordance with NFPA, IBC, and local building regulations. These storage closets must be vented to the outdoors, have automatic sprinklers, and, if an interior room, have approved mechanical ventilation for exhaust and makeup air.



GENERAL DENTISTRY

1750 SF

Figure 10-74. Space plan for general dentistry suite, 1,750 square feet. *(Design: Jain Malkin Inc.)*

Medical gases stored in this manner are piped through degreased, sealed copper tubing (using only silver solder) to a flowmeter in each operatory or surgery. If tanks are stored in a remote location outside the suite, a zone shutoff valve assembly and alarm system must be located within the suite to monitor the supply. The alarm panel monitors the gas pressure and provides both an audible and visual alarm if line pressure fluctuates more than 20 percent in either direction.

Figure 10-75. Space plan for oral surgery group practice, 5,000 square feet. *(Space Planning and Equipment Engineering: Lee Palmer, Burkhart Dental, San Diego; Space Planning Collaboration/Interior Design: Janet Pettersen, IIDA, DesignWave, Fallbrook, California)*

Communication Systems

Electronic Text Communication System

It is desirable, even in a small dental office, to have a digital communication system. This saves steps and enables the front desk to send messages to the treatment rooms without the clinical staff having to break asepsis to pick up a phone and without the patient overhearing messages. A communication panel integrated into the 12 o'clock wall is one option (see Figures 10-56 and 10-57). The keypad should have a membrane barrier that can be cleaned easily. Schedule changes, the caller's name, the priority of the next patient, utility reminders (e.g., clean vacuum traps), and communication with satellite offices can be responded to with the touch of a key and the keys are programmable with almost limitless uses. The Kelkom system (see Figure 10-57) enables back-office staff to move quickly and efficiently as a well-organized revenue producer. A communication panel would be located at the reception desk to handle check-in and check-out. Data can be entered manually or the system can interface with the computerized practice management system. There are three ways of delivering information to the back office with this system: a hardwired panel, a wireless tablet, or a virtual panel on a PC screen. To avoid screen clutter, the panel will disappear while in clinical work mode with the patient but an audible ring tone will alert the team to messages. This type of communication can also be delivered as part of the practice management software without having a terminal on the 12 o'clock wall. There are benefits to each option and dentists will have personal preferences.

Custom-Designed Systems

These are microprocessor-controlled custom systems that are designed, for example, to key the sequential order of patients in an orthodontic bay. A steady light indicates downstream patients, and a flashing light, the next patient. The microprocessor "remembers" which patient is next after a light is canceled. It alerts staff to emergencies or phone calls and signals the number of patients awaiting each doctor (see Figure 10-57).

Sterilization

Infection control has been discussed at the beginning of this chapter, and sterilization is one of the chief methods of preventing cross-contamination. The sterilization area should be close to the treatment rooms or operatories. If space permits, it may be a U-shaped arrangement (see Figures 10-73 and 10-76) or it may have parallel 8- or 9-foot counters or an L shape (Figure 10-75). It should be large enough for two or three people to work in it simultaneously, depending on the number of treatment rooms served. An area that is too small will cause stress for those who have to work there, which may be a dedicated sterilization technician who wipes down the operatories and handles instrument sterilization. Casework may be custom built or a prefabricated modular system specifically designed for dental sterilization (Figure 10-77).

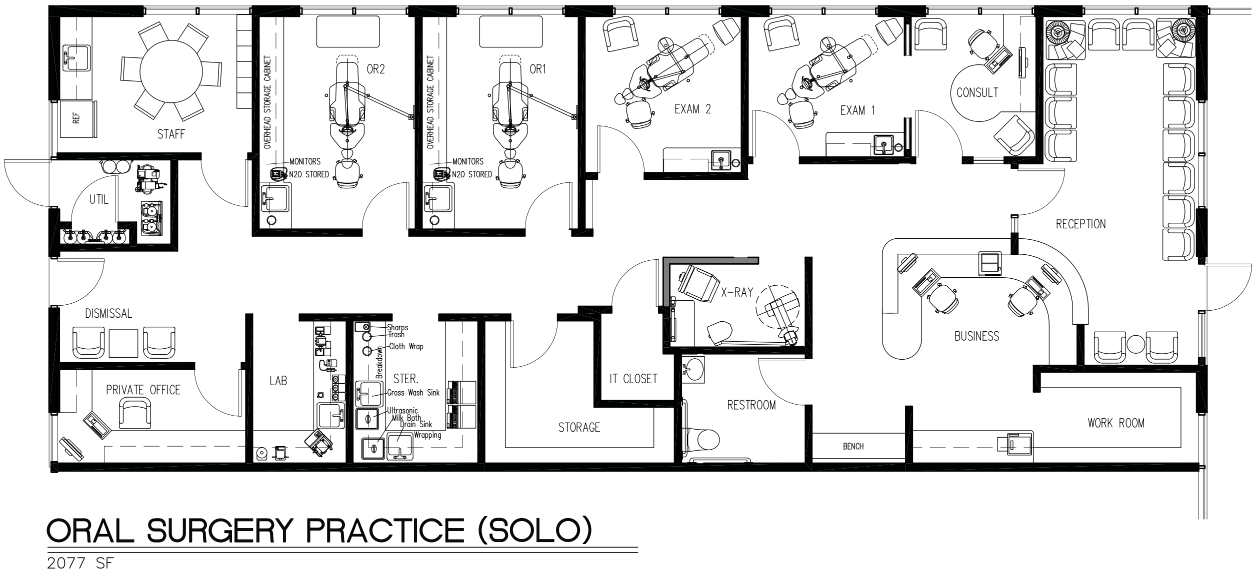


Figure 10-76. Space plan of oral surgery suite, 2,077 square feet. *(Design: Jain Malkin Inc.)*

Figure 10-77. Sterilization center. *(Photo Courtesy of A-dec, Inc.)*

Figure 10-78. BioSonic, an ultrasonic cleaning system. *(Courtesy of Coltene/Whaledent Inc.)*

Figure 10-79. STAT*IM*® autoclave. *(Courtesy of SciCan, Inc.)*

A sterilization area or room is typically 8 feet wide × 10 feet long providing 20 lineal feet of countertop; 16 lineal feet of countertop or work surface is considered the minimum to adequately perform the tasks of sterilization. Typically, with an engineered modular system, one can accommodate more equipment in less space.

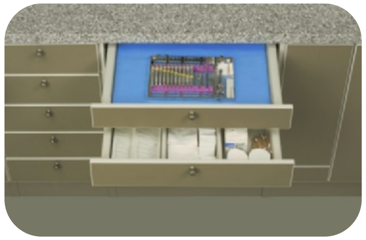
A large, single-compartment sink, space for sterilization equipment, and sufficient countertop area for both a dirty and a clean side are needed. The dirty side of the sterilization area is where trays/cassettes are

Figure 10-80. Dental assistant places wrapped instrument cassette into autoclave. *(Photo courtesy of A-dec, Inc.)*

brought after a procedure to "break them down"; disposable items are removed and discarded. Then the instruments are presoaked to rid them of blood, debris, or extraneous material before it has dried, after which they are placed in an ultrasonic cleaner (Figure 10-78), then rinsed to remove dislodged debris and residual cleaning solution, placed in a dryer, and then bagged or packaged for processing in a chemical sterilizer or autoclave (Figures 10-79 and 10-80). The sequence is always from dirty to clean. Dental hand-pieces, both high and low speed, are separated from the instruments during the tray/cassette breakdown procedure and then processed through a cleaning/lubrication cycle before being washed externally, dried, and packaged for heat sterilization. They are not usually put into the ultrasonic cleaner and may be added back into the instrument cassette just before it is wrapped for sterilization if the practice wishes. Note that an eyewash device (discussed previously under Hazardous Materials Standard) at the sink must be provided in a sterilization or lab area (see Figure 10-10).

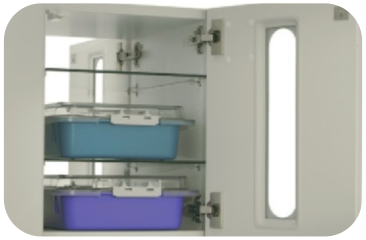
Cleans and lubricates equipment
Item to right – Assistina –
lubricates internal components
and removes debris. On left
is an automated cleaning device

Large sink, extendable sprayer; foot-activated faucet



Waterproof storage drawers

Waterproof drawers storage



Glass shelf cabinet with prep tubs

Crown prep tub

Figure 10-81. Component details of sterilization center in Figure 10-77. *(Photo courtesy of A-dec, Inc.)*

The clean side of the sterilization area is used for setting up trays/cassettes of sterilized instruments (packaged and wrapped) for specific procedures. The sink is commonly located on the dirty side and requires a sprayer attachment, as well as suction for removing solutions from the ultrasonic cleaner and presoak basin, which have to be changed frequently. The CDC recommendations for processing dental instruments require large ultrasonic cleaners, large sinks, and large spaces for wrapping instruments and for breaking down dirty trays or cassettes. Figure 10-81 shows component parts of the sterilization center in Figure 10-77. A custom-built sterilization center in Figure 10-82 has a full wall of cabinets with blue glass doors for storage of clean tray set-ups. The custom sterilization center in Figure 10-83 puts infection control measures on display by virtue of glass walls. Both of these are general dentistry practices.

The clean side may include a 3-foot-wide kneespace desk at a 30-inch height to allow the assistant to make phone calls to order supplies or do paperwork. A computer and monitor and a shelf for binders containing policies and protocols, equipment maintenance records, and logs of various incidents (such as needle sticks) are required. Additionally, storage must be provided for clean and dirty linen, supplies, and disposables.

Tray/cassette set-ups can be stored in pass-through upper cabinets that open from both sides, making it unnecessary to enter the treatment room to stock it with

Figure 10-82. Sterilization center. *(Courtesy of Wilcox Design Group and Atlanta Dental Spa)*

clean trays or tubs. Slots can be created within the cabinet to hold the trays or the cabinet can be designed to accommodate a prefabricated chrome rack to hold them (Figures 10-84a and b). Note that most vendors use red and blue LED lights in casework to signify, respectively, dirty and sterile instruments which generally move from left (dirty) to right (clean).

Universal Precautions

Staff must follow universal precautions when disinfecting and processing instruments. It is impossible to know if a patient has HIV or hepatitis; therefore, one should handle all waste and contaminated instruments with the same level of concern and protection. Heavy-duty utility gloves must be worn to protect hands and forearms when processing instruments. In addition, the lid should always be on the ultrasonic cleaner when in use to minimize pathogenic spray.

Distilled-Water Supply

Distilled water for the treatment rooms (to refill equipment-mounted containers) and for sterilization autoclaves may be purchased in bottles (in which case it requires storage) or it can be distilled onsite with a distiller located on the clean side of the sterilization room. Another alternative is the *Ezee Kleen* (Oasis Dental Group) unit that uses reverse osmosis to produce a gallon of "purified" water in two minutes.

Understanding Sterilization Techniques

With the increased emphasis on sterilization explained earlier in this chapter, a number of manufacturers have developed research-based engineered modular systems such as the *Steri-Center* by Planmeca® Triangle (Quebec, Canada), the *Integra*™ *Steri-Center* by Midmark (Versailles, Ohio) and Preference ICC® by A-dec, Inc. Planmeca® offers an interesting fold-out brochure illustrating all steps of the disinfection and sterilization process which is also available online.

Waste Management. There are three types of waste:

1. Regular trash
2. Medical solid waste (gauze with blood on it, gloves, and masks); need not be red bagged
3. Biohazardous waste (sharps, blood-soaked gauze, tissue, bodily fluids); must be collected by a certified hauler

Providing appropriate storage of medical waste prevents access by unauthorized persons and protects waste from insects. Casework occasionally has knee- or foot-activated hands-free waste containers. If the sterilization area is adjacent to treatment rooms, a sharps container may not be required in every room (verify state requirements) but may be located in the sterilization area. Sharps containers must be disposed of at least every six months (even if not full), which can be quite an expense for a

dental office if one is placed in each treatment room in addition to sterilization.

Presoaking. Presoaking is used to remove blood and debris and to reduce the level of airborne contaminants by containing them in liquid. The goal is to prevent blood and other particles from drying on the instruments. Although presoaking is a common practice, some infection control experts believe that skipping this step in favor of immediately putting the instruments in an ultrasonic cleaner removes the bioburden more effectively. A thermal disinfector is sometimes incorporated into the modular casework to disinfect instruments placed in cassettes (Figure 10-85).

Ultrasonic Cleaning. This step removes saliva, particles of tissue, and blood, which can interfere with the disinfection and sterilization process. The ultrasonic cleaner is often recessed into the countertop to make it easier to see into it and to suction out and refill with solution. It is sometimes put on a lowered counter. The sprayer hose on the sink may be used to refill it and a suction hose to empty it. There are high-quality solutions that can be used in the ultrasonic cleaner that have a surfactant that rejects water and therefore eliminates the need to dry the instruments. Solutions that have a neutral pH do not damage instruments.

Rinsing. After items have been removed from the ultrasonic cleaner, they are then rinsed in the sink (either in a basket or in a cassette) with the spray hose to remove debris, detergent, or residual cleaning solution unless the ultrasonic solution manufacturer recommends otherwise.

Drying. After cleaning, instruments are dried before being wrapped or packaged for sterilization. Moisture interferes with all methods of sterilization and, in addition, wet steam provides a fertile field for the growth of microorganisms. Drying also helps to prevent rusting, dulling, and corrosion of instruments. Transfer baskets or cassettes are used for placing instruments into the dryer, which may be recessed into the countertop or underneath it.

Lubrication. Lubrication helps to dislodge patient material from the internal surfaces of hand-pieces, enhances

Figure 10-83. Sterilization center with high visibility. *(Courtesy of Joe Architect; Photographer: Bob Soman Photography)*

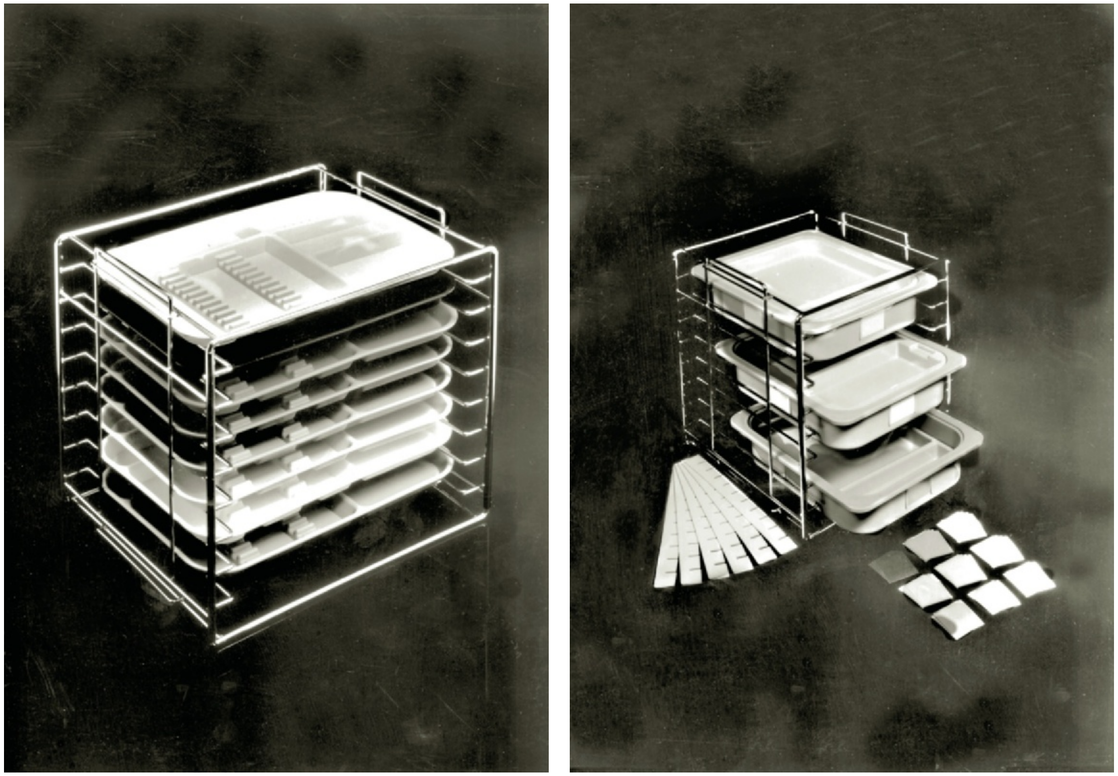


Figure 10-84a and b. Rack for tub set-ups (a) and rack for tub set-ups (b). *(Photo courtesy of Clive Craig, Van R. Dental Products, Inc., Oxnard, California)*

the effectiveness of the sterilization process, and protects hand-pieces from corrosion. One of the pieces of equipment used for this is the *Assistina® 301 Plus* by A-dec, Inc., which can be seen in Figure 10-81—it's the item with the black "bubble" cover.

Packaging. Instruments must be packaged in pouches (called bagging) or placed in cassettes wrapped with special paper prior to and during sterilization and remain sealed until use. Instruments that are used together as a set may be bagged as a set prior to sterilization, and later placed on tray setups to increase efficiency. Modular sterilization casework sometimes includes shallow drawers that, when open, function as surfaces for packaging instruments. Cassettes are wrapped with special paper and labeled for specific procedures.

Sterilization. The process of sterilization destroys all types of microorganisms, viruses, bacteria, and fungi and is required for critical items that penetrate bone or oral soft tissue. Semi-critical items (those touching mucosa) should also undergo heat sterilization according to the CDC *Guidelines*. There are various methods of sterilization, each with advantages and disadvantages.

Steam Autoclaving. This is a common form of sterilization that uses live steam under pressure. Because steam is water saturated, it has the disadvantage of rusting and corroding certain metals and dulling the cutting edge of some instruments. Many ultrasonic cleaning solutions coat instruments with rust inhibitors and therefore should not be rinsed off before steam autoclaving.

Flash Sterilization. When a few instruments are needed in a hurry between patients, a small steam sterilizer called *STATIM®* by SciCan (often recessed into the casework as in Figure 10-86) processes instruments in a cassette in a 9- or 15-minute cycle with a 15-minute drying cycle. It uses distilled water and has a drain hose that attaches to a waste bottle outside the machine, placed below the level of the machine. It needs no venting and has an optional printer to print a sterilization log as well as a USB port. The latest series, the *STATIM 5000 G4* (Figure 10-87), has Internet connectivity, a color touch screen, and automatic logging of data on a USB drive or it can be stored in the Cloud.

Cassette Sterilization. Using cassettes reduces labor costs by eliminating wrapping and bagging and some of the handling that would otherwise be required. In addition, personnel have less risk of exposure to microorganisms. All the instruments for a specific procedure can be placed in one cassette, which then goes through the aforementioned processes. In theory, one never has to open the cassette until it is needed in the treatment room. For large practices with many treatment rooms, the *Miele* disinfector in Figure 10-85 holds multiple cassettes. It may not be practical for a small office because one wouldn't want to run the machine until it is full and this would require a considerable investment in cassettes and hand-pieces. Cassettes are wrapped and taped prior to sterilization,

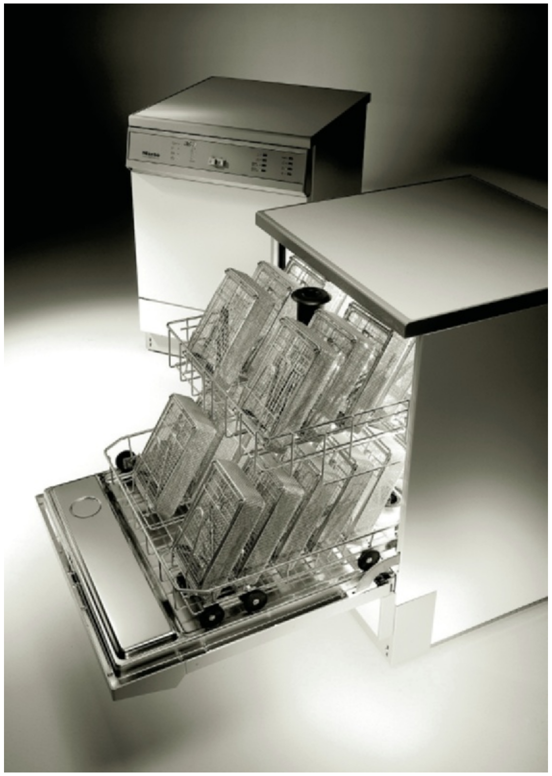


Figure 10-85. Miele cassette disinfector. *(Photo courtesy of Patterson Dental Supply, Inc., St. Paul, Minnesota)*

Figure 10-86. Sterilization area for orthodontics. *(Courtesy of Joe Architect; Photographer: Steven Evans Photography)*

then brought into the operatory and opened with instruments being used directly from the cassette. At the end of the procedure, dirty instruments are placed back into the individual compartments in the cassette; it is rewrapped in its original paper and carried back to the sterilization area where it goes through the various steps of the decontamination and sterilization process. *Hu-Friedy*® Corporation manufactures the cassettes.

Storage. Sterilized tray set-ups should be stored inside cabinets that are free of dust and moisture. They may be stored in a central location (see Figure 10-82) or may be stored in each treatment room, typically at the 12 o'clock wall, which often has a pass-through cabinet to enable trays to be restocked in the room from the corridor. Tubs, another organizational vehicle, may also be used with tray set-ups. Tubs are generally 9½ × 11½ × 2½ inches deep. Trays and tubs are color coded or labeled by type of procedure for which they are intended, making it easy for staff to select the proper tray or tub. During the procedure, the instrument tray is placed on a mobile cart or other work surface convenient to the assistant as is the tub containing medicaments and other supplies necessary for the procedure.

Utility Considerations

A few construction issues should be noted. With respect to electrical service, most sterilizers require a separate circuit. Electrical outlets need to be carefully coordinated for the many pieces of equipment housed within the cabinets or placed on open shelves. Regarding ventilation,

Figure 10-87. STAT*IM*® 5000 G4 sterilization unit. *(Courtesy of SciCan, Inc.)*

steam and condensation from the autoclave should be exhausted into the plenum or directly outdoors, if possible. The exhaust fan is best located over the autoclave with an adjacent timer switch. Consideration should be given to a solid-surface material like Corian for the countertop, backsplash, and integral sink to eliminate crevices that collect moisture and may harbor microorganisms. If a plastic laminate countertop is used, the sink should be one that fits under the countertop without a flange or stainless steel trim ring. The faucet with spray head should ideally be activated by knee or foot pedal or, as in some prefabricated units, by a kickplate in the base.

X-Ray

Digital dental radiography has, in most dental offices, replaced film. It has many advantages (discussed previously) and is equal to or exceeds film in all respects. It exposes the patient to considerably less radiation (and therefore requires less radiation shielding) and avoids the discomfort of rigid plastic bite-wing inserts in the mouth.

Two Competing Technologies

There are two competing technologies by which images are scanned into a computer—direct digital and photostimulable phosphor plate (PSP). With either technology, an intraoral X-ray unit is required, which can be placed on the 12 o'clock wall but more commonly is placed on a side wall or built into a pass-through cabinet that serves two treatment rooms.

Direct Digital. A sensor placed in the patient's mouth (attached to a cable) captures images in a direct digital system (Figure 10-88) and these are immediately available chairside as opposed to a film-based system, which requires leaving the room to process films. With film, a bad exposure must be redone, exposing the patient to more radiation, whereas, with digital, an almost infinite number of adjustments can be made with the computer. In addition, images can be enlarged to a macro size so that the patient can view them on a monitor. Direct digital is based on charged-coupled devices or CCD technology. Schick, Gendex, and Carestream are three of the more well-known vendors.

Storage Phosphor Technology. This system mimics film-based radiography with reusable imaging plates in various sizes to accommodate intraoral, panoramic, or cephalometric images. Intraoral imaging plates are placed in a film positioning device similar to a bitewing. It does not employ cabled sensors as does direct digital, although the *Scan-X*® system by Air Techniques does offer a direct sensor option. After the images are taken, the imaging plates are loaded onto a carousel and placed in a scanner where the information captured is digitized and sent to a computer or server (Figure 10-89). Images can be saved in many formats and, from this point, manipulated chairside as with direct digital, assuming one has a networked environment. In this case, a computer, monitor, and scanner are placed in a central location. The *DenOptix*™ by Gendex is another storage phosphor technology scanner. This system allows dentists to transition from film to digital.

Scanner Workstation. Once the imaging plates have been exposed, they are sensitive to light and should be handled

in an area with a light level of 10 to 20 lux, which is about 25 to 50 times brighter than a darkroom. Light levels can be checked with a photographic light meter. The scanner can be placed in an existing darkroom, leaving the lights off and the door open during loading of images onto the carousel. An alternate location for the scanner is an open niche off of the corridor, but the same issues exist with respect to light levels.

Direct Digital versus Storage Phosphor Technology. Both systems eliminate the cost of film processors, X-ray film, mounts, toxic chemicals, and heavy metals, and the weekly maintenance associated with film processing. Depending on a number of variables, both systems emit 60 to 90 percent less radiation than conventional film. Direct digital may require the purchase of a new DC-type intraoral X-ray machine to make the extremely short exposures, since many of the older AC-types are incapable of making very short exposures. Storage phosphor–type X-ray systems are less sensitive to overexposure and will tolerate even old machines, making it easier to phase in digital without a large financial outlay. The downside is that it involves extra steps, which has a labor cost associated with it. However, Scan-X® images are 150 percent larger than corresponding sensor images, which means that fewer X-rays must be taken to document the same area.

Handheld X-Ray System. Whether using film or a digital sensor, the portable *Nomad Pro*™ (weighs 5.5 pounds) eliminates the need for a wall- or cabinet-mounted X-ray head in each operatory (see Figures 10-42 and 10-43). Due to the integrated shielding and backscatter shield the radiation is contained enabling the assistant to stay in the room with the patient. This unit exposes the patient to far less radiation than conventional X-rays, according to the manufacturer and various statistical comparisons. One of these portable machines can serve three or four operatories. The handset is set into a charging cradle between uses.

Panoramic X-Ray

Panoramic X-rays provide a view of the complete mouth rather than just the limited area of the intraoral X-ray series.

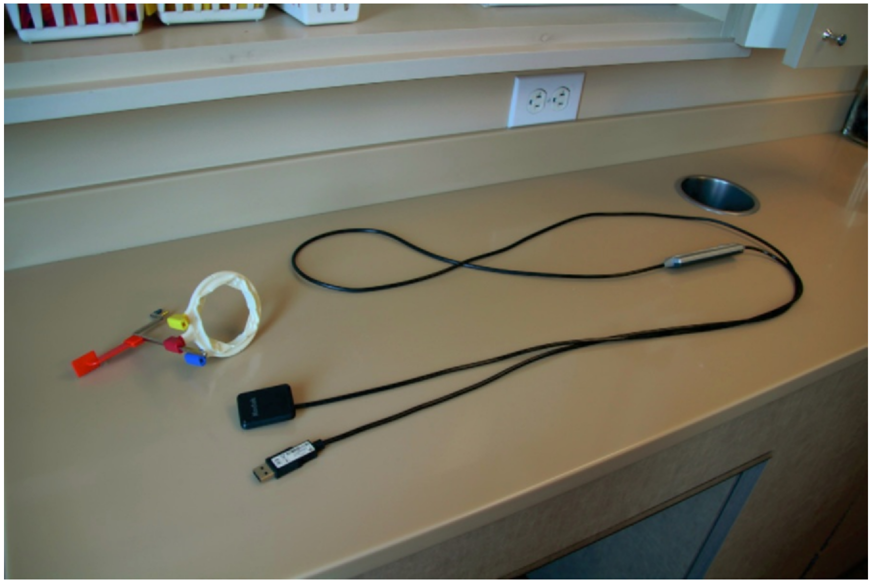


Figure 10-88. Direct digital X-ray sensors with cable and positioning device. *(Photo: Jain Malkin)*

This allows the dentist to assess abnormal bone configurations, cysts and tumors, impacted teeth, abscesses, temporomandibular joint (TMJ) problems, periodontal disease, and even sinus problems. The direct digital unit shown in Figure 10-90 requires an alcove 80 inches wide by 48 inches deep with an 88-inch ceiling height. The unit can be adjusted to accommodate a patient standing or sitting or in a wheelchair. Check specific space requirements for the brand and model of X-ray to be used because these vary widely.

Cephalometric X-Ray

Cephalometric radiography is a comprehensive diagnostic device for facial views and lateral, posteroanterior, and oblique views. These are different images of the head and jaw that can be captured by panoramic X-ray although the two modalities may be combined in a pan/ceph unit as in the Gendex *GXDP-700*™ in Figure 10-91, which is a 3-in-1 machine that also has 3D. The Instrumentarium *Orthopantomograph*® OP300 is also a 3-in-1 machine (Figure 10-92). Cephalometric X-ray units are used primarily by orthodontists and oral surgeons. Although

Figure 10-89. Storage phosphor technology scanner known as ScanX®. *(Courtesy of Air Techniques, Inc.)*

dimensions may vary somewhat among different models, a pan/ceph requires an alcove approximately 88 inches wide and 60 inches deep with a ceiling height of 87 to 92 inches.

Panoramic and cephalometric X-ray units are typically located in an alcove off of the corridor (Figure 10-93). Alternatively, dentists sometimes refer patients to a dental X-ray lab for these studies if they prefer not to invest in the equipment.

Cone Beam 3D

Cone beam 3D is the newest radiographic technology. It is also known as Cone Beam Computed Tomography (CBCT). It involves a cone-shaped X-ray beam and a scanner that rotates around the patient's head obtaining hundreds of cross-sectional images that are then reconstructed by computer into a composite 3D image that can be manipulated—enlarged, rotated, and with the ability to zoom in on specific areas. It records soft tissue, muscle, bone, and blood vessels, making it an important tool in treatment planning and diagnosis, especially in implant dentistry. The Vatech *PaXReve 3D* (see Figure 10-17), the Gendex *i-CAT*® (Figure 10-94), Planmeca® *ProMax*® (Figures 10-93, 10-95, and 10-96a and b), and the *Carestream CS 9300* (Figure 10-97) are all examples of this technology. It is used by endodontists, periodontists, orthodontists, and oral surgeons. Group general practices that routinely place implants may have one or are buying a panoramic machine that can be upgraded in the future for CBCT. These new machines emit much lower levels of radiation.

Lead-Shielding Requirements

This has been discussed earlier under the heading *Exposure to Radiation*.

Miscellaneous Construction Details

The wall that supports the intraoral X-ray mount must have additional reinforcement to support the weight and longitudinal pull, starting at 36 inches off the floor and terminating at a height of approximately 60 inches. The designer must check with the manufacturer or dental equipment installer to determine the proper amount of bracing for the unit. Panoramic and pan/ceph units also require wall bracing but usually from 72 to 90 inches off the floor and on 16-inch centers.

Automatic Processors. The *Peri-Pro III*® (Figure 10-98) is a small unit 25 inches long by 10 inches by 8½ inches high, which only processes intraoral films. It does not require plumbing or a floor drain, because it is totally self-contained. It requires only a standard electrical outlet but has a water drain in the base which needs to discharge to a sink or perhaps a container that can be placed under it. The slightly larger unit, the *A/T 2000XR*® (Figure 10-99), processes intraoral, panoramic, and cephalometric films and is also available with a daylight film loader option. This unit is 15 inches wide by 25 inches deep by18 inches high and has a built-in replenisher unit. There are several other brands of processors for intraoral-only films and several for the combination of intraoral, panoramic, and cephalometric films. The daylight loader portion of the processor hangs off the edge of the countertop, requiring that the countertop be 25 inches deep. This unit does require cold water (¾-inch-diameter male garden hose fitting) and an open vented drain. It does not require a floor drain, however, although local codes may require one whenever a processor has replenisher tanks. Codes vary widely with respect to waste drain requirements, and the designer must check local ordinances.

It should be noted that the fixer and developer generally go down the waste drain, unless local codes prevent this. In some cities, chemicals have to be collected in containers or, at the very least, the fixer must be processed through a silver recovery unit. There should be a small area for storage in the darkroom or the processing alcove for bottles of developer and fixer. These plastic bottles are 1-quart size for the *Peri-Pro III* and ½-gallon size for the *A/T 2000XR*. There will also be a need to store packages of film. Unlike medical X-ray film, dental X-ray film is stored in lead-lined dispensing units, which are either wall-mounted in the operatory or stored in a drawer.

Figure 10-90. Panoramic X-ray Orthopantomograph. *(Courtesy of Instrumentarium Dental Inc.)*

Dental Laboratory

The size of the laboratory will vary, depending on whether the dentist sends out most of the lab work or employs

Figure 10-91. Panoramic/cephalometric with 3D imaging, Gendex GXDP-700™. *(Gendex: Images courtesy of Gendex Dental Systems)*

in-office lab technicians (see Figure 10-34a). If two workbenches are arranged so that they face each other, a dental engine, lathe (Figure 10-100), model trimmer (Figure 10-101), porcelain oven (Figure 10-102), casting machine, and other tools can be shared. If the workload demands it, two separate workstations can be set up so that one person does not interfere with the other.

The porcelain station should be separated from the metal station to avoid contamination. Upper cabinets should be positioned so that they are accessible to seated technicians without too much stretching, and the sink should be in a central location.

The type of vacuum used in the lab is a bench-top dust collector (Figure 10-103). Having no connection to the central suction used in the treatment rooms, this small portable vacuum is used for collecting dry grinding and polishing dusts produced by the lathe or the hand-pieces.

The lab requires compressed air, water, waste disposal (acid-resistant drainage lines and sink with plaster trap), a plaster bin, and many electrical outlets (continuous plug strips should be mounted above the countertops). If gas is required, it will most likely be a portable source rather than piped natural gas. It is important to design the electrical service to accommodate the high usage requirements of various pieces of equipment. The lab may be located near the operatories to meet demands of immediate impression pouring, but if many noisy procedures are performed, it is wise to keep the lab a distance from the operatories. Since labs tend to be messy, it is desirable to have a door on the room so that patients cannot see into it.

CAD/CAM Workstation

Dentists who do in-house milling of restorations will require a clean lab or workspace for computers, monitors, and the milling machine as in Figure 10-27. This may also serve as a central location for equipment like the *Cerec* and the *E4D* discussed previously.

Vanity Area

A mirror and shelf or vanity cabinet may be located in the corridor near the reception area if space permits. Thus, a

patient can comb hair or repair makeup while the receptionist is scheduling a future appointment (see Figure 10-39). A cabinet in the operatory corridor with attractive accessories takes little space but does much to enhance the office (see Color Plate 28, Figure 10-134).

Patient Education/Consultation Room

Some dentists have small patient education rooms that consist of a countertop at 29-inch height, stools or chairs, and several electrical outlets for computer, although this type of programming is increasingly being offered in the operatory.

Patient education can also occur in a consultation room where a prosthodontist, periodontist, or cosmetic dentist may explain a course of treatment or specific procedures. This room is sometimes a combination operatory and office for a treatment coordinator. It will have a computer and monitors and should be attractively designed (see Figures 10-39 and 10-74).

Plaque Control

A plaque control room is a combination patient education/hygiene room that may be set up in different ways. One way is to equip it with two sinks built into the countertop and a wall-to-wall mirror so that a dental assistant can explain and demonstrate dental flossing and proper brushing techniques, although this can also be carried out in a standard dental chair in a treatment room.

Staff Lounge

It is desirable to provide a staff lounge (preferably with windows) where the staff can relax, eat lunch, or have a cup of coffee. This is especially important in hectic, high-volume practices and in surgical practices, where staff may be involved in long procedures. The staff lounge needs a built-in cabinet with sink and garbage disposal,

Figure 10-92. Panoramic/cephalometric with 3D imaging, Orthopantomograph OP300. *(Courtesy of Instrumentarium Dental Inc.)*

Figure 10-93. Planmeca® ProMax 3D® (Cone Beam) also does panoramic and cephalometric imaging. *(Photo copyright © Nathan Padilla Bowen)*

Figure 10-94. Cone beam 3D computed tomography *i-CAT®*. *(Gendex: Images courtesy of Gendex Dental Systems)*

undercounter refrigerator, microwave, and perhaps a cooktop (Figure 10-104). There should also be a table with chairs and perhaps some lounge seating. A closet for smocks or lab coats could be located here or in the corridor. The trend is for staff to wear uniforms only in the office; thus, dressing facilities may be a consideration.

Restrooms

Locate the staff restroom so that personnel are not observed by patients when exiting. The restroom for patients may be located toward the front of the suite near the waiting room or perhaps in the treatment area. An attractive, nicely accessorized restroom is a pleasant amenity for patients and staff (Figures 10-105 and 10-106).

Treatment Coordinator

Some offices have a treatment coordinator who handles patient relations and financial arrangements (see Figure 10-75). In other offices, this person might be called the office manager or business manager. The duties vary, depending on the needs of the individual practice, but generally this person manages the staff, handles any patient problems or complaints, acts as an executive assistant to the doctors, handles patient financial arrangements, and acts as office administrator. An ideal location for this office is near the reception or business office, so that when the office door is open, the treatment coordinator can keep an eye on exiting patients, as in Figure 10-61 (consultation office) and Figure 10-75. If a patient needs to discuss financial arrangements in privacy, the administrator's office is nearby. This office need not be large, but must accommodate a desk, computer and monitor, printer, and two guest chairs. The ambience should be warm and nonthreatening.

Figure 10-95. Wheelchair-accessible *ProMax 3D®*. *(Courtesy of Planmeca USA, Inc.)*

Private Office

Dentists tend to have small private offices, sometimes as small as 8 × 10 feet (see Figure 10-75). Patients rarely enter a dentist's private office, so it is used primarily to read mail, return phone calls, or relax between procedures. Sometimes, in order to save space, dentists will share a private office (see Figure 10-73).

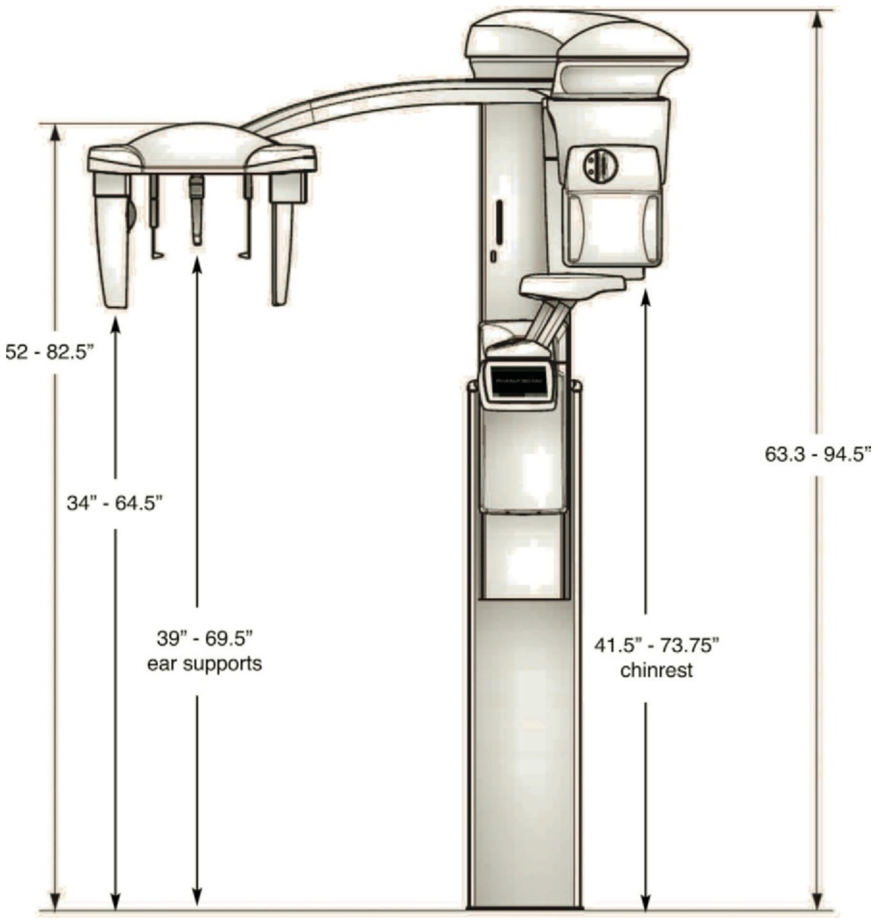


Figure 10-96a. Elevation of *ProMax 3D®* with dimensions. *(Courtesy of Planmeca USA, Inc.)*

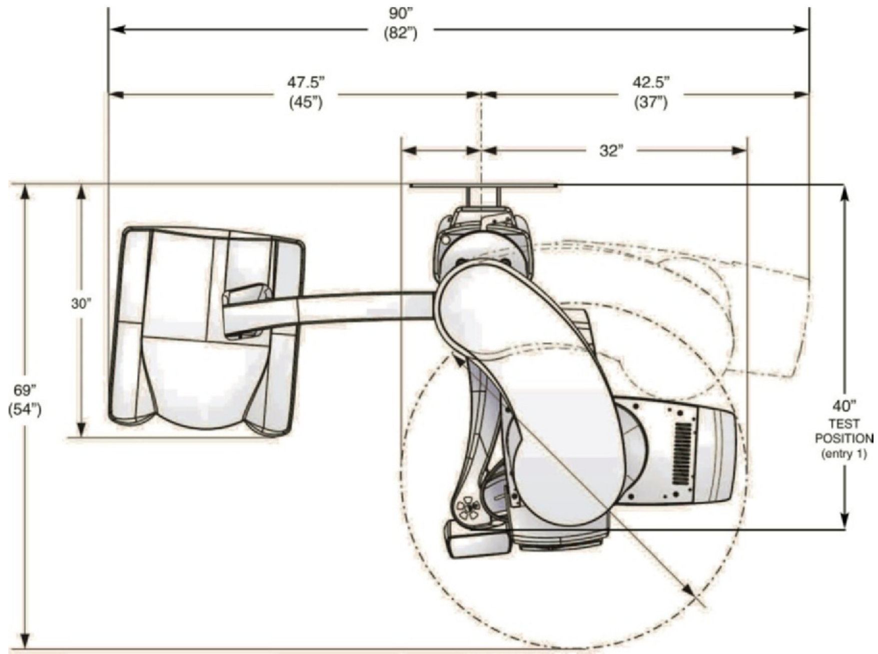


Figure 10-96b. Plan view with dimensions of *ProMax 3D®*. *(Courtesy of Planmeca USA, Inc.)*

Business Office

The business office of a dental suite is generally smaller than that of a similarly sized medical office (Figure 10-107). One can expect that dentists will commonly have electronic dental records and digital X-rays within the next couple of years if they don't already have them, which will eliminate the need for file cabinets to store large amounts of paper.

The popularity of dental insurance plans, including HMO prepaid dental plans for subscribers, may necessitate a larger business office to accommodate additional insurance and bookkeeping functions, although electronic claims processing is the norm. A workroom off of the business office is practical for copier, scanner, shredder, fax machine, printers, and supplies (see Figure 10-75). For those who do have paper charts, the *Times-2 Speed Files* cabinet works well in dental offices where it is desirable to

make every foot of space count (see Figure 10-61). The unit spins around in place to access filing on the two long parallel sides.

Storage and Housekeeping

A common complaint from office managers is the lack of storage. A 6 × 8–foot minimum or, preferably, 8 by 8-foot room, lined with shelves, is essential as is a room approximately 6 × 6 feet for housekeeping supplies and equipment.

Waiting Room

The reader is referred to the Waiting Room section of Chapter 3 for a general discussion of waiting rooms. Dentists tend to have smaller waiting rooms than medical offices of the same square footage since the patient volume is lower (see Figures 10-1 and 10-108). A family practice physician may see upwards of four patients per hour, while the general practice dentist may see only two, depending on the procedure and whether the appointment is primarily for examination and diagnosis or for restorative work. In cold-weather climates where people wear coats and boots and use umbrellas, a coat closet or coat rack should be located where it can be supervised by the business office staff.

It is important to make the patient feel welcome, which means the reception desk should be open without glass and, perhaps, even without a door between the waiting room and the treatment area, as in Figures 10-109a and b and Color Plate 26, Figure 10-110.The reception desk should have a 42-inch-high stand-up-height transaction shelf to provide privacy for the receptionist's work area and to make it easy for someone to make a payment, for example, but a 30 to 34-inch-high area should also be provided for ADA access (Figures 10-107 and 10-109b).

In the exit corridor, there is a need for privacy at checkout that can be accomplished by separating the reception

Figure 10-97. Cone beam 3D CS 9300. *(Copyright © Carestream Health, Inc.)*

Figure 10-98. X-ray film processor, *Peri-Pro III®*. *(Courtesy of Air Techniques, Inc.)*

Figure 10-99. Automatic X-ray film processor, *A/T 2000XR®*. *(Courtesy of Air Techniques, Inc.)*

Figure 10-100. Dental lathe. *(Photo courtesy of Handler, Westfield, New Jersey)*

Figure 10-101. Model trimmer. *(Photo courtesy of Handler, Westfield, New Jersey)*

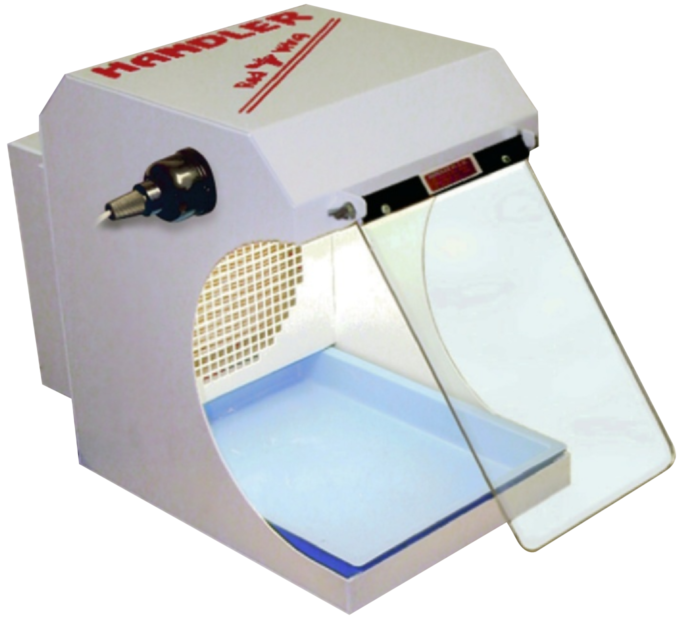


Figure 10-103. Benchtop dust collector vacuum for lab. *(Courtesy of Handler Red Wing International)*

Figure 10-102. Vacuum porcelain furnace with quartz spiral muffle. *(Photo courtesy of Degussa-Ney Dental, Inc., Bloomfield, Connecticut)*

Figure 10-104. Staff break room. *(Design: John Lum; Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

Figure 10-106. Restroom with residential ambience. *(Courtesy of Janice M. Thayer, Signature Environments, Inc.)*

Figure 10-105. Dental office vanity area. *(Courtesy of FORMA Design Inc.; Photography by Geoffrey Hodgdon)*

Figure 10-107. Dental office reception workspace. *(Design: Kui Tan; Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

area from the cashier/appointment area so that conversations about financial arrangements cannot be easily overheard by those in the waiting room (Figures 10-61, 10-73, and 10-75).

Even though modern dentistry is relatively painless, a visit to the dentist still inspires terror in many people, and the interior design of the suite should be directed toward creating a relaxing, soothing environment (see Figures 10-2, 10-3, and 10-6). The waiting area in Figure 10-114 is like a living room or lobby of a boutique hotel. A fountain built into the wall at the end of a corridor adds visual interest (Figure 10-111) as does the tall fountain with sandblasted glass that acts as a room divider and is the first thing patients see as they enter the office (Figure 10-112). A children's corner (Figure 10-113) will be appreciated by children and parents alike. Also see Color Plate 26, Figure 10-122; Color Plate 28, Figure 10-133; and Figures 11-22 and 11-24, for ways to accommodate children.

A patient wants to feel confident about being cared for by his or her dentist. If the office appears to be well organized and well cared for, with healthy live plants, and if it lacks visual clutter and has current, high-quality magazines, comfortable seating, and appropriate light for

Figure 10-108. Elegant contemporary design of endodontics reception room limits palette to white, black, and red. *(Courtesy of Joe Architect; Photographer: Bob Soman Photography)*

reading in the waiting room, chances are the patient will transfer that evidence of quality to the clinical setting.

As a rule of thumb, two seats in the waiting room should be provided for every treatment and hygiene room. High-volume practices such as orthodontics and pedodontics, which are characterized by many short appointments, should have three to four seats per dental chair, if space permits.

GENERAL DENTISTRY: PROSTHODONTICS EMPHASIS

Dentists may have a specialty in prosthodontics or maxillofacial rehabilitation, which requires additional postgraduate training. Occasionally, general dentists have an emphasis in the discipline of prosthodontics or maxillofacial rehabilitation. Prosthodontists

Figure 10-109a. Orthodontic waiting room with custom magazine rack for collectors' editions of magazines. The lighted element with vertical and horizontal tubes is a commissioned artist's installation. *(Courtesy of Joe Architect; Photographer: Steven Evans Photography)*

Figure 10-109b. Wheelchair-accessible reception desk with custom-formed laminated walnut veneer construction. *(Joe Architect; Photographer: Steven Evans Photography)*

Figure 10-110. One signature color and a striking hand-blown glass light fixture create a dramatic design. *(Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

Figure 10-111. Custom water feature in faculty dental practice. *(Design: Jain Malkin Inc.; Steve McClelland Photography)*

Figure 10-112. Glass water wall greets patients in reception room. Sandblasted design acts as a semi-transparent room divider. *(Fountain by Harmonic Environments, www.hamonicenvironments.com; Photo courtesy of Andrea Huysing, Issaquah Dental Arts, Issaquah, Washington)*

Figure 10-113. Children's corner with recessed TV is welcomed by both parents and children. *(Photo courtesy of Andrea Huysing, Issaquah Dental Arts, Issaquah, Washington)*

specialize in complex dental and facial rehabilitation with a focus on fixed, removable, and implant-related prostheses. Even within the prosthodontist's office, there may be varying emphasis on geriatric patients or the oral care and management of patients undergoing radiation and chemotherapy treatment, or perhaps a younger aesthetically oriented patient base. In terms of space planning, there are no special requirements except a large laboratory and perhaps a panoramic/cephalometric X-ray machine (see Figures 10-36, 10-38, and 10-115).

ESTHETIC/COSMETIC DENTISTRY

There has been a dramatic increase in recent years in aesthetic dental services performed by general dentists. Remarkable changes to an individual's smile can be achieved by skilled practitioners. Restorative dentists, enabled by new software, digital cameras and scanners, as well as the proliferation of computers and monitors throughout the dental office, are capable of letting patients see what can be accomplished. Imaging software features include image capture, storage, retrieval, manipulation, editing, and printing.

Figure 10-114. Hospitality design dental waiting area. *(Courtesy of Joe Architect; Bob Soman Photography)*

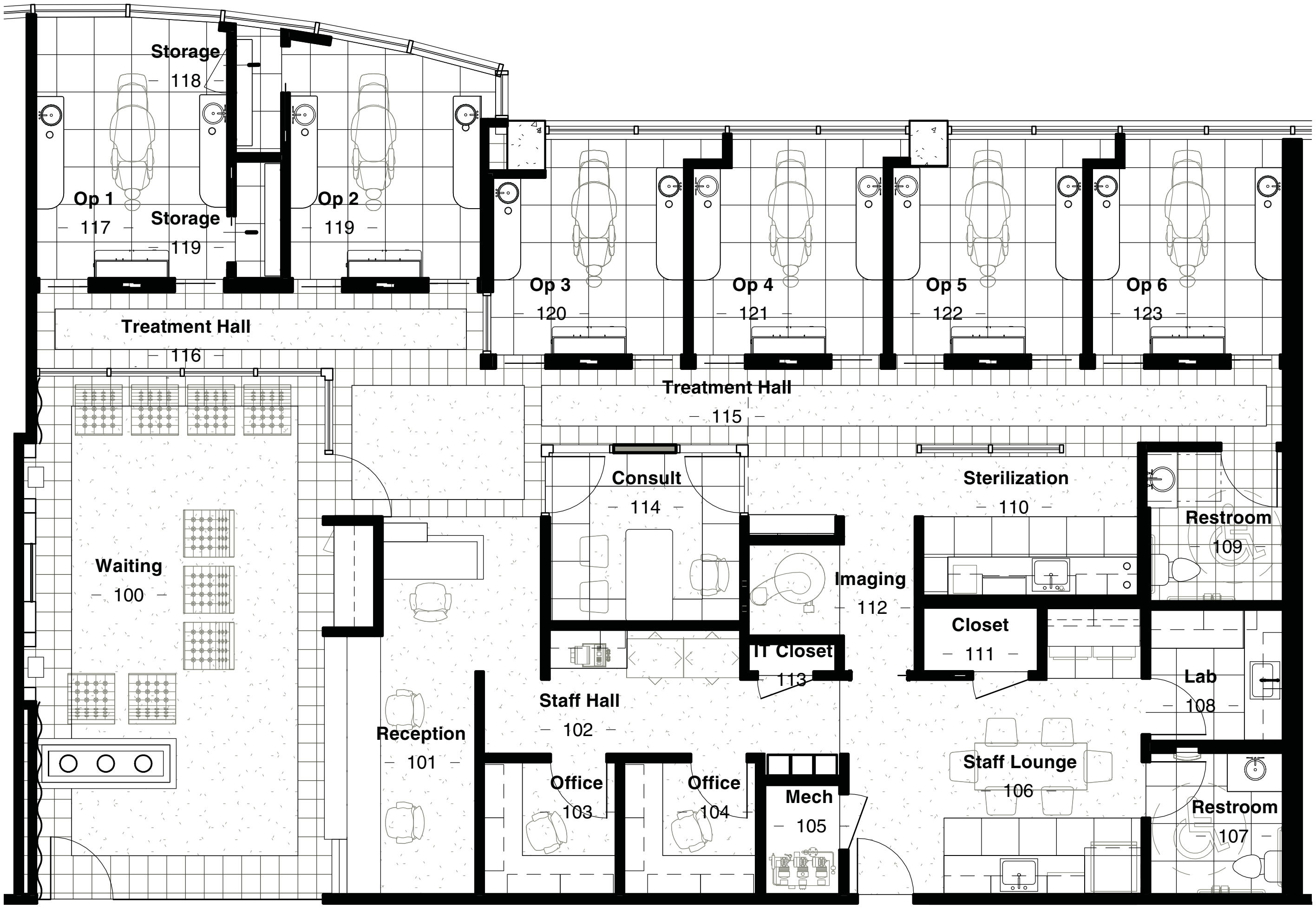
To capture the "before" photo, a photograph can be taken with a digital camera. As previously discussed, an imaging alcove or niche is often created for this purpose (see Figure 10-39). These digital images are stored in an electronic "photo album" for future reference. They can be altered by selecting options from the "smile" library, which consists of individual "ideal" teeth, several teeth, or the entire arch, and can demonstrate effects such as teeth whitening. Teeth can be rotated, lengthened, and reshaped. However, skill is required to carefully align the patient's actual smile with the replacement selections or "try-ins" to provide the patient with a realistic expectation of the proposed treatment.

Space-planning considerations include private operatories, as esthetic/cosmetic dentistry procedures are often lengthy (see Figure 10-35), and a large lab (see Figure 10-39). It is not uncommon to have a 4- to 6-hour procedure during which time an anesthesiologist will monitor and keep the patient sedated. Many anesthesiologists bring their own anesthesia equipment. Medical gas connections can be built into the casework near the foot of the chair on the left side (if the dentist is working on the right) as a convenience. Be aware that the use of conscious sedation involves additional code requirements, which are explained in Chapter 5 under Plastic Surgery and elsewhere under the topic "office-based surgery" (consult the Index).

Those who practice aesthetic/cosmetic dentistry may be more aware of creating a high-profile image in their office interior design. A number of dentists who have an aspect of their practice dedicated to teaching may build seminar facilities within their offices to train other dentists in specialized techniques (Figures 10-116). This involves a training room with computers, video monitors, and three projection screens side by side and may include a large laboratory and a kitchen for preparing or serving food.

TECHNOLOGY RESOURCES

The Internet has made it easy to review products and to access articles in magazines like *Dental Economics, Dental Products Report*, and various trade magazines that do a comparative analysis of different types of products such as intraoral cameras or explain various radiographic modalities. In addition, vendors have all their product literature online, including installation data, utility requirements, and so forth. In seconds, a wealth of information is available on virtually any topic.



GENERAL DENTISTRY
2,893 SF

Figure 10-115. Space plan for general and cosmetic dentistry suite, 2,893 square feet. *(Courtesy of Joe Architect)*

Figure 10-116. Lecture/classroom for Capital Oral and Facial Surgery Center. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

RELEVANT INFORMATION IN OTHER CHAPTERS OF THE BOOK

To make it easier for dentists to find information relevant to dental practice in other chapters of this book, the following will serve as a guide. Use the Index to find the page(s).

Regulatory Issues/Codes

OSHA

Chapter 3

Accessible bathrooms

Appendix

Storage of medical gases

Chapter 8, Storage of Medical Gases

HIPAA legislation

Introduction and Chapter 3

Use of conscious sedation

Chapter 5, Surgical Specialties—Conscious Sedation/Minor Procedures and Office-Based Surgery; also see Chapter 5, American Association for Accreditation of Ambulatory Surgery Facilities (AAAASF), under Plastic Surgery, for classes of anesthesia

Oral Surgery: Accreditation, licensing, and Medicare certification

Chapter 5, Office-Based Surgery, under Plastic Surgery

Construction Methods and Building Systems

Chapter 13

Lighting

Chapter 12

Business Office Design

Chapter 3

Ergonomic Issues

Chapter 3

Interior Design: Furniture and accessories; interior finishes

Chapter 11

Miscellaneous

Dental interview questionnaire

Appendix

ORTHODONTICS

Orthodontics is the branch of dentistry that deals with straightening teeth and improving incorrect bites

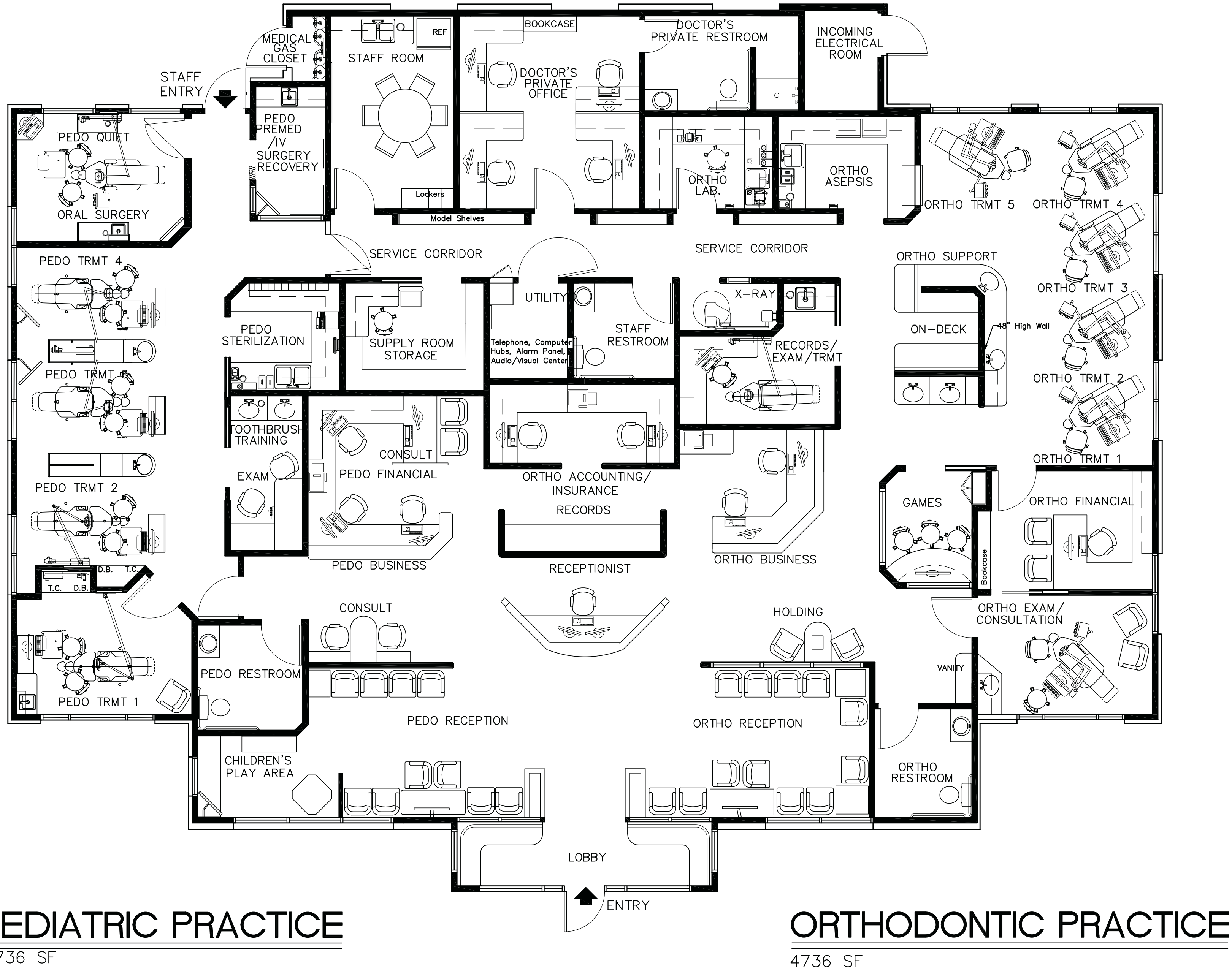


Figure 10-117. Space plan for pediatric and orthodontic dentistry suite, 4,736 square feet. *(Design: Jain Malkin Inc.)*

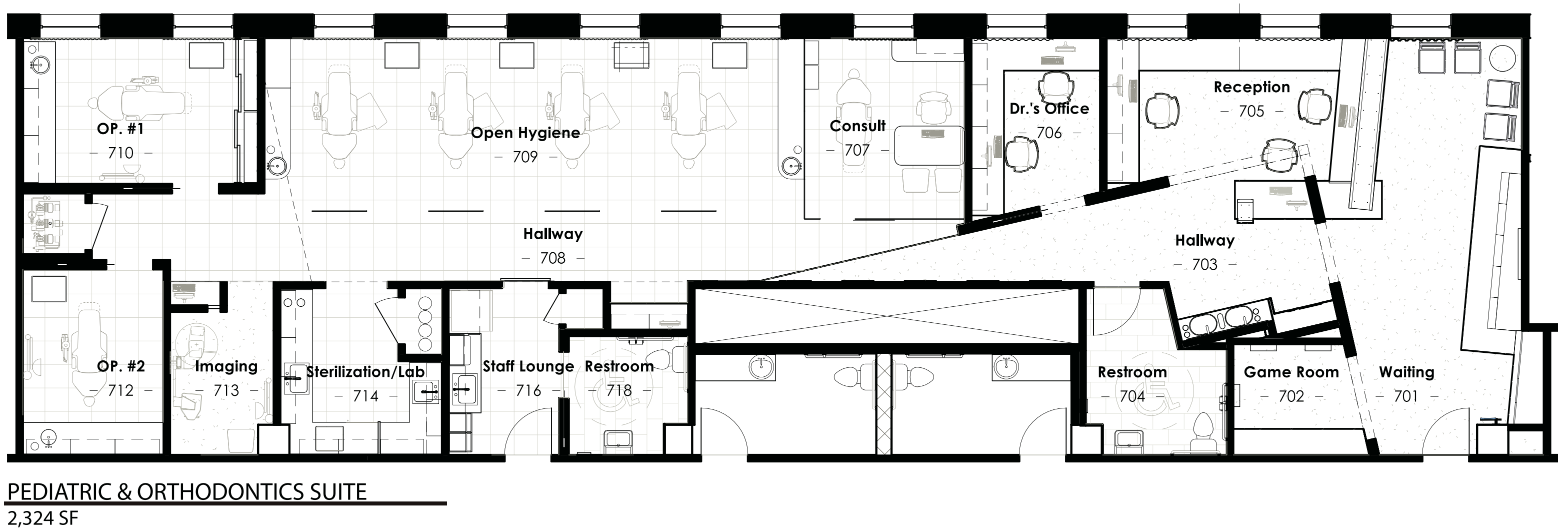


Figure 10-118. Space plan for pediatric and orthodontic dentistry suite, 2,324 square feet. *(Courtesy of Joe Architect)*

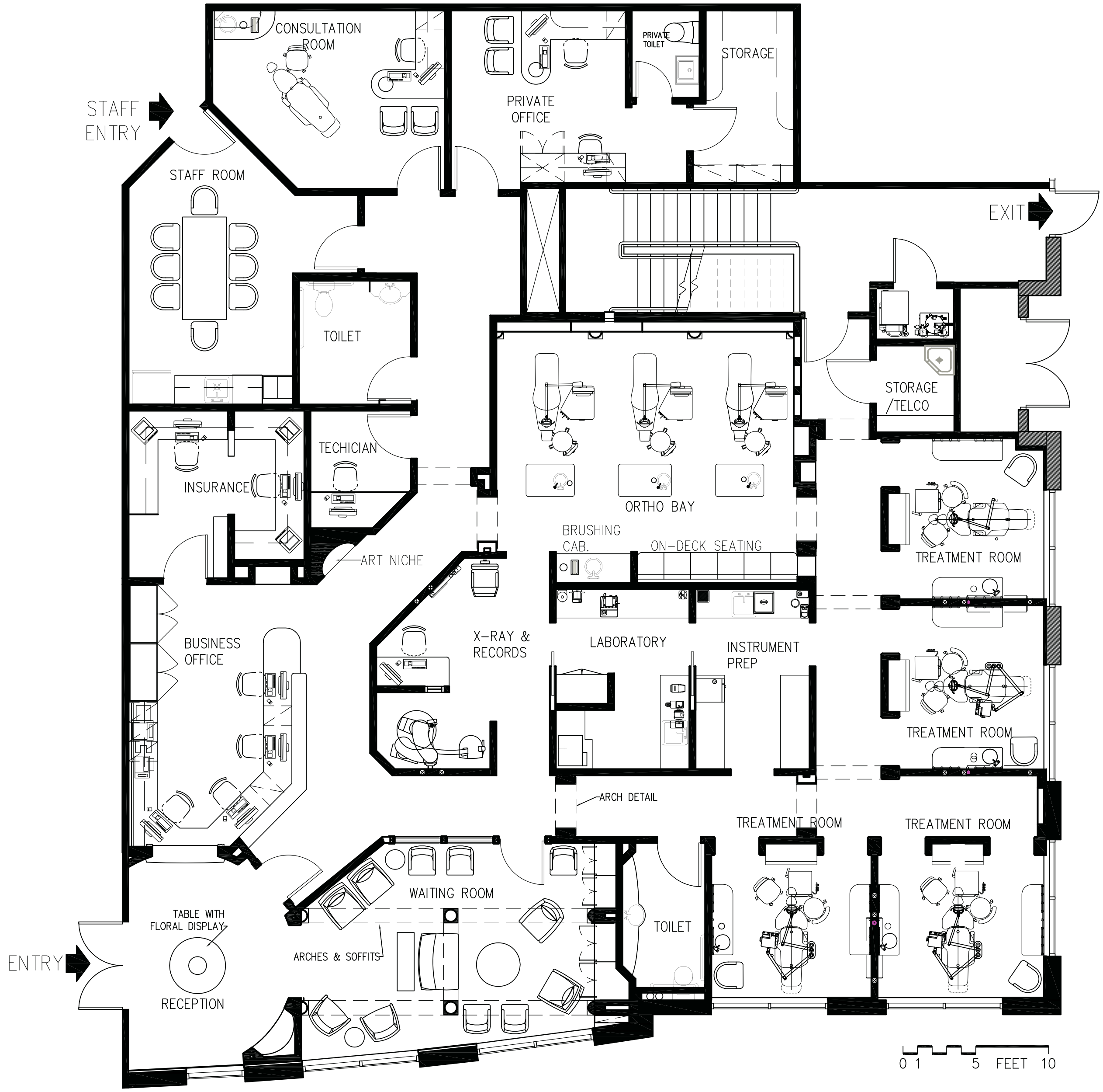
(malocclusions). The majority of patients are children aged 12 to 18, although a sizable number of adults now avail themselves of these services. The orthodontic process is slow, often necessitating monthly visits for two years or more. Pediatric practices may be combined with orthodontic practices because of the synergism and the obvious interface (Figures 10-117 and 10-118). General dentistry and orthodontics are combined in the suite in Figure 10-119.

The Paperless Office

The previously discussed technology wave affecting general dentists includes orthodontists. Practices now often have electronic patient records, digital X-ray, and treatment room computers and monitors. Patients can sign in on a computer upon entering the reception area and this brings up their name, check-in, and appointment time on a monitor in the treatment room bay to alert staff about who has checked in and how long they have been waiting. There are a number of practice management software systems available specifically adapted to orthodontics.

Circulation

On the initial visit, the child (or adult) is examined, and the orthodontist discusses the course of treatment with the parents. Some orthodontists have a well-designed exam/consultation room for making case presentations that includes the types of computers, monitors, and imaging software described in the General Dentistry section. It often includes, as in Figures 10-120, 10-121, and 10-124, a patient dental chair. Financial arrangements and future appointments may be discussed here or in an adjacent room, which frees up the exam/consult for the next patient. On subsequent visits, the patient proceeds to a tooth-brushing area (see Color Plate 30, Figure 10-139b) and then to an "on-deck" space often equipped with electronic games and other entertainment where he or she waits until proceeding to the treatment room (see Color Plate 26, Figure 10-122). After the first few visits, during which the major work is done, monthly follow-up visits are short. Orthodontics is a high-volume practice that benefits from a waiting room able to accommodate a large number of patients. Three or four seats should be provided for each dental chair if space permits.



GENERAL DENTISTRY PLUS ORTHODONTICS

4095 SF

Figure 10-119. Space plan of general dentistry and orthodontics suite, 4,095 square feet. *(Design: Jain Malkin Inc.)*

Table 10-2.
Analysis of Program
Orthodontics

No. of Dentists		1		2
Waiting Room		14 × 20 = 280		16 × 22 = 352
Business Office/Reception		12 × 16 = 192		14 ×16 = 224
Office Manager		10 × 12 = 120		10 ×12 = 120
Finance Consult		10 × 10 = 100		10 × 10 = 100
Operatory Bay (4 chairs)		12 × 24 = 288	(8 chairs)	12 × 48 = 576
On-deck Area		10 × 10 = 100		10 ×10 = 100
Consultation/Treatment Room		10 × 12 = 120	2 @	10 × 12 = 240
Quiet Room/X-Ray		10 × 11½ = 115	2 @	10 × 11½ = 230
Patient Education		8 × 12 = 96		8 × 12 = 96
Lab		8 × 10 = 80		8 × 12 = 96
Sterilization		8 × 10 = 80		8 × 10 = 80
Tech Closet[a]		4 × 4 = 16		4 × 4 = 16
Staff Lounge		8 × 10 = 80		10 × 12 = 120
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Pan/Ceph Alcove		6 × 8 = 48		6 × 8 = 48
Photo Imaging		10 × 10 = 100		10 × 10 = 100
Private Office		10 × 10 = 100		10 × 12[b] = 120
Storage		6 × 8 = 48		6 × 8 = 48
Housekeeping Room		6 × 8 = 48		6 × 8 = 48
Mechanical Equipment Room		6 × 8 = 48		6 × 8 = 48
Tel. Equip. Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		2,107 SF		2,962 SF
20% Circulation		421		592
Total		2,528 SF		3,554 SF

[a]Tech closet may be smaller if equipment rack is recessed into casework, as in Figure 10-55a.
[b]Shared private office.

Sterilization

Orthodontists follow the same sterilization techniques outlined previously for general dentists. Instruments are brought to the chair on trays or in cassettes and chairside storage is limited to nonsterile items such as cements, brackets, elastics, and arch-wires. The steam autoclave and dry heat are effective methods for sterilizing orthodontic instruments. A steam sterilizer is considered the best overall alternative. The unit in Figure 10-123 is used by many orthodontists to sterilize pliers, a frequently used tool. The *STATIM*® (see Figures 10-86 and 10-87) is also used.

Treatment Bay

Orthodontists do most of their treatment in a large, communal treatment room called a "bay," in which three to eight chairs are arranged with no separating walls between them as in Figures 10-60, 10-120, 10-124 and Color Plate 29, Figure 10-137. Sometimes private rooms or separating walls are used (see Figures 10-121 and 10-125). Chairs should be 3 feet from the wall, with 4 feet separating them from one another. The large practice shown in Figure 10-121 uses all private treatment rooms with built-in corner seats for parents or a sibling. This enables parents to accompany the child during treatment in order to ask questions or listen to instructions being given. A bench at the foot of chairs in the open bay can be used for the same purpose, although some orthodontists prefer not to have parents in the treatment area but will use a small stand-up consult area between the treatment bay and the waiting room instead (see Figures 10-120 and 10-121).

Treatment chairs are usually fully motorized like those found in general dentistry offices as these accommodate short and tall staff members more comfortably. There is a trend toward standard dental lights mounted either on the chair or on the ceiling, providing better lighting with more variable positioning.

The location of fixed and mobile cabinets is critical to enable the orthodontist and assistant to move quickly from one patient to the next. Orthodontic treatment rooms have very little fixed cabinetry, compared to pediatric or general dentistry treatment rooms. Orthodontists do not use as many dynamic instruments as general dentists, and it is not uncommon to see custom-designed cabinets to the side or rear of the patient chair with instrumentation built

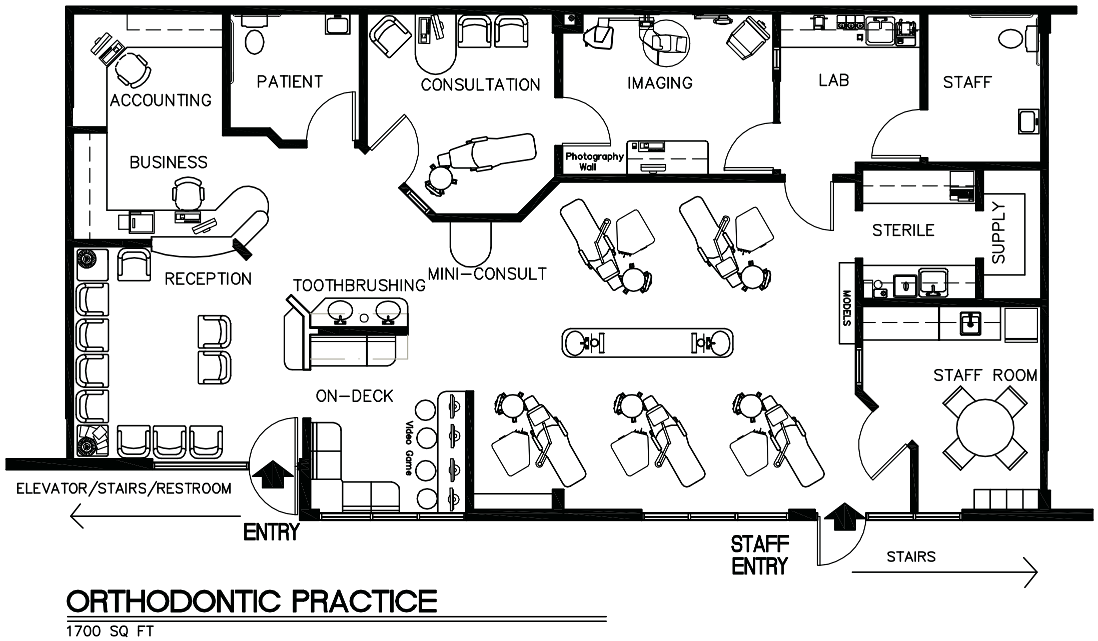


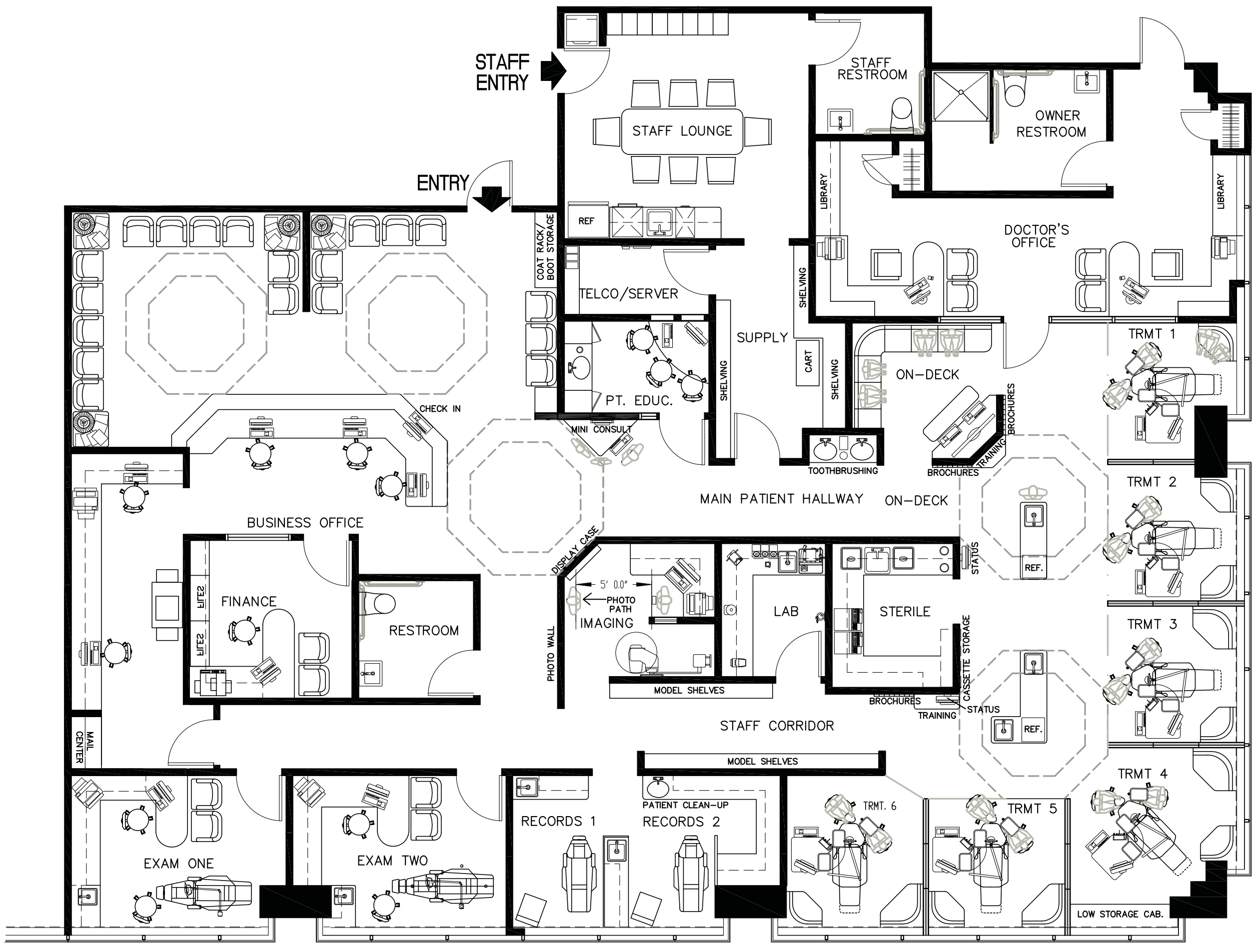
Figure 10-120. Space plan for orthodontics suite, 1,700 square feet. *(Design: Jain Malkin Inc.)*

in (Figure 10-126). The style of delivery is often over the patient, but could be rear delivery. Neither nitrous oxide nor oxygen is generally needed, only suction and air.

In addition to the treatment bay, the orthodontist usually has a standard individual treatment room, often referred to as a "quiet room," or an exam/consult, in which he or she may take X-rays, do the initial diagnostic examination, work on a noisy or obstreperous child, or treat an adult patient. This treatment room may have specialized equipment lacking in the orthodontic units in the bay.

Laboratory

The laboratory should be large, with a storage bin for plaster and storage for the considerable number of plaster models accumulated. Sometimes as many as 4,000 models, stored in cardboard boxes 3 × 3 × 10 inches, must be accommodated in the lab, or elsewhere in the suite, on shallow shelves (see Figure 10-121). The reader is referred to the General Dentistry section of this chapter for further discussion of a dental laboratory. As orthodontists shift to digital systems, the need to store models will disappear as will the need to take impressions. It will all be done electronically. The *iTero*™ (Figure 10-127) intraoral scanner is often used by orthodontists. It eliminates the imprecision associated with conventional impression materials and is often better tolerated by patients. Onscreen visualization of the scan in real time provides chairside feedback. *iTero* and *Invisalign*® feature certified connectivity to enable the orthodontist to scan and send the digital impression whereby the custom-made aligners can be fabricated. Other systems for digital impressions are *3M*™ *ESPE*™, *CEREC* by Sirona, and *E4D*® by D4D Technologies.



ORTHODONTICS

4256 SF

Figure 10-121. Space plan for orthodontics suite, 4,256 square feet. *(Design: Jain Malkin Inc.)*

Other Rooms

An orthodontist's office will have a panoramic/cephalometric X-ray unit, possibly a cone beam X-ray, or combination cone beam 3D/pan/ceph (see Figures 10-91 and 10-92), two toilet rooms, a fairly large business office, a patient education room, and, perhaps, a private office for a bookkeeper or office manager. The reader is referred to the General Dentistry section of this chapter for layout information on X-ray units which may, as in Figure 10-121, be combined in one general imaging room, which also has a computer and monitor on a work surface for the creation of case presentation photo albums which is all done by computer software. This is where the computer for the digital X-ray is located. A photo wall, with a roll-down blue fabric panel, is used for taking digital photos of the patient.

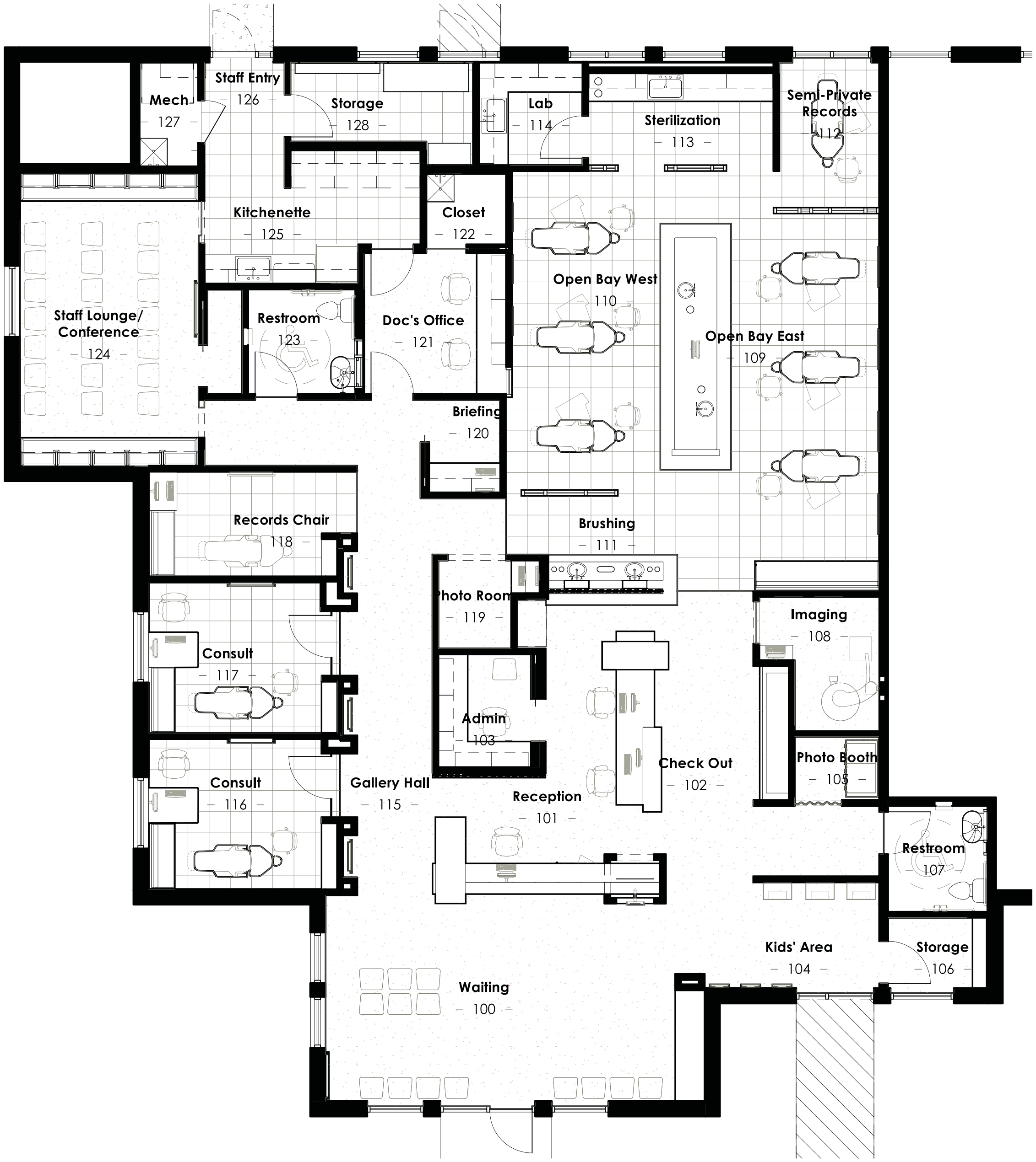
Waiting Room

The waiting room of an orthodontic office may be treated with great imagination since the patients are, for the most part, preteens and teenagers who often appreciate an office designed around a theme. Bloo Dental in Ashburn, Virginia, is designed around the theme of ocean imagery based on the doctor's love of scuba diving and the colors blue and white. This is actually a family dental practice focusing on adults and children. The architect sculpted walls and ceilings to create the feeling of waves (Figure 10-128) and even surfing inside a "curl" (Color Plate 27, Figure 10-129). Elsewhere, azure blue panels resembling shimmering water front the reception desk and walls opposite the banquette seating while a projection of water creates movement on the canopy over the reception desk (Color Plate 27, Figure 10-129). The space plan for this office is in Figure 10-131. In Color Plate 29, (Figures 10-137 and 10-138), an ortho/pedo practice, a sea theme underpins the design, explained in more detail under Pediatric Dentistry.

A very different design aesthetic can be seen in Image Orthodontics, in Saskatoon, Canada.

Figure 10-122. Entertainment center in pediatric and orthodontic dentistry office. *(Design: Rague Studio; Utgard Construction; Audio/Video Specialist: Keith Aderman/Mr. Hookup; Photo copyright © Nathan Padilla Bowen)*

Figure 10-123. *M11 UltraClave®* automatic sterilizer. *(Courtesy of Midmark Corporation)*



ORTHODONTICS SUITE
3,888 SF

Figure 10-124. Space plan for orthodontics suite, 3,888 square feet. *(Courtesy of Joe Architect)*

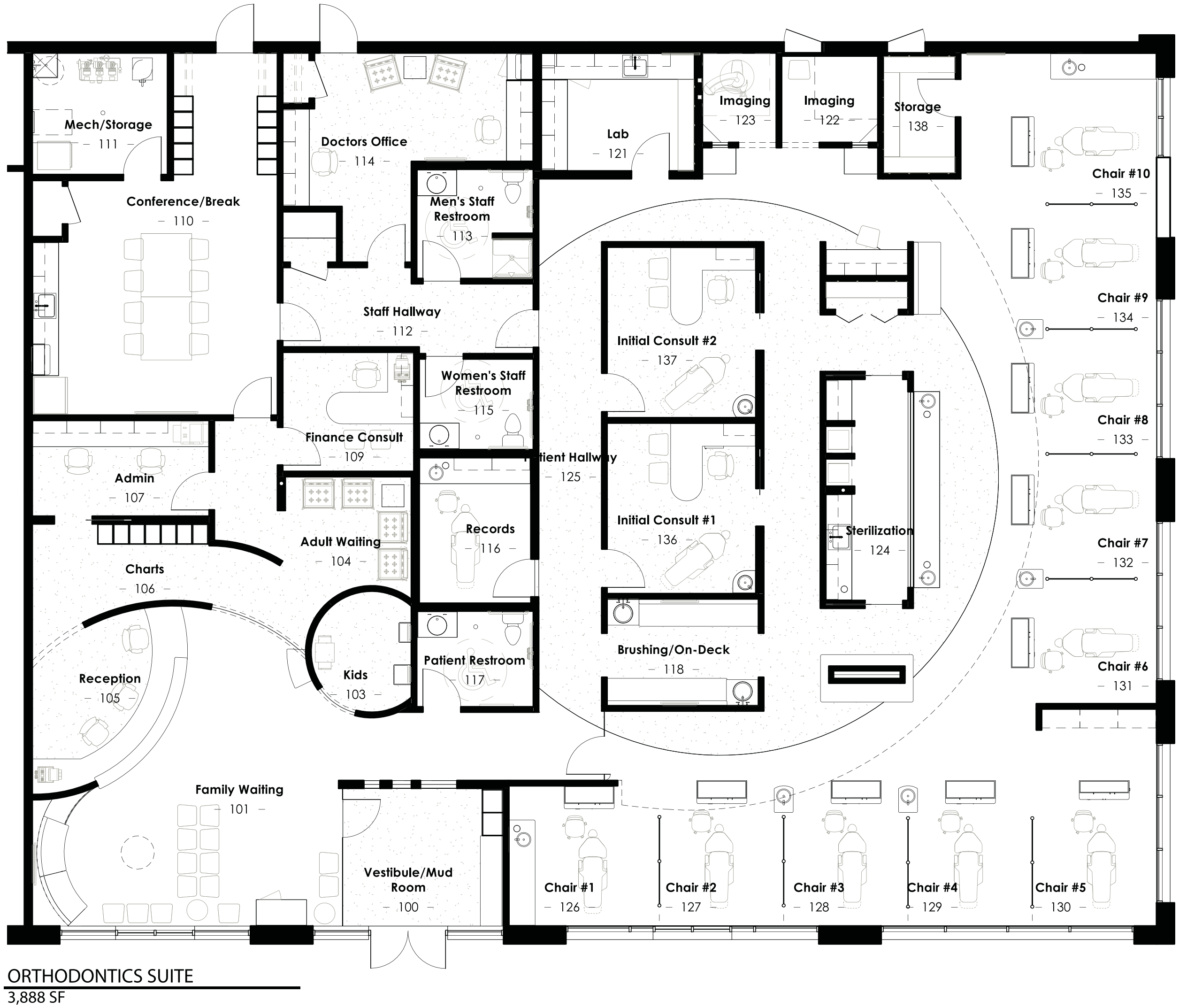


Figure 10-125. Space plan for orthodontics suite, 6,138 square feet. *(Courtesy of Joe Architect)*

Figure 10-126. Mobile pedestal orthodontics. *(Courtesy of Midmark Corporation)*

Figure 10-127. The *iTero* digital impression system. *(Courtesy of Align Technology, Inc.)*

A sophisticated palette of materials in earthy colors and an interplay of texture are complemented by high ceilings and a dual-sided fireplace (Figure 10-132). An entertainment/game area has an appealing pattern on the walls generated by the light fixture (see Color Plate 28, Figure 10-133). The space plan for this office is in Figure 10-125.

Patient Entertainment and Education

Many options exist for chairside education and entertainment using video, DVD, virtual reality video glasses, and satellite music or TV. As most appointments are short, however, the expense of installing a monitor in the ceiling may not be worthwhile. These topics have been discussed in detail under General Dentistry.

PEDIATRIC DENTISTRY

Pediatric dentistry (sometimes called *pedodontics*) is the branch of dentistry that specializes in children (see Figures 10-117, 10-118, 10-131, and 10-135 and Color Plate 29, Figures 10-137 and 10-138). It is based on a philosophy of prevention. If the child's teeth are maintained properly from an early age, there will be fewer problems as the child grows older. Thus, children from the ages of 2 to 18 visit pediatric dentists. Since the children are so

Figure 10-128. Design of waiting area reflects ocean imagery. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

Figure 10-129. Reception area design reflects the shape of a wave. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

young, much of the instruction and care of the child's teeth is entrusted to the parent. The parent must learn how to floss and brush the toddler's teeth, until the child is old enough to do it.

Thus, a patient education room is required and sometimes has a built-in bench so that the parent can be seated with the child's head in his or her lap and the child's body

Figure 10-130. Lighting and glass panel suggest ocean imagery. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

Figure 10-131. Space plan for Bloo Dental. *(Courtesy of FORMA Design, Inc.)*

Figure 10-132. Sophisticated design of orthodontics office features contemporary fireplace. *(Courtesy of Joe Architect; Photographer: Stuart Kasdorf Photography)*

stretched out on the bench. The bench simulates a couch or bed at home, where plaque control is done with a dry toothbrush, without paste or water. The dental assistant sits near the parent and guides him or her during the procedure. The room should also have a built-in cabinet with sink, a large mirror, and good illumination.

Traffic Flow

A child and parent, on the initial visit, are escorted to the treatment room where the child's teeth are X-rayed and examined. As an alternative, there may be a centrally located intraoral X-ray machine as well as one in each "quiet" room. Then the parent may visit with the doctor in a consultation room, or perhaps remain in the treatment room, to discuss the course of treatment, followed by a stop at the finance office to discuss the cost. Pediatric dentists often do interceptive orthodontics on 5- to 12-year-olds using fixed and removable appliances to grow and shape the bones of the upper and lower jaw, rather than waiting until they stop growing and then extracting teeth to make room. This type of work involves case presentations similar to orthodontics.

Figure 10-133. On-deck entertainment area in orthodontic office. *(Courtesy of Joe Architect; Photographer: Stuart Kasdorf Photography)*

Figure 10-134. Elegant vanity design in dental office. *(Courtesy of Joe Architect; Photographer: Jeff Scroggins Photography)*

Since visits are typically short, this tends to be a high-volume practice. Thus, the circulation of patients should be direct and well planned, and things that little children should not touch should be behind closed doors. The waiting room must be large, since each child is accompanied by one or both parents and, often, one or more siblings. A three-chair operatory bay may account for as many as 14 persons in the waiting room. The number of people in the waiting room is sometimes a function of the socio-economic composition of the practice. Families with low incomes who cannot afford babysitters tend to bring all the children when one of them has to visit the dentist.

Treatment Bay

The pedo chair is a bit smaller than a standard dental chair and it may be a flat table (see Figure 10-18). It is common in pediatric dentistry, as in orthodontics, to have the chairs arranged in an open bay (see Figures 10-52, 10-117, and 10-118). Peer group pressure seems to keep crying to a minimum. The room should have cabinetry, sinks, and other features similar to a general dentist's treatment room, and the room may be gaily decorated with artwork that appeals to children, located where they can see it.

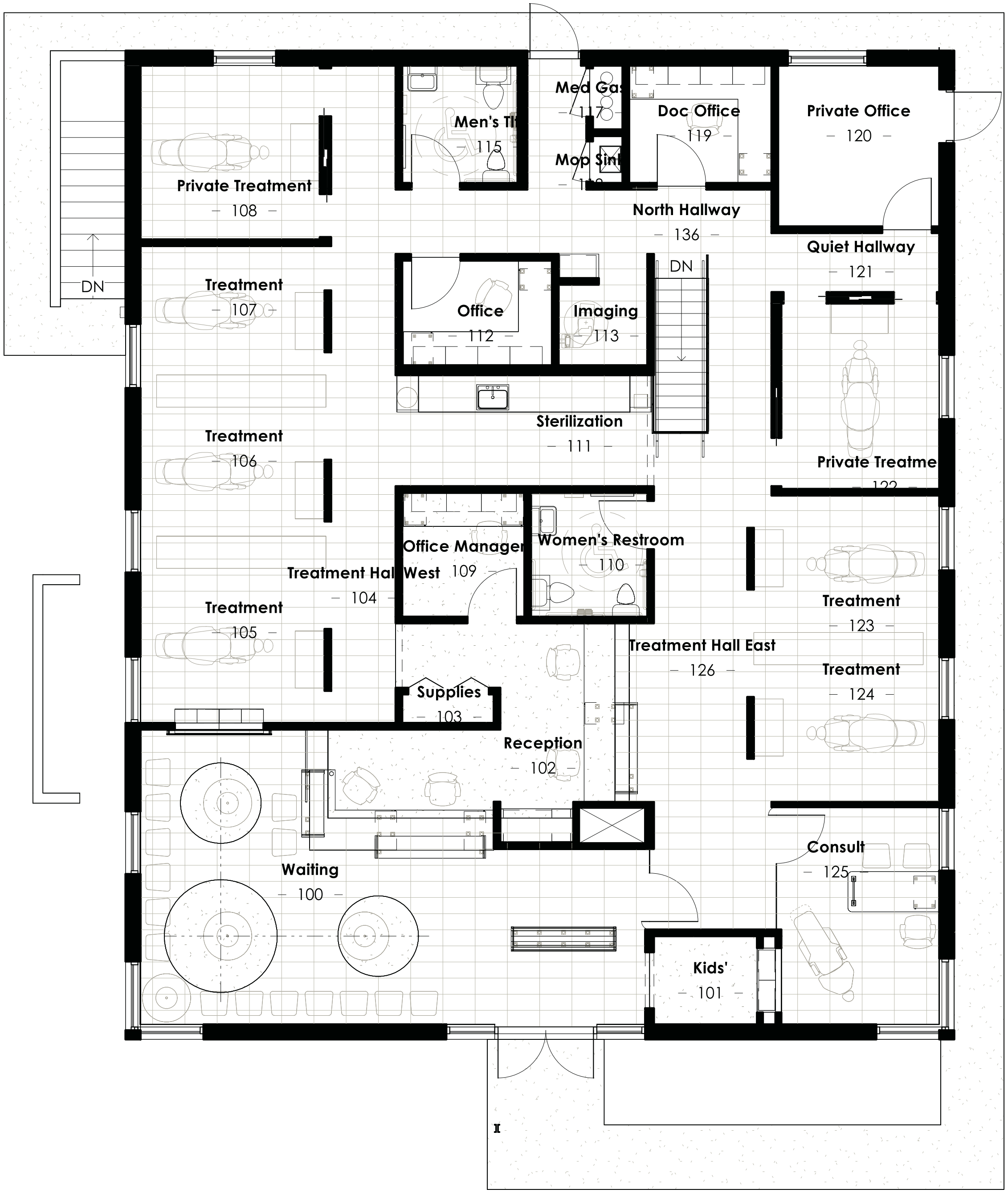


Figure 10-135. Space plan for pediatric dentistry suite, 6,000 square feet. *(Courtesy of Joe Architect)*

Table 10-3.
Analysis of Program
Pediatric Dentistry

No. of Dentists		**1**
Waiting Room		14 × 20 = 280
Business Office/Reception		12 × 16 = 192
Financial Consult		8 × 10 = 80
Office Manager		8 × 10 = 80
Operatory Bay (3 chairs)		12 × 18 = 216
Quiet Room/X-Ray		10 × 11 ½ = 115
Consultation/Exam		10 × 14 = 140
Sterilization /Lab		8 × 12 = 96
Pre-Med Room		8 × 8 = 64
Staff Lounge		10 × 10 = 100
Toilet Rooms	2 @	8 × 8 = 128
Prevention/Patient Education[a]		10 × 10 = 100
Panoramic X-Ray		6 × 6 = 36
Private Office		10 × 12 = 120
Housekeeping Closet		8 × 8 = 64
Storage		6 × 8 = 48
Mechanical Equipment Room		6 × 8 = 48
Tech Closet[b]		4 × 4 = 16
Tel. Equip. Closet		4 × 5 = 20
Biohazard Storage		4 × 4 = 16
Subtotal		1,959 SF
20% Circulation		391
Total		2,350 SF

[a]May also be done chairside with DVD or videos.
[b]Tech closet may be smaller if equipment rack is recessed into casework, as in Figure 10-55.

Pediatric dentists use the same dynamic instruments as general dentists. The delivery of instrumentation may be over the patient, from the side, or from the rear. There is no need for natural gas. Inhalation analgesia is fairly common in pedodontic practices. The gases are centrally piped to each chair, generally in the cabinet directly behind the patient's head. The sedation area in Figure 10-136 has a skyscape theme consistent with the rest of the office, with murals on walls and ceiling in shades of blue and rose. This room is located close to the private operatories and is used for sedating children prior to a procedure.

New Technology

Pediatric dentists will have the same high-tech equipment as general dentists: chairside computer and monitor(s), digital X-ray, intraoral cameras, and so forth, discussed in detail previously. A monitor over the child's head, in the ceiling, can be useful to distract them with cartoons, programming for children on dental hygiene, a DVD, or videos (see Figure 10-9, Figure 10-136, and Color Plate 29, Figures 10-137 and 10-138).

Other Rooms

The suite will require a business office and dental records area; darkroom (optional), panoramic X-ray unit (pan/ceph if interceptive orthodontics are done), storage room, sterilization area, lab, staff lounge; prevention/patient education room, private office, open treatment bay with at least three chairs to be used for examinations and hygiene, and two quiet rooms (generally equipped with intraoral X-ray) as soundproof as possible.

Waiting Room

This room can truly challenge the designer's imagination (Color Plate 30, Figures 10-139a and b, and Figure 10-140). It can be as fanciful as a fairy tale. Children get bored very quickly in a conventional waiting room. Therefore, they should be treated to something that captures their imagination and lets them climb around and expend their enormous energies. This has an added benefit: The children will associate a pleasant experience with a visit to the dentist, thus forging what may be a lifelong positive

relationship with good dental care. The space plan for the office shown in Color Plate 30, Figures 10-139a and b, can be seen in Figure 10-118. The office depicted in Color Plate 29, Figures 10-137 and 10-138, is focused on both pediatric and orthodontic care. The entire office has an elaborate design theme of the sea, featuring wave motifs in flooring, casework, and soffits and many works of art including both painted and mosaic tile murals. The entertainment center in Color Plate 26, Figure 10-122, is part of this office.

A built-in toy bin or treasure chest just under the cashier/checkout counter is welcomed by children. While the parent is making a payment or arranging a future appointment, the child is kept amused by selecting a toy. In Color Plate 30, Figure 10-139a, children are allowed to reach in and grab a toy from the casework to the left of the brushing cabinet upon exiting.

ENDODONTICS

This dental specialty is quite different from all the others in that much of the work is emergent in nature. Endodontists deal with the root of the tooth, and, therefore, all their treatment is within the tooth and difficult to see. Numerous working X-rays are taken during treatment to help guide the dentist.

Endodontists usually work four-handed except during surgical procedures, which are often done six-handed. One assistant handles the air, suction, and irrigation and hands instruments to the doctor; the other changes burs (drill bits) on the hand-pieces, reaches for items, and does the charting. Assistants also clean the room after the procedure and seat the next patient.

Perhaps more than any other specialty, endodontists use an operating microscope (see Figure 10-21), the mounting of which is critical to its ease of use. It requires appropriate bracing in the ceiling; minimizing vibration is essential. Refer to the previous discussion of ergonomics, operatory design, operating microscopes, intraoral cameras, and the placement of computers and monitors in the General Dentistry section. Endodontists are increasingly

Figure 10-136. Sedation area of pedodontic practice. *(Design: Rague Studio; Utgard Construction; Audio/Video Specialist: Keith Aderman/Mr. Hookup; Photo copyright © Nathan Padilla Bowen)*

Figure 10-137. Open bay for pediatric and orthodontic patients with a sea theme. *(Design: Rague Studio; Utgard Construction; Audio/Video Specialist: Keith Aderman/Mr. Hookup; Photo copyright © Nathan Padilla Bowen)*

Figure 10-138. One of many examples of art focused on sea imagery throughout this pediatric/orthodontic office. *(Design: Rague Studio; Utgard Construction; Audio/Video Specialist: Keith Aderman/Mr. Hookup; Photo copyright © Nathan Padilla Bowen)*

using a microscope with a high-quality digital camera with video output that enables them to see any tooth in great detail (aided by a mirror), and a computer or TV monitor. It provides a better image than an intraoral camera and this can be sent, with a digital X-ray and report, to the referring dentist by email.

The operatory in Figure 10-37, called the *optimal operatory*, works well for an endodontic practice. A solo practitioner would have two treatment operatories with a third one for postop visits or emergency care.

An endodontist has an intraoral X-ray unit in each operatory and a centrally located cone beam 3D radiography unit (see Figure 10-94) but there is no need for a panoramic or cephalometric X-ray within the suite. Digital imaging has become so widespread that the prior requirement for one darkroom for each dentist, unique to this specialty, will not be addressed. Some endodontists use an electronic device to measure the length of the root canal, thereby reducing the need for working X-rays during treatment. Sophisticated ultrasonic instruments are used to remove obstructions from root canals and, in microscopic surgery cases, allow for precise root-end fillings.

Figure 10-139a. Colorful waiting area for pediatrics/orthodontics office. *(Courtesy of Joe Architect; Photographer: Chipper Hatter)*

Figure 10-139b. Brushing cabinet in pedodontic/orthodontic office. *(Courtesy of Joe Architect; Photographer: Chipper Hatter)*

Endodontists use a lot of gadgets, perhaps more than any other specialty. In the process of doing routine root canal treatment, the following items are commonly used: an apex locator, an electric torque-control motor, an ultrasonic unit, a touch-n-heat unit, and a gutta-percha gun (or a System B heat source). These devices are in addition to the normal high- and low-speed hand-pieces and the air/water syringe. Each of these devices has a base and a hand-piece that must be easily accessed as well as a separate electrical plug. Therefore, there is a space management issue.

There is no need for a lab in an endodontic suite. The sterilization area should be designed as discussed under General Dentistry. The other rooms of the suite are similar to those required in general dentistry. There are no special requirements in terms of interior design other than those discussed under General Dentistry.

PERIODONTICS

Periodontists are dental specialists in oral medicine, the treatment of gum diseases, and the replacement of teeth utilizing dental implants. Some of these procedures involve both soft-tissue and hard-tissue grafting. Plaque control and oral hygiene are the essential components of

Figure 10-140. Reception desk in pediatric dental office. *(Courtesy of Joe Architect; Bob Soman Photography)*

the periodontal practice for long-term predictable results. This is why periodontic offices may have several treatment rooms specifically for hygiene and plaque control (see Figure 10-61), typically located at the front of the suite so that patients need not walk through the area of the office dedicated to treatment and surgery. In this plan, surgical and hygiene patients each have their own exit path for checking out and booking follow-up appointments.

Periodontic patients on the initial visit, after being examined, may meet with the office manager or treatment coordinator in the consultation room to discuss the course of treatment and make financial arrangements. Sometimes, the doctor discusses treatment options in a consultation room or private office where he or she may sketch the tooth and related tissue to explain to the patient what needs to be done.

The suite shown in Figure 10-61 is for a solo practitioner. A solo practitioner could function with two operatories, one for surgery and one for pre- and postop examinations; however, two surgery ops are better. Many periodontists believe that all operatories should be equipped in the same manner, enabling them to do surgical implants in any one of them. Others create a large surgical operatory for performing implant surgery.

Surgical Operatories

Surgical operatories are designed to meet hospital standards for sterility. Special consideration is given to smooth, cleanable surfaces (walls, floors, and ceilings), cabinets free of ledges to prevent the collection of dust; and an HVAC system that supplies the proper number of air changes per hour. Some doctors will have a scrub area, sterilization/clean utility room, recovery area, and soiled linen/cleanup room to support the surgery room. A dressing area may be required for changing into surgical attire and onsite laundry facilities are an option.

Operatory Size

A 10- by 12-foot room is the minimum for a surgery operatory as it typically involves six-handed dentistry (two

Table 10-4.
Analysis of Program
Periodontics

No. of Dentists		1		2
Waiting Room		14 × 16 = 224		14 × 16 = 224
Business Office/ Reception		12 × 14 = 168		14 × 16 = 224
Financial Consultation		8 × 10 = 80		8 × 10 = 80
Office Manager		10 × 12 = 120		10 × 12 = 120
Plaque Control/Hygiene Rooms	3 @	9 × 11 = 297	5 @	9 × 11 = 495
Surgical Operatories	2 @	11 × 12 = 264	4 @	11 × 12 = 528
Treatment/Exam		10 × 11½ = 115	2 @	10 × 11½ = 230
Sterilization		8 × 12 = 96		8 × 12 = 96
Tech Closet*		4 × 4 = 16		4 × 4 = 16
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Recovery (Optional)		8 × 10 = 80		8 × 10 = 80
Staff Lounge		10 × 12 = 120		12 × 12 = 144
Panoramic/Cone Beam Alcove		6 × 8 = 48		6 × 8 = 48
Private Office		8 × 10 = 80	2 @	8 × 10 = 160
Storage		6 × 8 = 48		8 × 8 = 64
Housekeeping Room		6 × 6 = 36		6 × 6 = 36
Mechanical Equipment Room		6 × 8 = 48		6 × 8 = 48
Tel. Equip. Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		2,004 SF		2,821 SF
20% Circulation		400		564
Total		2,404 SF		3,385 SF

*Tech closet may be smaller if equipment rack is recessed into casework, as in Figure 10-55.

assistants) and often involves a third assistant to circulate and bring items to the room during implant procedures. One assistant retracts and handles suction while another handles the instruments, which must be carefully

Figure 10-141. Implant Center, three-in-one unit offers Piezotome, I-Surg, and Newtron. *(Courtesy of ACTEON North America)*

separated as the titanium can be contaminated by the carbon steel instruments.

Blood may be drawn by a trained staff person or a contracted lab tech (phlebotomist) who brings a portable centrifuge, the purpose of which is to obtain autologous growth factor from platelet-rich plasma (PRP). This is added to bone graft material and becomes a gel, which is especially useful for sinus lifts with a bone graft. PRP enhances healing and bone formation.

There are numerous pieces of equipment that must be accommodated in the surgery operatory: a centrifuge for platelet preparation, dynamic hand-pieces, a laser, intraoral camera, computer and several monitors (explained below), digital X-ray, operating microscope (used by some doctors), and medical gases (N_2O and O_2), usually centrally piped. If intravenous sedation is used, blood pressure, pulse, and respiration must be constantly monitored. All emergency equipment, such as a defibrillator,

Figure 10-142. iPad station for updating medical history. *(Utgard Construction; Photo copyright © Nathan Padilla Bowen)*

should be behind the patient, out of view. The doctor may wear a fiber-optic headlamp, which is tethered to a battery pack or to an electrical outlet. If an operating microscope is used, a beam splitter and binocular eyepiece enable the assistant to see what the doctor is seeing. In addition, a video camera can be attached to the microscope.

A special electric surgery hand-piece is used when doing implants. The unit is portable and has to sit on something either behind or to the side of the patient (Figure 10-141). It has a stainless steel hook that holds a saline bag. The unit is self-cooled and must be connected to electricity to drive it. In addition, standard hand-pieces are also used.

The dentist may select over-the-patient, rear, or side delivery of instrumentation. Ideally, the dentist would use rear delivery, and the assistant, working to the left of the patient, would either work off of her own mobile cart or use a dual cart, shared with the doctor. All operatories may be equipped with intraoral X-ray units. Cone beam CT is used for treatment planning.

HVAC Issues

Although some periodontists pay more attention to this than others, HEPA-filtered air, with the number of air changes required for medical surgery rooms or clean rooms, reduces the possibility of infection. Some doctors install a laminar-flow system to “bathe” the patient in clean air, which is drawn out of the room by return air grilles near the floor.

Surgical Attire

Surgical staff wear scrubs during procedures and typically wear disposable gowns over the scrubs. As has been discussed earlier, OSHA does not allow staff to wear contaminated linen out of the office. Clothes must be changed prior to leaving the office and soiled linen placed in a hamper for laundry pickup. There will be additional linen associated with patient drapes and bibs, which, alternatively, may be disposable. Lockers may be provided for staff street clothes and personal effects; the staff restroom is often used for changing clothes.

Other Rooms

All other rooms in the suite are similar to those required for general dentistry, including the business office, staff lounge, private office, and so forth. There are no special

considerations with respect to interior design, but if the doctor does a lot of implant surgery, some of those patients will be elderly and may be more comfortable in an office that is calm and relaxing. A small recovery area may be provided with a recliner chair for the occasional patient who requires it.

ORAL AND MAXILLOFACIAL SURGERY

Oral and maxillofacial surgeons perform a variety of procedures: dentoalveolar surgery, oral and craniomaxillofacial implant surgery, correction of maxillofacial skeletal deformities, cleft and craniofacial surgery, trauma surgery, TMJ surgery, diagnosis and management of pathologic conditions, reconstructive surgery, and cosmetic maxillofacial surgery.

An oral surgeon's work consists primarily of *diagnosis* and *surgery*. On a patient's initial visit, a diagnosis will be made. Then the patient will be scheduled for surgery. However, the patient is often referred for surgery without a prior consultation. A medical history must be taken for each patient or filled out in advance. Some oral surgeons prefer to have the staff member take the patient history, perhaps in a private area in the business office, while others accomplish this in the consultation room. Most allow patients to complete their medical history while seated in the waiting room, using a clipboard or tablet computer (Figure 10-142). Similarly, some oral surgeons prefer to give postoperative instructions in the recovery room, while others like the patient and family members to sit near the front of the office to accomplish this prior to exiting.

Some oral surgeons use a consultation/patient education room located near the front of the suite to explain procedures to patients and to review X-rays (see Figures 10-75 and 10-76). Depending on individual needs, the room may have a table or desk, a computer and monitor, a dental chair, and a cabinet with sink.

For a solo practitioner, two treatment rooms will suffice for examination and diagnosis, and may be used for postoperative procedures and checkups, as well. One or both of these rooms will be equipped for taking intraoral X-rays, although this may be done in a central imaging room as in Figure 10-75. In addition, there is an alcove for a panoramic/cephalometric X-ray unit or perhaps a combined pan/ceph/cone beam CT unit (see Figures 10-91

Table 10-5.
Analysis of Program
Oral and Maxillofacial Surgery

No. of Oral Surgeons		1		2
Waiting Room		14 × 16 = 224		16 × 18 = 288
Business Office/Reception		14 × 16 = 224		14 × 16 = 224
Financial Consultation		8 × 10 = 80		8 × 10 = 80
Office Manager		10 × 10 = 100		10 × 10 = 100
Examination/Consult	2 @	10 × 11 ½ = 230	4 @	10 × 11 ½ = 460
Surgical Operatories	2 @	12 × 14 = 336	4 @	12 × 14 = 672
Gurney Holding Pre/Post		8 ×10 = 80		8 × 10 = 80
Prep/Cleanup		10 × 10 = 100		10 × 10 = 100
Recovery Area	2 @	6 × 8 = 96	4 @	6 × 8 = 192
Pan/Ceph/3D Cone Beam		6 × 8 = 48		6 × 8 = 48
Sterilization		6 × 12 = 72		8 × 12 = 96
Wheelchair Storage		4 × 4 = 16		4 × 4 = 16
Lab		8 × 8 = 64		8 × 8 = 64
Tech Closet*		4 × 4 = 16		4 × 4 = 16
Private Office[a]		8 × 8 = 64	2 @	10 × 12 = 240
Training Classroom		14 × 16 = 224		14 × 16 = 224
Toilets	2 @	8 × 8 = 128	3 @	8 × 8 = 192
Staff Lounge		10 × 12 = 120		12 × 12 = 144
Storage		6 × 6 = 36		6 × 8 = 48
Housekeeping Room		6 × 6 = 36		6 × 6 = 36
Mechanical Equipment Room[b]		6 × 8 = 48		6 × 8 = 48
Tel. Equip. Closet		4 × 5 = 20		4 × 5 = 20
Biohazard Storage		4 × 4 = 16		4 × 4 = 16
Subtotal		2,378 SF		3,404 SF
20% Circulation		475		668
Total		2,853 SF		4,072 SF

[a]Shared in two-doctor office.
[b]Vacuum, medical gases, air compressor, and generator.
*Contains rack for electronic equipment, audio-video, and IT server.

Figure 10-143. Oral surgery operatory. *(Courtesy of Joe Architect; Bob Soman Photography)*

Figure 10-144a. Contemporary design of oral and maxillofacial surgery office, San Francisco Surgical Arts Inc. *(Courtesy of Dr. Nima Massoomi, DMD, M.Ed, MD)*

and 10-92). If these rooms are located at the front of the suite near the waiting room, only surgical patients need enter the rear. Ideally, traffic would be separated so that the exam/diagnosis/X-ray functions are near the front

of the suite (see Figure 10-73) and the doctors' private offices, sterilization, recovery, and surgical operatories are at the rear of the suite, perhaps with an exit for postoperative patients, so they don't have to walk through the waiting room (see Figures 10-73 and 10-76).

A solo practitioner would generally have two surgical operatories in addition to the two exam/diagnosis treatment rooms (see Figure 10-76). A larger suite for three oral surgeons, where no more than two are practicing simultaneously, is shown in Figure 10-75. Typically, such a suite would have four surgical operatories, four exam/treatment rooms, a small lab, two or three recovery beds, a staff lounge, a good-sized reception/business office, and a large sterilization area.

Some oral surgeons do not have a lab; others have a small one. If the suite lacks space for a dedicated equipment room, the air compressor and vacuum can be located in the lab.

Flow to Surgery

Practices vary in how they handle the flow to surgery, in terms of where they administer anesthesia. Some may do it in a prep area, then roll the patient into the operatory and back to the recovery area; others will administer anesthesia in the operatory. It is not uncommon for oral surgeons to administer general anesthesia as most have a general anesthesia permit and, in fact, oral surgeons occasionally have a medical degree as well as a dental degree. The facility in Figure 8-5 is associated with an academic medical center and has been designed as a fully licensed and accredited surgery center available to oral surgeons and other surgical specialties. The oral surgery clinic that is attached to the surgery center is not shown in the book.

X-Ray

Oral surgeons generally have X-ray machines in the pre-op exam rooms. In addition, an alcove for a pan/ceph

Figure 10-144b. Geometry of internal core and lighting create a tranquil environment, San Francisco Surgical Arts Inc. *(Courtesy of Dr. Nima Massoomi, DMD, M.Ed, MD)*

X-ray is located near the front of the suite or examination area. A frequent oversight is lack of wheelchair access to the panoramic, and also intraoral, X-ray units. One of the most important diagnostic and treatment planning tools is 3D cone beam CT scanning. It provides precise, high-definition images of oral and maxillofacial

Figure 10-145. Oral surgery operatory, San Francisco Surgical Arts Inc. *(Courtesy of Dr. Nima Massoomi, DMD, M.Ed, MD)*

structures and uses far less radiation than conventional CT or film-based modalities. It is critically important for evaluating the amount of bone available for placement of the implant and provides a view of the sinuses, impacted teeth, nerves, and blood vessels. The Gendex *GXDP-700*™ incorporating *i-CAT*® *Precise* tomographic technology (see Figure 10-91) is designed for general practitioners who do implants and oral surgeons who do not need to see the whole skull. The Instrumentarium *Orthopantomograph*® *OP300* (see Figure 10-92) and the Gendex *GXDP-700*™ both offer three-in-one pan/ceph and 3D cone beam in one unit.

Surgical Operating Rooms

Oral surgeons usually work eight-handed, using three assistants. One assistant handles the suction and retraction, another stabilizes the patient's head and manages the airway, while a third assistant circulates to bring instruments needed during the procedure. The doctor often wears a fiber-optic headlamp for additional illumination. It is tethered to a battery pack or electrical outlet that must be properly located to avoid neck strain. This outlet must be on the emergency power system in case of a blackout.

Surgical operatories are generally large, 10 × 14 or 12 × 14 feet in size. Many oral surgeons like the room designed with a full wall of base cabinets behind the patient's head or to the side, on a long wall. There is a large sink, outlets for oxygen and nitrous oxide, an open area for storing the anesthesia cart, and perhaps an area for storing the assistant's mobile cart. There are a number of electrical outlets that must be properly located. The sink has foot-pedal controls or wrist-action faucets for scrub. Other equipment in the room includes a pulse oximeter, an automatic blood pressure machine, and an ECG monitor. A defibrillator is also required. All these items may be combined in one unit. The assistant, whether working off of a mobile cart from the rear or using side delivery, needs suction.

Some oral surgeons use compressed nitrogen to drive high-speed surgical hand-pieces because it is a pure propellant, delivering very high, constant pressure. An electric surgery unit (see Figure 10-141) is an option to nitrogen-powered hand-pieces and is always used with implant surgery. Compressed air is generally used only to drive hand-pieces in the lab. The doctor may use a Mayo stand to hold the instrument tray or may work off of a mobile cart or a table that slides over the patient's chest.

Medical gases must be piped into the room through degreased, sealed copper tubing (using only silver solder) to a flowmeter in each surgery. Building and fire codes are very strict regarding where and how medical gases are stored. The reader is referred to the General Dentistry section of this chapter for further discussion of this topic.

Oral surgeons may use a power procedure chair (see Figure 10-145), an operating table (Figure 10-143), or occasionally, a standard dental chair with an armboard attachment for administering intravenous sedation. Oral surgeons often work standing up but this is not universal, so the chair must be able to be raised to the proper height. A resuscitation cart is nearby and close to electrical outlets to enable emergency equipment to be used immediately. Surgical operatories should have a nurse call buzzer.

A surgical light in the operatory is needed and should be easy to manipulate. It needs good color-rendition lamps for skin tones and a high color rendering index (refer to Chapter 12 and also "Lighting" under General Dentistry).

Recovery

Before planning an oral surgery suite, the space planner must determine how the doctor transfers patients from the operatory to the recovery area. Many oral surgeons walk patients with assistance, others use a wheelchair, and some may even use an operating room–type gurney. The patient may remain on the gurney in the recovery room or may be transferred to a recovery bed. Sometimes oral surgeons do long, complicated procedures in a hospital or an ambulatory surgical center, rather than in the office. If a gurney is used to transfer patients, then surgical operatories, corridors, and recovery rooms have to be large enough to accommodate maneuvering (see Figure 10-73). In addition, a place to store the gurney or wheelchair is required. Consideration must also be given to access by paramedics to enter the suite, use the elevator, and evacuate a patient in an emergency (see Figure 10-73). Note that patients from skilled nursing facilities often arrive on gurneys; therefore, it may be desirable to use 42-inch-wide doors on surgery operatories.

Alternatively, the patient may be allowed to recover in the surgery room while the staff are cleaning it up, or the patient may be walked to a recliner chair (see Figures 10-73 and 10-148). If a recovery area is provided, there should also be a place for a companion to sit, a hook or locker for personal items, a toilet nearby, and a rear, private exit so that the patient does not have to pass through the waiting room after surgery. A certain amount of privacy should be provided for each recovering patient, either by fixed partitions or by a cubicle curtain. The recovery area must be located so that the staff can always observe patients while going about their cleanup and other duties (see Figure 10-75).

Figure 10-146. Hands-free glass doors with motion sensors are an infection control strategy, San Francisco Surgical Arts Inc. *(Courtesy of Dr. Nima Massoomi, DMD, M.Ed, MD)*

Provision for oxygen delivery must be considered as well as appropriately located electrical outlets for

Figure 10-147. Internet café at Atlanta Dental Spa. *(Courtesy of Wilcox Design Group and Atlanta Dental Spa)*

monitoring equipment. Most oral surgeons want centrally piped oxygen and suction in the recovery area.

Sterilization

The sterilization area for an oral surgery practice would not differ from that described under General Dentistry except that an area for storing clean linen and surgical supplies is required, as is a holding area for soiled linen, which should not be in the sterilization room.

Utilities

These have been discussed in detail under General Dentistry but a few additional comments are required. For obvious reasons, emergency back-up electrical power must be provided, adequate to enable the surgeon to complete the procedure. If on the ground floor, a diesel-powered generator may be used or, on an upper floor, a high-capacity battery back-up. Digital X-ray and computers should also be connected to it. This generator is about the size of a washing machine and needs good ventilation as it produces heat.

Another issue, relevant to HVAC, is that the surgical operatories should be zoned to be cooler than the rest of the office. A blanket warmer to comfort patients can be located in the sterilization area or prep workroom. Refer to Periodontics for a discussion of air filtration to reduce infection.

Regulatory Agency Review

Oral surgery suites are usually built to Accreditation Association for Ambulatory Health Care (AAAHC) or The Joint Commission standards, both of which are quite rigorous. The Joint Commission accredited its first oral surgery practice in March 2001 under its ambulatory care voluntary accreditation program. The use of general anesthesia—usually conscious sedation—triggers a variety of fire and life safety codes that have become far more stringent even in the past year. This has been explained in great detail in Chapter 8 as well as in Chapter 5 under Plastic Surgery. Consult the Index for other listings such as “office-based surgery.”

Other Rooms

A staff lounge is important due to the demanding nature of the work. The private office may be small, since patients usually do not enter. It is a place for the doctor to catch up on email, return phone calls, and take a break between procedures. The suite should contain at least two toilet rooms and a storage room. Due to the nature of the procedures, the volume of patients is low, so neither the business office nor the waiting room need

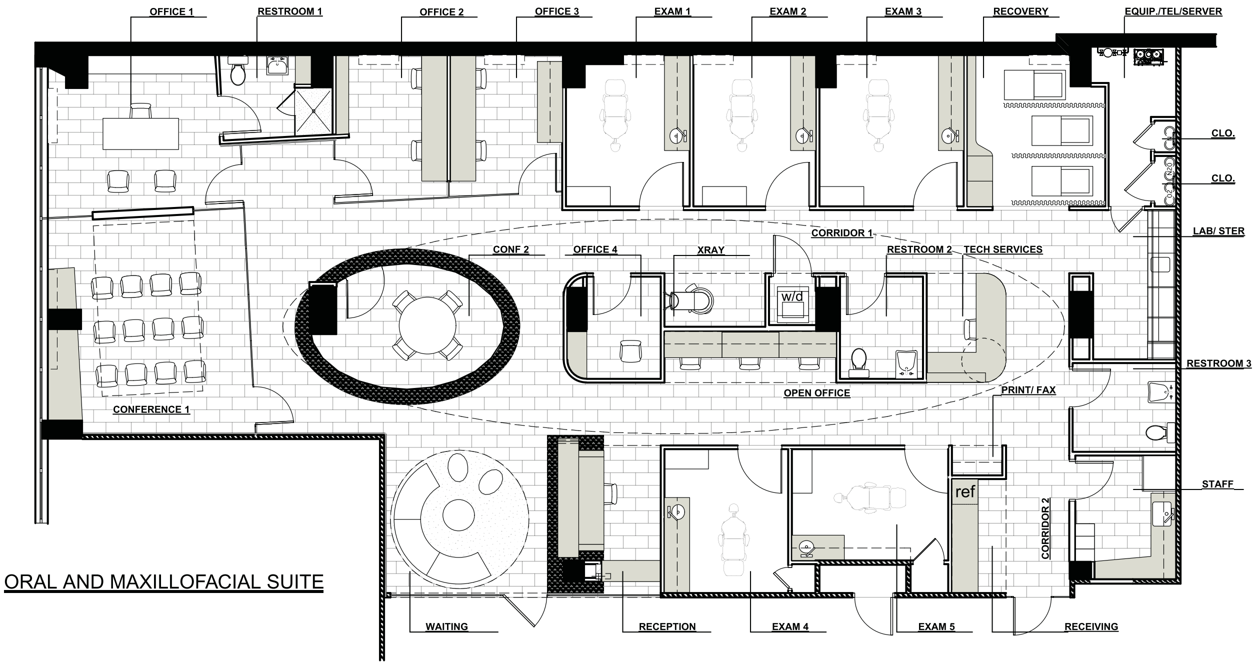


Figure 10-148. Space plan for Capital Oral and Facial Surgery Center. *(Courtesy of FORMA Design, Inc.)*

be large, but remember that most patients arrive with at least one other person, and sometimes two. As with any surgical specialty, the office should be conservatively furnished using relaxing colors and avoiding flamboyance or frivolity. The surgeon's image should be that of a serious person, skilled and successful at his or her profession.

Consult the reference guide at the end of the General Dentistry section for links to other chapters of the book that may be of interest to dentists such as lighting, color, and interior design.

UNIQUE PROJECTS

A number of dental offices integrated into this chapter have extraordinary design and it is unfortunate to not have been able to include a full set of photos for each of these projects. With limitations on color photos, not all appear in color. Although they vary considerably in style, what they share is attention to detail, originality, and good design. Two design firms in particular stand out. The body of work by the firm Joe Architect in Denver is impressive in both its scope and ability to work in diverse styles from sleek and modern to rustic, yet always consistent in good lighting design, use of color, and composition. These offices have good functional planning as well. Another firm, FORMA (Washington, D.C.), creates medical and dental offices with a consistent ultra-contemporary design aesthetic with bold use of color, intriguing ceiling design, and challenging geometry. Projects by these two firms can be seen throughout the chapter and in the Color Plates section of the book. Also look at the design of a LASIK Center in Color Plate 16, Figures 5-83c and 5-83d. The design of a dental office needs to resonate with the community served and feel comfortable but, at the same time, it is

an expression of the taste of the dentist who has to enjoy working in the space. Compare and contrast the design of the office in Figure 10-3, which is no doubt homey and comfortable for residents of this Seattle community, with the all-white office set off by one strong signature color in Color Plate 26, Figure 10-110 in San Diego, with the sophisticated endodontic office in Figure 10-108—in red, white, and black and the three projects that follow.

The following trio of projects represents very different aesthetic styles but each is uniquely original in its approach to design. Geographically, they are diverse: San Francisco, Atlanta, and Washington, D.C. It is interesting that two of them are oral and maxillofacial surgery.

San Francisco Surgical Arts Inc.

Dr. Nima Massoomi had a vision of being the "most high-tech, surgically-green practice in the Silicon Valley." Working with the Kohan Group, he accomplished it by becoming the first medical/surgical office in the nation to achieve LEED® Platinum (Commercial LEED-CI v.2009) status. The extent to which he embraced sustainability went from building materials to HVAC and water systems, selection of dental equipment, to LED monitors and solar-powered keyboards as well as adherence to green cleaning procedures. His strategies are outlined in a 10-page document that he is all too willing to share in order to encourage more dentists to follow his path. He maintains a totally paperless office and has calculated the carbon footprint of virtually everything in the office. His selection of dental equipment includes a dry *Eco-vac* vacuum system with amalgam separator, the *Vatech Reve-3D®* CBCT (see Figures 10-15 and 10-17) with ultra-low-dose radiation profile, *iTero* intraoral scanner for digital impressions (Figure 10-127), and the *NOMAD* (Figure 10-43) hand-held digital X-ray. These are but a few highlights of the strategies employed by a doctor driven by a passion to be a good steward of the environment. Every aspect of space planning was thoughtfully considered. The curved shape of the building shell posed challenges, as did the change in site elevation. Coring through the tension slab was performed in order to have under-the-floor plumbing in treatment rooms. Concern about acoustics led to using "Quiet Rock" sheetrock between operatories both to provide patient privacy and to reduce noise from hand-pieces.

Aesthetically, the goal was to create a warm, spa-like feel with the use of earth-tone pastel colors and carefully selected lighting (Color Plate 31, Figures 10-144a and b). A number of amenities have been provided for family members waiting for patients during surgery to entertain them. One of these is a beautifully appointed bathroom that actually has a TV monitor in it. A few of the more unusual aspects of the office follow:

- For teaching seminars the main operatory room is equipped with a digital video camera overhead that broadcasts surgeries live to all the monitors in the office.
- Real-time video cameras in all the operatories to monitor patient and staff flow and to resolve bottlenecks.
- Automatic hands-free sliding glass doors on operatories eliminate the need to manually open them (thereby enhancing infection control), reduce the transmission of sound, and admit natural light into the core space (Figure 10-146). These are operated by sensors.
- Note the sloping walls of the corridor, creating the illusion of more spaciousness (Color Plate 31, Figure 10-144b and Figure 10-146).
- Custom cabinetry fabricated from FSC-certified wood to hide the medical gas plumbing behind the chairs to reduce visual clutter and patients' anxiety (Figure 10-145).

Atlanta Dental Spa

Designer Mark Wilcox (Wilcox Design Group, Atlanta) sought to create a relaxing mood for this general dentistry office that he describes as providing an immediate sense of calm and a dream-like environment (see Figure 10-6). Interior elements are "organic" in design, materials, or concept whenever possible: keeping all finishes white or natural

in color, curving 75 percent of interior walls into a "river-like" path, incorporating an interior waterfall with "floating fish" suspended on fish line (see Color Plate 25, Figure 10-7a), selecting organically shaped furniture, designing the lighting to mimic sunlight through the trees and/or accentuating the shape of a winding riverbank (see Figure 10-7a), and designing a leaf motif sunscreen to help shade the 65-feet-long glass wall of the lobby (see Figure 10-6).

The white trees here and there are recycled crape myrtles that have been dried and coated with a high gloss finish. The floor is natural acacia "hand-scraped" engineered wood flooring, selected for its variation in grain. The columns (structural) are encased in round column covers, then faced with round glass mosaic tile. Seating is white wool and white leather. In various locations, stacked faux stone creates a dramatic contrast with the white furniture, white walls, and wood floor (see Figure 10-6; Color Plate 25, Figures 10-7a and b). An Internet café (depicted in Figure 10-147) is an amenity patients appreciate. This is an 8,000-square-foot office, which explains the large size of the sterilization area (see Figure 10-82).

Capital Oral and Facial Surgery Center

When Dr. Virginia Lee (Washington, D.C.) decided it was time to expand her office she thought about an image that expressed her personal taste and also her Asian heritage. She realized that the office she had been in for many years, even after redecorating, never really suited her. She wanted something very different from most dental offices she had seen—spaces that were transparent and open and flowing—all without sacrificing good functional flow. When she saw the work of FORMA Design she felt that together they could create the right design aesthetic. The geometry of the space with angled and elliptical glass walls (Figure 10-148) and the interplay of textures—some of them white on white—create a stunning elegance (Color Plate 32, Figures 10-149 and 10-150). Dark wenge wood wall panels are juxtaposed against white porcelain tile floors and sky blue accent walls in each operatory. The elliptical conference room is surrounded by an inset

Figure 10-149. Elegant reception desk, Capital Oral and Facial Surgery Center. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

of pebbles evoking a Zen rock garden. Her love of fresh flowers was reflected in the large photo of orchids incorporated into the reception desk on an illuminated glass panel (Color Plate 32, Figure 10-149).

Dr. Lee gives lectures and educational seminars, which meant that a lecture/classroom had to be incorporated

Figure 10-150. Sophisticated design in a neutral color palette is enhanced by a range of textures and interesting geometry, Capital Oral and Facial Surgery Center. *(FORMA Design, Inc.; Photography by Geoffrey Hodgdon)*

into the space (see Figure 10-116) and it takes advantage of the only daylight in the space. FORMA went on to do branding for the dental practice, developing a new logo based on Aphrodite.

SUMMARY

Much has changed in the practice of dentistry in the last 10 years, causing many dentists to want to renovate their offices. Computers and monitors in dental treatment rooms enable patients to more fully understand their dental conditions and treatment options. Concern about infection control has mandated new criteria for sterilization of instruments. Consumers are more educated about healthcare and, in turn, are more selective about the professionals with whom they place their trust. Dentists, increasingly concerned about marketing, are engaging designers with specific expertise in dental planning to help them create a functional office with an image that will appeal to their patients.

CHAPTER 11

Interior Finishes and Furniture

The interior design of a medical or dental office is critically important to the patients' assessment of the physician or dentist and the level of anxiety patients experience. Patients can rarely assess the quality of the clinical care provided. Nevertheless, a judgment is made based on interactions with staff and an evaluation of the interior environment. Visible attention to detail in office design generates feelings of confidence about the healthcare professionals who work there and the services that are provided.

This chapter will discuss specifications of interior finish materials and furniture items that are particularly well suited to medical and dental offices. Photographs of individual rooms displaying a great attention to detail are scattered throughout the chapters of this book and in the color plates.

Occasionally, medical and dental interiors are designed to residential standards, with materials not intended to withstand the stress of a high-volume office. A door that, in a residence, may be opened and closed 3,000 times a year, or, in a medical office, may be opened and closed 100,000 times a year. Similarly, cut pile carpet designed for residential use does not hold up well. It is difficult to clean and may show wear sooner than a commercial or healthcare-type carpet.

Certain high-profile suites such as plastic surgery may demand unusual interior finishes to achieve their marketing goals; however, sanitation and flammability considerations must not be overlooked. There are two issues here. First, if a product specified does not meet the minimum flammability standard for a particular usage, the physician may be denied Medicare reimbursement or the facility may be denied state licensing. For example, putting a hardwood floor in the operating room of an office-based surgery suite will prevent that physician from getting reimbursed for the use of the facility and may also prevent accreditation. In order to gain Medicare certification and reimbursement from many of the third-party payers, the surgery suite must meet NFPA 101® Life Safety Code, which stipulates fire ratings, among other things, for all areas of an office-based surgery suite.

The second issue is potential liability in case of fire faced by the designer who specifies interior finish materials. If, after a fire, it is determined that any of the materials within the office did not meet the minimum flammability requirements, the designer is certain to be included in the lawsuit. These are the two main reasons that designers should be extremely cautious and diligent in determining which, if any, local or state codes apply to the selection of interior finishes for their specific medical or dental project.

The International Building Code (IBC), adopted in all states, classifies medical office buildings as Group B occupancy. As of this writing, interior finishes having a flame-spread index of 75 or less would be suitable for all areas within the suite (with the exception of surgery suites, where patients may be unconscious). Some areas of the suite may have finishes with a flame-spread rating in excess of 75, provided the area is not an enclosed vertical exitway (stairway) or an exit corridor. However, in the IBC, *textile* wallcoverings must be Class A (flame spread of 25 or less) in any part of a suite.

A suspended acoustic tile ceiling is more functional than a gypsum board ceiling because it gives access to the electrical and mechanical equipment above it and is easier to clean. Where sanitation is of extreme importance, a vinyl-coated acoustic tile or an enameled gypsum board ceiling should be used.

HARD-SURFACE FLOORING

Flooring may be carpet, vinyl composition tile (VCT), sheet vinyl, linoleum, rubber, luxury vinyl tile, ceramic tile, or a combination of all of these. The least expensive flooring is VCT, which is very durable, but it does need to be waxed and buffed. Sheet vinyl is recommended for wet areas such as bathrooms if the budget does not allow for ceramic tile. Sheet vinyl is also recommended in minor surgeries or anywhere sanitation is a concern because it has fewer seams than VCT and may be installed with a self-cove base. Tarkett, a Swedish manufacturer, markets several high-quality sheet vinyl floorings suitable for operating room suites and other treatment areas where cleanliness is important. It also offers a cushioned sheet vinyl that does not compress under the weight of heavy equipment. The Tarkett products are extremely flexible and malleable, allowing them to be coved up and around inside and outside corners, pipes, floor sinks, or other obstructions, creating a seamless floor. Similar products by Mannington and Armstrong are also excellent. Seams should be heat-welded to protect against the penetration of dirt and moisture.

Sheet vinyl used in high-traffic areas or where considerable pivoting takes place, such as in an operating room, should have color that is integral throughout the entire thickness of the material, as opposed to a thin layer of color laminated to a backing material. Suitable products include Armstrong Medintech, Mannington BioSpec®, and Tarkett iQ Eminent.

Wood-look floors are very popular in commercial applications as they provide a more sophisticated look without the maintenance of a real wood floor. Wood-look floors are available in both plank or sheet goods. Planks are anywhere from 3 to 9 inches wide and typically 36 to 48 inches long. A wide variety of wood species and finishes are available from manufacturers such as Amtico, Parterre®, and Centiva. A wood-look sheet good product provides a seamless installation although a self-cove base on a wood-look floor can look peculiar. Care must also be taken to specify a heat weld rod that coordinates with the wood tone. A great number of wood-look sheet vinyl products are on the market, including Toli® Mature Wood, Armstrong® Rejuvenations Timberline, Lonseal Lonwood, and Gerflor® Nera Contract Wood.

Products such as sheet vinyl, vinyl composition tile, and luxury vinyl tile contain polyvinyl chloride (PVC) and phthalates, or plasticizers, used to make the vinyl more malleable. The manufacturing of PVC has been linked to health problems such as cancer and endocrine disruption. Phthalates are also endocrine disrupters and have been linked to asthma and allergies. To avoid the use of such chemicals in an interior environment, PVC-free options are available including linoleum and rubber flooring. Forbo and Armstrong® offer linoleum in a variety of colors and patterns. Mondo® and Nora® offer rubber flooring in either tile or sheet goods. PVC-free options from Johnsonite® include both rubber tile and linoleum. CERES offers Sequoia, a wood-look plank floor, and WELS Sheet, both manufactured without the use of PVC.

For an authentic wood floor, an attractive product from Nydree Flooring meets Class 1 flame-spread rating, although does not create a seamless installation. Nydree is an engineered wood composed of a wood veneer wear layer impregnated with liquid acrylic making it a stronger floor and easier to clean. Armstrong® Performance Plus™ is another commercial hardwood floor that meets Class 1 flame-spread rating.

CARPET

It is not uncommon to find entire medical or dental offices carpeted although exam rooms, treatment rooms, and dental operatories—due to spills—should be hard-surface. Apart from any considerations previously discussed regarding infection control, carpet, if selected properly, is easy to maintain and adds warmth to the office appearance. It provides a much-needed acoustic function as well, and it prevents serious accidents caused by people slipping. Acting as an air filter, carpet actually improves indoor air quality by holding on to dust particles, which might otherwise become airborne, until vacuum cleaners equipped with environmental airbags remove the dust from the carpet.

Performance Factors

When discussing carpet construction, it is important to keep in mind the fiber composition of a carpet style is only one of several performance factors to consider in the specification process. *Backing, yarn weight, pile height, camouflage, texture*, and *color* can have as great a combined impact on the suitability and performance of carpet as fiber selection. However, these factors can never compensate for a budget-priced fiber that lacks the physical structure or stain-resisting additives of quality healthcare carpet. Therefore, careful evaluation and comparison of all specifications should be made prior to selecting a specific carpet.

Nylon is the fiber of choice for most healthcare facilities. Superior performance characteristics such as resiliency, abrasion resistance, cleanability, stain resistance, and texture retention have virtually eliminated other fibers such as polyester and acrylic in the commercial setting.

In commercial carpet, the two types of nylon most prevalent are nylon 6,6 and nylon 6. Type 6,6 nylon (Antron®, Ultron®) is a harder and more resilient fiber than type 6 due to the construction of the fiber and a tighter molecular structure. According to the manufacturers of Ultron®, nylon 6,6 fiber has a 12 percent harder fiber surface and a 20 percent higher resilience than nylon 6. All other things being equal, this could affect performance characteristics accordingly; however, pattern, camouflage, color, and other factors can help to compensate. Piece-dyed and yarn-dyed solids or tonal colorations are often constructed with type 6,6 nylon. Piece-dyed means that the carpet is made in what is called greige goods (undyed, neutral gray/beige yarn color) and dyed after it is woven as a "piece" of carpet. For obvious reasons, there can be variability in dye lots when piece-dying carpet. Yarn-dyed refers to the yarn being dyed before it is woven into carpet.

Type 6 nylon is manufactured by a variety of vendors and often by carpet mills themselves. In response to a growing demand for green building materials, more and more carpet is being manufactured using type 6 nylon with recycled content. Aquafil produces Econyl®, made up of approximately 50 percent postconsumer content, and is used in many Interface carpet patterns. Shaw's Eco Solution Q type 6 nylon fiber contains approximately 45 percent recycled content, including 25 percent post-consumer recycled content from reclaimed carpet.

Solution-dyed nylon carpet is available in both type 6,6 (Antron® Lumena) and type 6 fiber construction. In areas where the use of caustics and bleaching agents is common, solution-dyed nylons may be the best option. In solution-dyed fabrics, the color is integral to the manufacturing process when the fiber is extruded; hence, there is never a dyelot color-matching problem. These yarn systems do not necessarily have better general stain resistance, but are substantially more colorfast than conventionally dyed nylons and permit the use of cleaning agents containing bleach. Some yarn-dyeing methods rival the colorfastness of solution-dyed yarns by using cationic dyes and other proprietary methods. Colorfastness warranties and stain-removal warranties are well worth consideration when evaluating the real benefits offered by these systems. Focus on the details of these warranties in this important area.

Carpets well suited to the maintenance and durability requirements of healthcare settings have never been more plentiful. The industry has reached a high state of achievement whereby extraordinarily beautiful carpets, in rich colors, that meet rigorous standards for flammability, durability, and ease of maintenance are widely available and at moderate cost. Despite this, it is difficult for the consumer to evaluate the technical properties of carpet, as thicker pile is not necessarily better. A wise buyer will consult a design professional or competent commercial (not residential) carpet dealer to evaluate and select an appropriate product. All too often, a residential product is installed which gives disappointing performance.

Treatments to Inhibit Soiling and Microbial Growth

Antimicrobial treatments, such as Intersept® from Interface, Inc., inhibit the growth and reproduction of microorganisms

and should be considered for most hospitals and other medical facilities where patients may be highly susceptible to these pathogens: allergists' offices, chemotherapy areas, surgery centers, oral surgery offices, and pulmonary specialty clinics. When applied to carpet yarn and backing, molds, mildew, fungi, and other microorganisms cannot multiply, cause odors, or discolor the carpet. Potential infection and allergic reaction to these organisms are significantly reduced. The control of odor and mustiness is perhaps the most notable advantage of these treatments.

Fluorochemical treatments for enhanced soil resistance, such as DuraTech® from Invista, are an important aspect of any specification for carpet in a medical environment. These treatments, which may be effectively applied at several points in the manufacturing process, greatly reduce the surface tension of the fiber and thus its propensity to attract soil. This enhancement may be the most important in the medical environment, since much more carpet is replaced each year because of food and protein stains than for most other reasons combined. Remember, nylon fibers do not wear out; the appearance just deteriorates. Maintaining the appearance of the carpet through good maintenance can make a significant difference in the useful life of the carpet. DuraTech is available only on Antron® Legacy nylon and Antron® Lumena solution-dyed nylon.

Static Control

Static control "branded" nylons, such as Antron® and Ultron®, will contain a small percentage of conductive filaments capable of reducing static dissipation charge to below the level of human sensitivity (3.5 kilovolts). Antron® uses a carbon core that is extruded through the nylon fiber, making the antistatic property inherent in the yarn. Increased static control can be added through a custom specification that requires extra carbon bundles to be extruded in the nylon. Some mills offer additional static control by using a conductive backing and latex. This extra static control can be important for use with sensitive computer equipment.

Carpet Backings

Several commercial carpet backings offer improved seam strength, lamination integrity, moisture resistance, texture retention, and cleanability. There are two issues with respect to moisture: moisture being wicked up into the carpet from the concrete slab and moisture penetrating through the backing into the slab from a spill on the *surface* of the carpet. When liquids seep through the backing into the slab, they are virtually impossible to remove when the carpet is cleaned and, over time, undesirable odors develop. With all backing systems, most manufacturers recommend the use of chair pads in order to enhance appearance retention, although an editorial comment here: They sure look awful.

Enriched latex systems, usually 12 feet or 12 feet 6 inches wide, with a secondary Actionbac, offer improved tuft bind test results and often carry warranty protection against seam raveling and delamination. Note, however, that these styrene butadiene latex systems can lose some of their physical strength when exposed to excess moisture from flooding or high slab moisture conditions. They are, however, an excellent approach to general office areas when the budget will not allow a more expensive backing structure.

Acrylic latex, or Acrylate emulsion polymer broadloom backing systems provide excellent bundle encapsulation, tuft lock and lamination strength, and can be used for moisture barrier backing options that pass the British Spill Test. The premium for this backing is approximately 10 to 15 percent of the cost of the face product, depending on the manufacturer, and it comes with an extended warranty of up to 15 years. All styles and patterns can be made with these backing options and are offered in either 12 foot or 12-foot-6-inch widths, depending on the tufting technology used to make each product.

Polyurethane backing systems, available in both broadloom and carpet tile, offer excellent tuft bind test results

and carry warranty protection against seam raveling and delamination. The premium for these backings is about 20 to 25 percent, depending on the style. Moisture does not affect the integrity of polyurethane laminate or attached cushion backings and they are available for use with both patterned and nonpatterned products. Polyurethane backings allow slab moisture to escape, due to their open cell structure.

Some manufacturers offer moisture resistant polyurethane backing options, in both laminate or high-density attached cushion options, as they prevent water penetration from the surface leeching through the backing into the slab or subfloor. Low-profile, high-density polyurethane cushion backings extend the appearance life of the face product, provide underfoot comfort, and enhanced sound reduction properties and allow for ease of roller mobility, while also providing a thermal barrier in cold weather climates. Warranty options for these backings extend from 10 to 20 years, contingent on backing type and manufacturer.

Vinyl (PVC) backing or polyolefin thermoplastic backing systems, usually 6 feet wide, or carpet tile, offer warranty protection against seam raveling and delamination. The premium for these backings is about 20 to 25 percent, depending on product engineering. Closed cell vinyl and thermoplastic backings are moisture impermeable and as such are highly sensitive to the presence of slab moisture, which can cause backing failure, deterioration, or plasticizer migration if not controlled. Check with the manufacturer for installation standards regarding slab moisture recommendations. Many styles and patterns are available with these options; however, matching of large-scale patterns can be more difficult.

Pile/Texture

A *level loop* pile is the most serviceable for high-traffic areas, although a combination loop and cut pile will work well in many medical and dental facilities. A number of high-traffic commercial cut piles are available that perform quite well, although solid colors will not camouflage soil.

Installation

Carpet in a medical or dental office is usually glued directly to the slab with no pad. This provides a firm footing, making it less likely that people will trip. Direct glue-down is the recommended installation method in any healthcare facility installation and many other commercial facilities as well. In offices, it sometimes eliminates the need for acrylic chair mats since it is firm enough to allow chairs and carts to roll freely. For installation specifications, reference the latest published guidelines for commercial carpet installation from the Carpet and Rug Institute. Proper maintenance is defined in detail by most manufacturers. Consider scheduling a meeting with the technical services representative from the mill and the senior maintenance managers involved.

WALL BASE

To conceal the joint between the wall and the floor, wall base is installed once the flooring material is in place. This wall base helps prevent accumulation of dirt between the wall and the floor and protects the wall from maintenance equipment, the wheels of rolling carts, and foot traffic. Wall base can be either straight or coved, depending on maintenance and code requirements.

Standard cove base, such as Traditional Wall Base from Johnsonite®, is the most inexpensive commercial wall base option. Made of either rubber or vinyl, this base comes in 120-foot coils to minimize seams between sections or 4-foot strips. Rubber is preferable to vinyl in terms of durability. A standard height in an exam room or hallway is 4 inches, although 6-inch and 2.5-inch options are available. The toe at the bottom keeps water used in

floor maintenance from seeping under the base and into the drywall and is typically used with resilient flooring. A toeless version is available from many manufacturers for installation with carpet.

Contoured rubber base provides the look of a custom wood base with less cost and less maintenance. An upgrade from a standard cove base, the contoured base gives a more sophisticated appearance. A variety of profiles and colors are available, with heights ranging from 3 inches to 8 inches high. Visuelle® Wall Base from Roppe and Profiles Wall Base from Burke Flooring have longer roll lengths to minimize seams. Millwork® Wall Base from Johnsonite® has a wide variety of color and profile options from which to choose.

Self-cove base is a seamless base installation that wraps flooring material from the floor up onto the wall to a typical height of 6 inches. Self-cove base is highly recommended and often required by code at procedure rooms, housekeeping closets, soiled utility rooms, and any other area that requires heavy floor maintenance. With resilient flooring (sheet vinyl), a cove filler strip should be specified to support the flooring material at the junction between the floor and the wall. This goes behind the flooring material at the juncture of the floor and wall. A cove cap is also recommended to finish the edge of the resilient material on the wall. Johnsonite® makes cove caps in a variety of colors so caps can be coordinated to the flooring material. Metal cove caps are also available for more durable installations but they do not look as nice.

Wood base is an upgrade that helps to create a more high-end interior space. Usually reserved for waiting rooms and other high-profile spaces, wood base can be manufactured in custom sizes, profiles, and finishes. Wood species most often used are maple, walnut, and cherry. These woods can be finished in custom stains to match other wood finishes in a space. A wood species like oak or maple is more practical if it fits the decor because it does not require a stain. When it gets scuffed it barely shows as opposed to wood that needs to be stained dark to achieve a cherry or walnut appearance. When it gets scratched, it is light colored underneath.

WALL TREATMENTS

If budget permits, walls may receive commercial vinyl wallcovering (see Chapter 13 for classification characteristics), although, in high-profile-design offices, there are other more expensive options that are even more durable than vinyl and richer in texture and appearance such as Carnegie Xorel and Maharam Tek-Wall™. If the designer is knowledgeable about using color, dramatic effects can be achieved with paint and it is a less expensive option than wallcovering. Gypsum board walls make a good substrate for application of vinyl wallcoverings, provided they have not been textured. A light texture is desirable, however, if the walls will be painted, since texture helps to conceal drywall taping and nail heads. The lightest texture is best so that walls appear smooth, especially if deep accent colors are used. A heavy stucco or sand finish texture is to be avoided since it collects dirt and is difficult to clean. Porous or excessively textured wall treatments such as wood paneling, grasscloth, or woven fabrics should not be used in examination or treatment areas, but may be used in limited areas such as consultation rooms and waiting rooms.

A class of woven wallcoverings made of polyolefin that carries a Class A flame-spread rating, is mildew resistant, remarkably durable, and has the luxurious appearance of fine linen fabric, is widely available. These high-performance wallcoverings may even be used in patient areas of hospitals. Even though these fabrics appear to be delicate, they are extremely tough and some patterns may even be cleaned with a bleach solution.

DesignTex and Maharam make several patterns of high-performance woven wallcovering of this type.

The paint finish specified is very important. It is not necessary to use semi-gloss in order to be assured the wall is washable. An eggshell or low sheen finish (for walls) may have differing trade names within each brand of paint but look carefully at this since the amount of sheen varies among manufacturers. The higher the sheen, the more institutional will be the appearance. Also look for a no-VOC or low-VOC paint to avoid noxious fumes.

FURNITURE

Offices located in cities with inclement weather must provide an area near the entrance to the waiting room for removing boots, rubbers, and winter apparel. An umbrella caddy and coat hooks (some low enough for children) are also necessary. For the comfort of those waiting, it is desirable that the coat area be visible from the waiting room. Offices in Southern California and other areas with a temperate climate usually do not have entry vestibules or coat closets.

To eliminate the clutter of magazines strewn about the room, waiting rooms ought to have a magazine rack. Wall-hung units are most functional. While these may be custom designed, those shown in Figures 11-1, 11-2, and 11-3 are available in a number of options with respect to size and finish.

Most offices need to display and dispense many healthcare education pamphlets and brochures. The brochure rack shown in Figure 11-4 comes in various sizes and may be placed near the nurse station or in the waiting room. Custom-designed units (see Figure 3-32) can be an attractive addition to a room.

Medical exam rooms no longer use chart racks due to HIPAA privacy considerations and also because most practices have converted to electronic health records. It

Figure 11-1. Contemporary wall-mounted magazine rack. *(Courtesy of Peter Pepper Products, Inc., Compton, California)*

Figure 11-2. Contemporary floor-style magazine rack. *(Courtesy of Peter Pepper Products, Inc., Compton, California)*

Figure 11-3. Wall-mounted magazine rack. *(Courtesy of Peter Pepper Products, Inc., Compton, California)*

is a nice amenity to provide an individual magazine rack in each exam room such as that shown in Figure 11-5. Exam rooms also require coat hooks and hangers. Guest chairs may or may not have arms; they should be stable and accommodate overweight individuals (Figures 11-6 and 11-7).

Figure 11-4. Brochure rack. *(Courtesy of Peter Pepper Products, Inc., Compton, California)*

Decorative accessories that are also functional add color to a business office or nurse station such as the clock in Figure 11-8.

There is great latitude in selecting waiting room seating. The main criteria are that a suitable number of individual chairs with arms be provided and that the chairs not be too low or hard to get out of. The seating in Figures 11-9 and 11-10 is well suited to medical and dental waiting rooms, although there are many variations on this theme. Each of these is well balanced, so that it will not tip when someone pushes down on one arm only. Wooden arm caps protect the fabric where it is most vulnerable to soiling. Both of these manufacturers offer individual chairs as well as modular or ganged versions that accommodate more people in less space (Figures 11-11 and 11-12).

Figure 11-5. Individual magazine rack. *(Courtesy of Peter Pepper Products, Inc., Compton, California)*

Figure 11-6. Zag chair works well in exam rooms: sleigh base is stable, the arms aid the elderly, and the seat accommodates even very large individuals. *(Photo courtesy of Source International, Shrewsbury, Massachusetts)*

Figure 11-7. Guest chair for exam or waiting room. *(Photo courtesy of David Edward Co., Baltimore, Maryland)*

The Nemschoff Cities® Uptown seating (Figure 11-13) is available in three different sizes, with five variations of arm cap styles and four different back details. A unique comfort feature is the spring seat construction. As tandem seating, two-, three-, and four-seat modules combine with individual chairs. Industrial hook-and-loop replaceable upholstery, mortise-and-tenon joinery, and totally replaceable components make this seating durable and somewhat of a lifetime purchase.

The modular seating in Figures 11-11 and 11-12 is both attractive and practical. It is easy to vacuum under the seating (no legs) and the separation between seat and back makes maintenance easy. Figures 11-14 and 11-15 demonstrate a creative approach to using modular seating that can be curved.

In selecting seating, one must be mindful of accommodating overweight individuals and sparing them the embarrassment of squeezing into a chair that is too narrow (Figures 11-16, 11-17, and 11-18). Providing a few chairs without arms, or a loveseat, will serve this purpose. For offices with a number of bariatric patients, seating should

Figure 11-8. Wall clock. *(Courtesy of Peter Pepper Products, Inc., Compton, California)*

Figure 11-9. Voyage guest seating. *(Photo courtesy of Carolina, an OFS Brands™ company, copyright © 2012)*

Figure 11-10. Solstice guest seating. *(Photo courtesy of KI, Green Bay, Wisconsin)*

Figure 11-11. Voyage Collection, bariatric and ganged seating. *(Photo courtesy of Carolina, an OFS Brands™ company, copyright © 2012)*

be carefully selected. Furniture manufacturers vary widely in the capacity of their bariatric seating, as there is no current testing standard applied. Some bariatric seating can accommodate a 1,000-pound dynamic load while others can only accommodate a 300-pound dynamic load. The dynamic load represents not only the weight of an individual, but the weight plus the force that is applied to a chair in the process of sitting down and sitting in different postures. Bariatric seating is typically reinforced with stronger springs and thicker frames, and most styles blend in with other nonbariatric seating so that it is not stigmatizing.

Practices with a number of geriatric patients or patients with arthritic or orthopedic problems may wish

Figure 11-12. Coronado modular seating. *(Photo courtesy of Carolina, an OFS Brands™ company, copyright © 2012)*

Figure 11-13. "Uptown" seating system includes individual chairs and modular seating in a variety of sizes and different arm and back styles. *(Photo courtesy of Nemschoff, Sheboygan, Wisconsin)*

to provide some high-backed seating such as that shown in Figure 11-19. The chair shown in Figure 11-20 has a back that flexes which is quite soothing.

Accommodating laptop computer or tablet users shows consideration for individuals who wish to make productive use of waiting time (Figure 11-21). Any number of options and styles exist for chairs with attached tables and some have electrical outlets in the base or on the sides.

It is important for the sanity of parents and staff to keep children well occupied—patients and siblings alike (Figures 11-22, 11-23, and 11-24). A small table or work counter will provide space for coloring or for playing games. Proper storage for toys may encourage the children to replace toys after use.

Educational exhibits or artwork can be put to good use in a medical waiting room. The subject matter may provide useful information about the facility or its physicians or history, or explain birth defects, sports injuries, or other medical conditions.

UPHOLSTERY FABRIC

There has been tremendous innovation in textile technology in recent years, resulting in fabrics that have the look and feel of silk, linen, chenille, bouclé, wools, and woven tapestries—all quite magnificent—that are, in reality, hardwearing synthetic fibers that are flame retardant, impervious to staining, and easy to clean, and that can

Figure 11-14. Serafina modular seating. *(Design: Jain Malkin Inc.; Photo: Copyright © Ed LaCasse)*

withstand tremendous abrasion. Unlimited in range of patterns, colors, and type of weave, it has never been easier to brighten a waiting room with fabrics.

Look for the following types of fabrics and fibers to assure top performance in medical and dental office settings.

Nylon is one of the most popular synthetic fibers. Although it is highly durable, 100 percent nylon upholstery fabrics sometimes pill and often lack the fine aesthetic character or "hand" that blended fabrics achieve. A nylon blended with other synthetic or natural fibers often provides the best solution. Nylon is resistant to many chemicals, water, and microorganisms, and has high resiliency.

Solution-dyed fabrics are 100 percent solution-dyed nylon or olefin fiber. Manufacturers offering these fabrics include DesignTex, Maharam, Arc-Com, Architex®, Knoll Textiles and Momentum Textiles. These durable fabrics meet or exceed the 40-hour NAFM light fast (fading) requirement. They are recommended especially in

Figure 11-15. Serafina modular seating allows for curved and serpentine configurations. *(Design: Jain Malkin Inc.; Photo: Copyright © Ed LaCasse)*

areas where fabric or seating is exposed to ultraviolet light. Solution-dyed nylon fiber can even be cleaned with bleach.

High-performance fabrics are typically constructed of polyester fibers, solution-dyed fibers, or a combination of the two. These fabrics have high abrasion performance, making them extremely durable. In addition, they are very often treated with Crypton or Nano-Tex finish for additional stain resistance. Nearly every major commercial fabric manufacturer carries products labeled as "high performance." A close look at the composition and technical specifications of these fabrics can verify if this rating is appropriate.

Crypton® finish is an excellent solution where wet soiling is a problem. Crypton® is finished with proprietary

Figure 11-16. Bariatric seating, Marco Collection. *(Furniture by Nemschoff)*

Figure 11-18. Bariatric seating, Whitney. *(Photo courtesy of Carolina, an OFS Brands™ company, copyright © 2012)*

Figure 11-17. Bariatric seating, Olivia. *(Furniture by Nemschoff)*

Figure 11-20. KI Flex motion-back patient seating. *(Photo courtesy of KI, Green Bay, Wisconsin)*

Figure 11-19. Orchestra motion patient chair. *(Photo courtesy of Carolina, an OFS Brands™ company, copyright © 2012)*

Figure 11-21. Arcadia Leaf modular guest seating, four-chair configuration with tables. *(Photo courtesy of Arcadia Contract, La Palma, California)*

Figure 11-22. Sand table with magnetized boats moved by levers under the table amuses young children. *(Photo courtesy of People Friendly Places, Inc., La Jolla, California)*

Figure 11-23. Multi-station interactive play unit requires little space in a waiting room. *(Photo courtesy of People Friendly Places, Inc., La Jolla, California)*

Figure 11-24. Interactive play unit requires little space and keeps active toddlers entertained. *(Photo courtesy of People Friendly Places, Inc., La Jolla, California)*

treatments consisting of a polymer latex and fluorochemical stain blocker that provides a total moisture barrier, yet it is "breathable." It is antibacterial, antifungal, and antimicrobial. It is soil and stain resistant but cannot be cleaned with bleach. Manufacturers with Crypton® fabrics include Maharam, DesignTex, Momentum Textiles, Arc-Com, and CF Stinson.

Nano-Tex® is available as a standard on many commercial fabrics and is designed to repel stains and soiling. In the Nano-Tex® finishing process, nanotechnology is used to transform fabric fibers at a molecular level, enabling the fibers to repel liquids. Because the finish is applied at a molecular level, it does not wear off over time, unlike older versions of stain repellents. Fabrics with Nano-Tex® technology are offered by most commercial textile manufacturers including Pallas, Arc-Com, Joseph Noble, and Luna Textiles.

Xorel textiles by Carnegie Fabrics are an option where extremely durable "industrial-strength" upholstery fabric is required. Woven from polyethylene, these textiles repel liquid stains and are washable, colorfast, antibacterial, and self-healing when punctured; hence, they are virtually indestructible. The fabric's high resistance to abrasion (often withstanding one million double rubs on the Wyzenbeek test) is another feature.

It is important to understand something about textile technology when selecting an appropriate fabric.

Durability

Measured by the Wyzenbeek abrasion test (ASTM D3597) under the standards set by the Association of Contract Textile Companies (ACT), durability is critical to the selection of fabric in healthcare settings. In this test, a fabric is subjected to the revolving action of two abrasive wheels. The number of revolutions the fabric withstands before breaking a yarn is the fabric's rating. All fabrics carry this rating in their specifications. A rating of 30,000 double rubs with no wear qualifies a fabric for heavy-duty use; 15,000 double rubs classifies it for medium duty. Heavy-duty use should be considered for any healthcare setting.

Light Fastness

A fadeometer exposes a portion of a fabric to a light source for a specific number of hours. The exposed section is compared to the unexposed section and then rated on a scale of 1 to 5 (no change) for fading. Typical for upholstery or wallcovering is a minimum standard of 40 hours with little or no change.

Soil and Staining

Various tests such as the oil repellency test evaluate a fabric's resistance to specific stains. Similar tests also evaluate the effectiveness of soil and stain repellents after having been applied to fabrics, comparing them to control samples.

Flammability

Although it is a concern in any healthcare facility, flammability is rarely an issue because most contract or institutional fabrics are Class A, the most stringent code classification. Nevertheless, one must always check this specification. The flammability and smoke generation characteristics of fabrics, as well as the composition of the filling in upholstered furniture, and the burn characteristics of the complete furniture assembly, are an issue in any "I" or institutional occupancy. California is one of a number of states that follows Technical Bulletin 133 for upholstered furniture, but it does not generally apply to medical and dental offices, just hospitals. When adhering to this code, it is the furniture manufacturer's responsibility to certify and label that the piece of furniture complies.

The reader is referred to Chapter 14 for additional code information. **A caveat: Codes are applied and interpreted differently in different jurisdictions and should always be thoroughly verified**. The information in this book is intended only as a general guide.

CHAPTER 12

Lighting

BIOLOGICAL EFFECTS OF LIGHT

Traditionally, lighting engineers and those in the design professions have been concerned with lighting in terms of vision or aesthetics. Until recently, the biological significance of light has been overlooked. The fabrication of incandescent and fluorescent lamps is based on the assumption that people will be exposed to sunlight as a normal part of each day and not be confined to a habitation of electrical illumination. These lamps emit a narrow spectrum of light that does not include ultraviolet.

Fluorescent light is light without heat, whereby ultraviolet radiation is converted into radiation of a longer wavelength. (Since the human eye is not sensitive to ultraviolet radiation, these wavelengths are lengthened by phosphors to which the eye is sensitive.) Different phosphors create different tints of fluorescent light. Thus, fluorescent lamps, in simplistic terms, are nothing more than glass tubes, the inner surface of which has been coated with phosphor powders, which, when excited by ultraviolet energy created within the arc stream, give off visible light. Most fluorescent lamp tints cost the same to manufacture, although, due to marketing demand, cool white always costs less than more appealing colors.

If people are to be confined for long periods away from sunlight, a balanced light that emits a fairly full spectrum of wavelengths is desirable. The illumination of our environment acts both to induce and to time glandular and metabolic functions affecting, among other things, milk produced, the quality and quantity of eggs laid, and stimulation or inhibition of sexual activity. Light dilates blood vessels, thereby increasing circulation. Sudden exposure to bright light stimulates the adrenal gland. Our biological time clocks—our circadian rhythms—are manipulated by light. Studies have shown that subjects who are forced to live in darkness for prolonged periods suffer sensory deprivation. The loss of environmental cues that tell the body what to do throws body systems out of kilter.

As populations increase and pollution keeps pace, those in urban centers spend increasingly more time in indoor environments. People confined to nursing homes or institutions who are not able to get outdoors similarly depend on their indoor environment to supply well-balanced light that includes some ultraviolet. Those who design such environments must be aware of not only the biological effects of light, but also the psychological effects, as well as the visual quality of the light.

Perhaps the optimal solution for lighting offices, homes, restaurants, hospitals, and hotels would be a system of changing light levels and tints. Since natural light changes throughout the day (warm and rosy at dawn and dusk, bright with a bluish cast at midday), should we not try to imitate these day-night cycles in our indoor environments?

TECHNICAL DATA

The sensations that we call color and light are our psychological interpretations of certain portions of the electromagnetic spectrum. How well we see colors depends on how closely the ingredients of artificial (electric) light sources match the ingredients of sunlight. Electric sources of light have varying degrees of each color—some have more warm wavelengths and some more cool. An incandescent bulb, for example, is high in orange and red and

low in blue and violet; thus, it imparts a warm glow, but it is far from the color of daylight.

Fluorescent Lamps

Typically, fluorescents produce about 72 lumens (the amount of light generated at the light source) per watt, compared with 6 to 24 lumens per watt produced by an incandescent lamp and fluorescents have an average life of 15,000 hours. Although fluorescent lamps have been the mainstay of commercial lighting, the proliferation of fixtures using LEDs has increased exponentially in just the past 18 months. Despite this, because of the increased cost of LED lamps and fixtures, fluorescents are likely to be the lamp of choice in numerous settings for the foreseeable future. Designers and architects, however, have been strongly embracing LEDs. And, with so much interest in green design and LEED®, LEDs enable more creative lighting design within the allowable watts per square feet. LEDs have been in use for many years in electronic devices, outdoor signs, traffic signals, the exteriors of buildings and monuments, but the last frontier to conquer has been interior architectural lighting. While they are an appealing lighting modality, there are problems with consistency and reliability according to a recent report by the U.S. Department of Energy (see LED Lamps below).

Fluorescent lamps are continually being improved to offer higher efficiency and numerous proprietary colors are available. However, careful selection must be made after consulting manufacturers' lamp specification catalogs, because bulbs of the same wattage do not necessarily have equal lumen counts. There are often other quantitative and qualitative differences about a specific lamp from one manufacturer to another.

Fluorescent lamps are selected on the basis of lumen output, color temperature, and color rendition. The color temperature is expressed in Kelvins. The higher the color temperature, the bluer the appearance and the closer to daylight; the lower the color temperature, the redder the appearance. The color rendering index (CRI) describes the ability of a lamp to render objects as they would be seen in outdoor sunlight, which has a CRI of 100. Thus, a lamp with a CRI of 80 renders the object 80 percent as accurately as outdoor sunlight. The closer the CRI to 100, the better the color rendition of the lamp. Below is a list of the most commonly used fluorescent lamps plus a few unique ones. The optimal color temperature for most areas of medical and dental facilities, with the exception of surgeries and dental operations, is 3,500 Kelvins with a CRI of 85 or higher.

Cool White lamps are approximately 4,100 Kelvins with a CRI of 68. They intensify white, gray, blue, and green and do not blend well with incandescent. **These are not recommended**.

Deluxe Cool White lamps are 4,100 Kelvins with a CRI of 89. Their color rendition is a big improvement over Cool White lamps, but the lumens per watt are reduced considerably, so more of them are needed to achieve the same level of illumination as with cool white. They produce a white light with a slightly pink tint.

Warm White lamps are approximately 3,000 Kelvins with a CRI of 56. They slightly distort all colors and have a pink glow, but mix well with incandescent. **These are not recommended**.

Deluxe Warm White lamps are 3,000 Kelvins with a CRI of 74. They greatly intensify warm colors, are not as pink as standard warm white, and blend well with incandescent. **These are not recommended**.

Daylight lamps are 5,000 to 6,500 Kelvins and usually have a CRI of 75. This lamp produces a cold blue-white light, not enhancing to warm colors and incandescent light, but useful in a room where a large quantity of natural light is present.

Full-Spectrum lamps range from 5,000 to 6,500 Kelvins with a CRI of 90 to 98. This is a high-quality lamp ideal for color-critical applications such as dental operatories. It produces a bright white light that simulates the full color and ultraviolet spectrum of sunlight. These are manufactured by several sources: *Lumichrome®* by

Lumiram is 6,500 Kelvins with a CRI of 98 and 5,000 Kelvins with a CRI of 96; *Verilux*® by Verilux, Inc., is 6280 Kelvins with a CRI of 94.5; Sylvania *Octron 950* is 5000 Kelvins with a CRI of 90. These lamps are ideal for dental operatories where exact color matching is critical. Specify high-frequency electronic ballasts to eliminate flicker.

The *Ultralume 3000* lamp is 3,000 Kelvins with a CRI of 85. Made by Phillips, this lamp enhances warm colors and has better color rendition than the warm white deluxe.

The *Pentron*™ *T5* lamp is available in various color temperatures with a CRI of 82. Made by Sylvania, the ⅝-inch diameter lamp gives 104 lumens per watt with 95 percent maintenance (constancy) over the life of the lamp. The high output (HO) version gives twice the lumen output of a T8 of similar size.

The *SP35* lamp is 3,500 Kelvins with a CRI of 73. Made by General Electric (GE), this lamp renders skin tones very well, making it ideal for medical offices. It has the good color rendering properties of cool white deluxe and warm white deluxe, but has considerably more light output. Cool white deluxe has 56 lumens per watt, while the SP35 offers 83 lumens per watt. The SP35 complements both cool and warm color palettes, producing a crisp light midpoint between cool white and warm white although a CRI of 73 is low.

The *SPX35* is 3,500 Kelvins with a CRI of 82. Manufactured by GE, it is an enhanced version of the SP35 and is more expensive, but makes colors appear more vivid. It greatly enhances interiors.

Compact fluorescent lamps are available in standard color temperatures from 2,700 Kelvins (with a CRI of 81) to 4,100 Kelvins. If one does not specify a color temperature, usually 2,700 Kelvins will be supplied as it most closely resembles warm white or incandescent. Manufactured by many lamp companies, this type of fluorescent is a small twin or quad tube in a U shape, available in 7-, 9-, 13-, and 26-watt lamps. The color rendition is somewhat similar to incandescent, but tends to be a bit more pink, rather than yellow. The 7-watt lamp is equivalent to a 40-watt incandescent; the 9-watt lamp, to a 60-watt incandescent; and the 13-watt, to a 75-watt incandescent. These lamps are very popular because they combine the high efficiency and long life of fluorescent lamps with fairly good color rendition. Their size allows them to be used in downlights, wall sconces, and other types of fixtures that previously required incandescent bulbs. It is important to match the color temperature of compact fluorescents to the other sources of light being used.

LED Lamps

Light-emitting diode (LED) lamps are rapidly becoming the lamp of choice for their energy efficiency, making them a great choice for LEED projects in particular. Selection of fixture types is no longer limited with new entries to the market almost monthly. There are fixtures for general ambient light, accent lighting, and downlights along with more specialty pendants and decorative fixtures. Because the light is so very bright white it doesn't take the place of halogens, for example, in all situations and it is susceptible to color shifts when dimmed. Today LED lamps have a typical life of 20,000 to 50,000 hours at full output, but see below for some critical discussion about this.

LED lamps can be dimmed with the appropriate driver and control equipment. The current light output of LED lamps is 25 to 75 lumens per watt, although that number is typically reduced by at least 15 percent depending on the light system. At the end of an LED lamp life, the light source will not turn off/burn out as in fluorescent or incandescent sources. LED light degrades over time. At a 70 percent lumen output compared to original output, an LED is considered at the end of its life and should be replaced. This can be very important when light levels are directed by code or essential to critical tasks. Therefore, LED drivers that indicate when light output has degraded below a certain level are available.

Due to the manufacturing process of LEDs, the electrical and photometric characteristics may vary between

individual diodes. In order to provide luminaire manufacturers and consumers with consistency in the appearance of light, LEDs are tested and sorted, or "binned," in accordance with certain characteristics such as color and brightness. LED luminaire manufacturers then order LEDs by bins to create fixtures that have a consistent and specific quality of light. When specifying LED luminaires or lamps, designers should be sure manufacturers tightly control bins.

LED Drivers

The driver is an important component of an LED lamp or an array of lamps. It regulates the power to an LED in the way that a transformer does for other low-voltage systems. It protects the light source from line voltage fluctuations and converts 120-volt AC to low-voltage DC power. The driver is the power supply for an LED system in the way that a ballast is to a fluorescent. It is usually small enough to fit inside the junction box. It is important to select the correct driver for the lamp and for the connected array of lights because drivers are rated for a maximum load and, if too much is connected to it, it will reduce lamp life and possibly also lumen output. Some drivers are manufactured to operate a specific LED device or array and they can also be designed to enable dimming and color sequencing. Most are compatible with occupancy sensors, photocells, remote controls, and other electronic light control devices.

LED Performance

Selection and specification of LED fixtures and lamps is far more complex than for fluorescents, HID, or halogen sources. It is still a new technology for interior architectural lighting. A good source of information for those who wish to enhance their knowledge is LEDs Magazine, an online resource. In a recent article the DOE was reported to have said, "There is no definitive way to rate system life expectations. Driver life and system level color maintenance remain hard to quantify."[1] The existing methodology focuses primarily on lumen depreciation since the useful life of LEDs is the point at which light output declines by 30 percent. "It is expected that IES LM-84 standard will help define methods for measuring both lumens and color maintenance (color shift) at the lamp or luminaire level."[2] The DOE report ended with the troubling prediction: "products will continue to fail catastrophically and parametrically, through various mechanisms." This means that design professionals must specify products at the top end of the quality chain and work to understand more about this technology.

At the base of an LED is a thermal heat sink slug that pulls heat away from the LED chips. The efficiency and quality of this element is important to the functioning of the LED. The longer the lamp burns, the more heat produced at the LED junction; if the heat sink is not effective in dissipating the heat, it will cause noticeable color shift and stress the lamps. This is particularly important in multiple cluster designs. Manufacturers like Philips with a long history in LED technology are continually working on issues like this. The Philips Luxeon high-efficacy CoB lamp offers greater uniformity of light. Xicato, in San Jose, California, is another manufacturer dedicated to quality with a Web site that is educational and informative. Xicato makes LED modules and lamps that are used in fixtures designed by numerous manufacturers. The Xicato Corrected Cold Phosphor Technology® controls color shift enabling them to offer a five-year color consistency warranty. If the manufacturer of a luminaire sends them a fixture (using Xicato modules), they will test it and, if it passes, they will extend their warranty to that fixture. Xicato lamps are available in color temperatures from 2,700 to 4,000 Kelvins and a CRI of 80 to 95.

LED Surgical Lights

LEDs have gained favor for procedure and surgical lights. They can increasingly be found in dental operatories/treatment rooms (see Figures 10-58 and 10-59), in oral surgery operatories, and in medical minor surgery/procedure

[1] Mary Wright "DOE publishes fact sheet on the lifetime and reliability of LEDbased lighting," August 22, 2013 (ledsmagazine.com/news/10/8/14); retrieved August 23, 2013.

[2] Ibid.

rooms (see Figure 3-56) as well as in portable examination lights (see Figure 3-54, 3-55, 3-57, and 3-58).

Low-Voltage Lamps

Low-voltage lamps are of many types, the most common being the MR-16. These are 12-volt quartz halogen lamps that average 3,000 Kelvins and render colors vividly. The beam can be precisely focused to enhance textures or an art object or to add drama to a room. The miniature size of the lamp allows it to be used in fixtures much smaller than those that accommodate incandescent bulbs. MR-16s give a clean, white light that enhances all colors. **When specifying MR-16 lamps, it is necessary to note the desired width of the beam (spot or flood, narrow, medium, or wide beam)**. Look for long-life MR-16s rated for 4,000 to 5,000 hours.

The *ConstantColor Precise MR-16* lamp by GE delivers crisp white light with no color shift for the rated life of the lamp (5,000 hours). For comparison, an incandescent lamp is 2,800 Kelvins, and daylight (although it does vary with the time of day, the time of the year, and whether the sky is sunny or cloudy) is arbitrarily established at 6,500 Kelvins. The reader is encouraged to visit the Web sites of Osram-Sylvania in Danvers, Massachusetts; GE in Nela Park, Ohio; and Westinghouse in Bloomfield, New Jersey. These manufacturers offer excellent technical literature on their lamps. And design professionals should have a copy of the *Illuminating Engineering Society of North America* (IES) handbook on lighting healthcare facilities.

Color Rendition

Color is an important aspect of lighting that must not be overlooked. In an outpatient setting, this can have an impact on diagnoses, especially in specialties like dermatology; color rendition is highly important in dental operatories and in all surgery settings. The color rendering index (CRI) assesses the naturalness of a light source in comparison to the rendering of the same object under incandescent light or daylight. Values are on a scale of 0 to 100, with 100 being the rendering of color in daylight. A lamp with a low CRI will shift the appearance of finish materials and skin tones to unacceptable colors. Lamps for general ambient lighting should be at least 80 CRI. In an exam room, however, where color appraisal is more critical, a lamp should have a CRI of 85 or higher. Fluorescent tubes will generally have the color temperature and CRI noted on them. When shopping online, this information is readily available and also can be found on the Web sites of major lamp manufacturers such as Sylvania, Philips, GE, Osram, and others. LED lamps also carry CRI ratings but some feel they cannot be accurately assessed by CRI as the current system is not compatible with the type of spectral emissions from LED sources which may alter the saturation of certain colors. Efforts are underway to standardize a color-rendering tool for LED sources.

The Light Box—A Great Investment

The best advice for design professionals is to build a large light box (with a white interior) and fit it out with various color temperatures of fluorescent lamps, halogens, and LED sources. By flipping different switches, one can mock-up the lighting of a specific room. There may be fluorescent lamps at 3,500 or 4,100 Kelvins for ambient light and accent lights of compact fluorescent and halogen or LED. Place carpets and other finish materials and fabrics inside the box to see how the light sources accurately render the materials.

Author's Comment: In my office a light box is an essential design tool. Ours is 30 inches high by 24 inches deep and 60 inches wide. The "floor" of the box should be at 36" stand-up height with lights mounted on the "ceiling" of the box, 30" above the floor of the box. A panel of switches on the right side of the enclosure controls the various lighting options. All interior surfaces of the enclosure should be matte white. This accommodates large carpet samples, finishes, and other items. There is no other way to assess how materials will look under the specific lighting conditions of the project.

INNOVATION AND TRENDS

Lamp Technology

Great strides have been made in both lamp technology and fixture design in recent years. Fluorescent lamps with rare-earth phosphors have greatly improved color rendition; lamps like the slim T5 offer extremely high light output per watt, meaning fewer fixtures (less cost and reduced energy consumption); compact fluorescents in high wattages can accommodate electronic ballasts and offer excellent color rendition. Overall, the trend is toward energy-efficient lamps with high light output, extremely long life, and excellent color rendition.

And, of course, there is the LED, discussed previously, that will continue to have improved consistency and performance and a larger share of the market as cost decreases dramatically every 18 months. There is real innovation here, considering that these lamps were used in electronic devices in "small scale" applications for many years and later in road signs and parking lot lighting. To develop products for interior applications was a big step forward. Anyone who has watched LED product development from 2008 to 2013 has seen huge advances in design and number of offerings. To accelerate the adoption of LED lighting solutions, an international consortium of companies is working to develop specifications that enable interchangeability of LED light sources made by different manufacturers (zhagastandard.org).

In the future, it is likely that lighting sensors and controls will play more of a role in medical and dental offices as opposed to larger public facilities. When this happens we will see integrated daylight harvesting with automatic adjustments made to the lighting based on the amount of daylight in the space. And we may see adjustments in the color temperature of the light to synchronize with human circadian rhythms as they change during the day.

Organic light-emitting diode (OLED) technology may be the next big thing but it is not just around the corner. The electroluminescent layer is a film of organic compounds the thickness of a human hair that emits light in response to an electric current. Commonly used in TV screens, computer monitors, and mobile phones, the next area of research is to develop lighting applications for this technology.

Lighting Fixture Technology

A trend in commercial lighting is a departure from the ubiquitous 2 × 4–foot lay-in luminaire with either prismatic acrylic lens or parabolic louver that is the "building standard" fixture in all medical and dental offices. This type of fixture is cheap, creates glare in patients' eyes and on CRT monitors and, unless electronic ballasts are used, produces flicker that can, in susceptible persons, create eyestrain and headaches. These negative features are compounded by the ubiquitous cool white lamps that are commonly used. A better option is the perforated "basket" type lens that directs light upward (indirect) and downward without glare (see Figures 3-117, 3-118, and 4-25). These are made by numerous manufacturers and should be the baseline in medical and dental offices for ambient (general) lighting in all rooms. They provide broad applications of light on horizontal surfaces while shielding the light source for someone lying on an exam or procedure table looking up at the fixture. There is actually 32 percent energy savings to be had in changing from the standard 2 × 4–foot parabolic fixture with three 32-watt T8 lamps to, as an example, the Cooper Metalux ArcLine that uses two 32-watt T8 lamps to achieve the same lighting level.

Recessed Luminaires and Downlights

The *Avante* fixture by Lithonia is a moderately priced basket-type fluorescent fixture available in 2 × 2 and 2 × 4 sizes. This fixture is now available as an ambient LED luminiere. Focal Point's *Luna* is another moderately priced basket-type fluorescent. Others are available from Cree lighting, Columbia lighting, and Cooper Industries (Neo-Ray™).

Cree Lighting offers a high-quality recessed LED luminaire. Fixtures with conventional fluorescent tubes can be retrofit with LED tube lights such as the *Alinea*® by AAMSCO Lighting and other options from Seesmart Technology.

For lighting effects, consider the *iColor Cove MX Powercore* color-changing LED by Philips Color Kinetics, which can be used in cove lighting to wash walls with colored light.

Downlight or "can light" fixtures work well for circulation spaces. There are many options for downlights such as the Amerilux *Evoke G2* LED; Lightolier's *Vetro*, available in compact fluorescent (CF) and LED models; Gotham's *Evo*, also available in CF and LED; Shaper Lighting's Farallon, available in CF and LED and wall washer/art lights by DaSal. The downlights Vetro, Evo, and Farallon each have numerous decorative glass trims that either surround the downlight or are suspended from it, creating a variety of lighting effects and adding some sparkle to an otherwise somewhat utilitarian fixture.

Graphic Image Luminaires

For many years, solid research has indicated that views of nature, including simulated views in a photograph, have restorative effects and reduce anxiety making this type of art especially important in diagnostic imaging, radiation therapy, chemotherapy, blood draw, procedure rooms, prep and recovery rooms (see Figure 5-40; Color Plate 19, Figure 6-9; and Color Plate 21, Figures 6-32a and b). This used to require working with a photographer (there are many who specialize in just the right types of nature images for healthcare settings) and a photo lab to create these images to fit into light fixtures or to be designed into custom wall treatments which further required coordinating the back-lighting inside the wall cavity. Now the ease of doing this has been accelerated by the availability of *Changing Views Visual Therapy* by Cooper Lighting (Figure 12-1). Products include a 1-inch-deep LED image panel that can be recessed into a wall, or a conventional recessed troffer using T5 or T8 lamps, and even a similar fixture gasketed for cleanroom applications. Standard fixture sizes of 2×2 and 2×4 can be grouped together to form larger installations. The photography is by Joey Fischer, the iconic nature photographer who was the first to recognize the healing and restorative value of nature photography. He led this movement some 20 years prior to the many fine nature photographers who today offer their work. Cooper also offers custom sizes and applications for diagnostic imaging using Joey's photos. There are numerous other companies offering back-lit nature photos but Cooper has the advantage of being a lighting company which means there is one less thing for a designer to worry about in terms of coordination. Other vendors offering graphic image luminaires are Kenall and Sky Factory. TESS USA also creates large-scale custom back-lit displays.

Coves, Track Lighting, and Linear Pendants

Other luminaires include linear recessed or surface-mounted fixtures used for coves and wall grazing, and track lighting that uses fixture heads for directional light. These accent fixtures may be more appropriate for reception areas, waiting rooms, or circulation spaces with special design features or artwork. Linear recessed fixtures are available with fluorescent ballasts, but mostly specified as LED, such as the *LC32* from Cooper Lighting or the *Plexineon®* from *iLight* Technologies. Track lighting, such as the *Boa system* from Bruck Lighting or the *Monorail system* from LBL Lighting, is widely available with halogen lamps, but more LED track heads are becoming available as LED lamps have a much longer life than halogen lamps. The *Adjust-e-lume™* track light head by B-K Lighting has adjustments for lumen level.

ENERGY CONSERVATION

Worse than not enough light is too much light. More is not better, in this case. The designer, if not qualified to do the lighting calculations, may wish to retain a lighting consultant or an electrical engineer. A high level of general illumination washes out textures and colors. Much more interesting, not to mention energy efficient, is an interplay of high and low levels of illumination. In offices, we light the task, not the entire room. Lighting, skillfully handled, can set up a rhythm of patterns, light, and shadow that can transform an otherwise commonplace interior into something quite spectacular.

Another practical way to prune watts is to install fixtures with dimmer controls and to use occupancy or motion sensors for rooms with infrequent occupancy. In fact, with

Figure 12-1. Wall and ceiling changing views of nature help to relax a patient. *(Courtesy of Eaton's Cooper Lighting Business, Fail-Safe Changing Views Series)*

current energy restrictions, occupancy sensors that turn off lights based on daylight conditions are fairly standard. Fluorescents must be ordered specifically with dimming ballasts. An attempt to save electricity by removing two of the four lamps in a four-lamp fixture without changing the ballast saves nothing. Specify high-frequency electronic ballasts to conserve energy and also to eliminate flicker.

MEDICAL OFFICE ELECTRICAL AND LIGHTING REQUIREMENTS

The electrical and lighting requirements for medical and dental offices differ greatly with the specialty and are discussed somewhat under each chapter. Chapter 10 discusses thoroughly the requirements of dental operatories, so that information will not be repeated here.

Exam rooms need a maintained light level of 100 footcandles. This can be achieved by two three-lamp (2×4 feet) recessed luminaires provided the correct high output lamps are used. Physicians who require a high-intensity light for examinations will have a portable lamp or other light source for that purpose. Figure 3-60 shows a procedure room with indirect "basket-type" luminaires, especially important when patients are lying down looking up. A ceiling-mounted examination light adds high-intensity light where needed (see Figure 7-22).

Nurse stations also require a maintained illumination of 50 footcandles except where medications are prepared, which should be 100 footcandles. The nurse station in Figure 12-2 has halogen pendant lights, compact fluorescent downlights for ambient illumination, and wall sconces. The feeling is warm and nonclinical. A lower light level is appropriate for ***waiting rooms*** (30 to 50 footcandles), and the concentration of illumination should be where people are reading. Lighting in the lobby/waiting area is an elegant design for a community health center in San Francisco (Figure 12-3).

Corridors need only about 5 to 10 footcandles of illumination, and the light certainly need not be confined to the ceiling. In fact, lighting mounted on the walls of a corridor often gives better color rendition to interior finishes than would those same lights mounted on the ceiling (see Figure 3-26 and Figure 12-4). Also, there is more glare when lights are mounted on the ceiling. Another type of pendant fixture that bounces light off of the ceiling by SPI is especially effective where glare on computer monitors can be problematic (see Figure 12-2). Low-voltage cable lighting is effective in corridors, especially when high ceilings are possible (Figures 5-92 and 5-93).

Decorative pendant lights are effective at ***reception desks*** (see Color Plate 9, Figure 4-16, Figure 5-89, and Color Plate 23, Figure 7-20).

The ***consultation room or private office*** requires approximately 15 footcandles of light for conversation but for reviewing reports or paperwork may require 40 footcandles concentrated over the desk. Additional lighting in

Figure 12-2. Wall sconces, pendant lights, and recessed downlights illuminate corridor and nurse station. *(Design: Jain Malkin Inc.; Photographer: Glenn Cormier)*

Figure 12-3. Good lighting design adds interest to community health center. *(Interior Architecture/Interior Design: Polytech Associates Inc.; Photography: pmstructure photography)*

a consultation room may be used to accent diplomas or artwork if the room is large enough to handle additional lighting.

Minor surgery rooms require from 100 to 150 maintained footcandles, depending on the types of procedures performed. Most minor surgery rooms will have a ceiling-mounted high-intensity surgical light in addition to two four-lamp fluorescents (see Figures 5-107 and 7-22).

Certain types of workrooms such as endoscopy scope processing require careful attention and shadow-free lighting where the decontamination of scopes requires brushing of the channels. Here, lights mounted under the upper cabinets will provide the light where needed in addition to overhead illumination. There is high risk to patient safety if the scopes are not properly cleaned. The overall illumination should be 100 footcandles.

Reliance on daylighting, where available, for overall illumination is a good strategy; it can be complemented by high-intensity task lighting for needle insertion, for example, at an infusion station. Clearly, medical facilities pose a unique challenge for lighting design due to the higher levels of light needed for clinical procedures and for patient safety. The light reflectance values of finish materials is an important consideration. Dark colors absorb light and require more lumens and fixtures to illuminate the space.

Figure 12-4. Indirect pendant lighting provides soft illumination for corridors. *(Design: Jain Malkin Inc.; Photographer: Steve McClelland)*

Creative Lighting Design

A dramatic light fixture is the perfect selection for the dental suite in Color Plate 36, Figure 10-128, a design that expresses, throughout, the doctor's love of water and surfing. The office of an oral surgeon has a very interesting corridor with LED lighting (see Color Plate 31 Figure 10-144b). In the Lasik surgery center in Color Plate 16 Figure 5-83c lighting fans out around an unusual water feature, like rays of the sun. In the corridor, Color Plate 16, Figure 5-83d, brilliant blue wall sconces add just the right sparkle to the space. The waiting room of the dental office in Figure 10-1 has a unique ceiling design as well as light fixtures recessed into walls, low near the floor. The room has a variety of interesting lighting for different effects. The lobby/waiting area of the urgent care center in Color Plate 4, Figures 3-118a and b, has both an interesting ceiling design and selection of lighting. Sometimes lighting needs to be subtle as in the massage room in Color Plate 17, Figure 5-95. Throughout this book there are numerous examples of creative lighting design.

CHAPTER 13

Construction Methods and Building Systems

LEED®/GREEN DESIGN

There has been considerable interest in recent years in green design as a visible demonstration of commitment to sustainability and the health of the planet. It may be a while before it becomes mainstream in private practice medical and dental offices but clinics associated with hospitals and larger organizations such as Kaiser Permanente are making that an imperative. In Chapter 3, Cisco LifeConnections is LEED Gold and in Chapter 4, community health center Adelante Healthcare, is LEED Platinum. San Francisco Surgical Arts, an oral surgery facility presented in Chapter 10, represents total dedication of a solo-practice provider to Leadership in Energy and Environmental Design (LEED), a doctor who became an evangelist for this concept and shares generously and transparently all of his innovation. In July 2013, Kaiser Permanente, Oakland, made a commitment to spend an estimated $30 billion on the building of new health facilities to a minimum LEED Gold certification standard. According to an article in *Health Facilities Management* magazine (July 2013), they are aiming to achieve energy performance 25 percent better than ASHRAE 90.1–2007 and to use at least 30 percent less water than the baseline established by the U.S. Energy Policy Act of 1992.

All too often, medical office buildings (MOBs) have been built by developers under pressure to build at the lowest cost in order to be competitive. This means taking shortcuts and choosing inexpensive systems that have a bigger environmental impact. There will be a tipping point, however, at which market forces will favor LEED-certified buildings and then, in order to be competitive, the majority of developers and contractors will enthusiastically support stewardship of the environment. This is an evolutionary shift in attitude that has been occurring over the past 15 years, and it has really picked up steam. In the manufacture of building products, interior finish materials, furniture, coatings like paint, and fabrics, it is increasingly uncommon to find products that contain substances that off-gas, or that contain PVC or other unhealthy substances. Years ago, manufacturers saw the handwriting on the wall and have progressively transitioned their product lines to be environmentally safer. If a physician or dentist moves into a building that was not designed to comply with LEED, it becomes very difficult for an individual medical or dental office to become certified because LEED points relevant to the site and building shell as well as mechanical system and utilities will not be available.

At the center of the movement to have healthier buildings is the United States Green Building Council (USGBC), which offers the LEED certification system, which puts projects through a rigorous process of review. In exchange for constructing a more sustainable built environment, projects are rewarded with tiered rankings and coveted plaques that reflect a company's commitment to a high-quality built environment.

LEED certification is a standard for green building that can be found around the world and comprises an

extensively detailed process that includes components of site location, water and energy efficiency, material selections, indoor air quality, and occupant comfort. The USGBC offers a variety of rating systems from which to choose. These include new construction, homes, schools, healthcare, retail, commercial interiors, and so forth. Depending on the type of construction project one of these specialty systems is selected and its various prerequisites and elective points are pursued through the process of design and construction. Within each system, the number of points obtained determines which LEED certification is awarded. The highest level that can be earned is Platinum, followed by Gold, Silver, and Certified. Certain prerequisites must be met in each category. Beyond that, the project team selects which elective credits to pursue depending on various factors of the project, including budget, tenant/owner priorities, and the desired level of certification.

While some criticize this process as costly and time-consuming, the reward of LEED certification is a return on investment in energy savings, employee satisfaction, and a higher premium on leasable space. LEED certification also provides businesses with a competitive advantage and a LEED "badge of honor" that consumers recognize. For the government, LEED is a standard at the federal level for new building projects and quite often the standard at state and local levels. For example, in California all new and renovated state-owned facilities are required to be certified LEED Silver or better. States such as Arizona, Rhode Island, Nevada, New Mexico, Washington, Michigan, and Pennsylvania have similar requirements. More and more businesses are realizing the advantages of getting their projects LEED certified.

A rating system specifically for medical and dental offices does not exist. LEED for Healthcare is targeted toward green hospitals but may be used for larger stand-alone offices on individual sites. Kaiser, as an example, is using *LEED for New Construction Building* for its MOBs. For a majority of medical and dental offices that lease or own space in a medical office building, LEED for Commercial Interiors (LEED-CI) is the appropriate choice for certification. Both LEED-CI and LEED for Healthcare are broken down into seven main categories: *Sustainable Sites; Water Efficiency; Energy and Atmosphere; Materials and Resources; Indoor Environmental Quality; Innovation in Design;* and *Regional Priority*. A large portion of the credits to be obtained for LEED-CI certification are in the categories of *Energy and Atmosphere* and *Sustainable Sites*. LEED for Healthcare also places emphasis on *Indoor Environmental Quality*.

To begin the process of obtaining LEED certification, a project team, which includes the tenant/owner, the designer/architect, and typically a LEED consultant, will choose which rating system to use. A project administrator, usually the LEED consultant, will register the project on the USGBC website. This begins the official LEED process. A certification application, including all documentation for the prerequisites and credits, as well as required fees must then be submitted. The application will then be reviewed and a certification decision will be made by the USGBC. This decision can be either accepted or appealed. During the appeal process, a project team may add additional credits in an attempt to obtain or increase their level of certification. Once a project is certified, the USGBC provides guidelines for public relations promotion and information on ordering LEED plaques and certificates. Plaques are often displayed in prominent locations at the entry of a suite or building and signify the commitment to green building.

A LEED Accredited Professional (AP) is very often included in a project team as a consultant who tracks targeted points and helps guide the design team in their selections and specifications. Interior designers and architects are often LEED Accredited Professionals as well. By using an independent LEED consultant, the design team can be freed up to focus on their expertise while the LEED consultant maneuvers through the system of certification. LEED and green building consultants have proliferated in recent years to meet the demands of this growing market. In order to become a LEED Accredited Professional, one must pass a detailed examination on green building and relevant LEED rating systems. Continuing education credits are required to maintain the LEED AP with specialty accreditation. The advantages of working with LEED-accredited architects and designers should be

emphasized even if one has engaged a LEED consultant to manage the process. These experienced design professionals will know how to select appropriate building systems and materials that will lead to maximum LEED points while providing a high level of design. Even the selection of furniture figures into the equation. Furniture that is manufactured within a 500-mile radius of the site adds to the points. A LEED Accredited interior designer will be familiar with these resources.

For physicians, dentists, or practitioners who wish to create a LEED certified clinic under the LEED for Commercial Interiors rating system, selecting a building or development site is an important first step in the design process. LEED heavily rewards site selections that are in existing LEED certified buildings. If the building is not LEED certified, then points may be earned for buildings developed on brownfields, with stormwater management plans and water efficient landscaping, and with elements that mitigate a heat island effect and light pollution reduction. LEED points may also be earned under *Sustainable Sites* by selecting an office location in an established, walkable community or close to public transportation. Site amenities such as bicycle storage and changing rooms for employees can also earn points toward certification.

The *Water Efficiency* section promotes the wise use of water and requires every LEED-CI project to reduce water consumption by 20 percent from current baseline standards. The savings can be met by using low-flow toilets, urinals, and faucets. Technology for these fixtures has improved significantly in recent years so that low-flow does not equate to a less effective plumbing fixture. Fixture companies such as Toto and Kohler have been on the cutting edge of low-flow technology. If water use savings on the project are increased further, more points may be earned toward certification. For example, at a 30 percent reduction, 6 points are earned; at a 35 percent reduction, 8 points are earned; and at a 40 percent reduction, 11 points are earned.

A section heavily emphasized in the LEED rating systems is *Energy and Atmosphere*, which deals primarily with increasing energy performance in building systems. One of the two prerequisites for this category is the "fundamental commissioning" of building systems. This fundamental commissioning process verifies that the energy efficient systems specified and installed on a project are operating as intended and documented. Another prerequisite is compliance with energy efficient codes and the reduction of required power loads through energy efficient lighting and Energy Star® qualified equipment. Zero use of chlorofluorocarbon (CFC)-based refrigerants in HVAC and refrigerant systems must also be met. Beyond these requirements, points may be earned with energy efficient lighting loads, using daylight controls and occupancy sensors, and creating HVAC zones with separate controls. Projects that engage in an enhanced commissioning process and/or implement a system that measures and verifies actual energy use may also earn points toward certification. Purchasing green power, through a Green-e certified source or its documented equivalent, is also a path to earn points in the *Energy and Atmosphere* section.

Selecting green materials for the office suite is another avenue of earning points toward LEED certification. In the *Materials and Resources* section, once the requirement for the storage and collection of recyclables has been met, points can be earned based on the idea of minimizing the use of natural resources. The elective points include signing a commitment to stay in the space for a minimum of 10 years, reusing existing nonstructural components, and recycling or salvaging nonhazardous construction and demolition debris. Tenant improvements that include salvaged, refurbished, or reused materials, including furniture and finishes, may earn points, which are calculated based on the percentage of cost of the overall budget. Specifying and installing rapidly renewable materials, materials with recycled content, FSC certified wood, and materials manufactured and/or harvested regionally (within 500 miles) are all paths to additional LEED points.

A LEED-CI category that affects both employees and patients within a space is the *Indoor Environmental Quality* section. In this section, LEED points are earned by creating a space with high indoor air quality and access to daylight and views. Specifying materials and adhesives that meet certain LEED standards of VOC emissions are key

to obtaining points for certification. Additionally, ventilation requirements must be met and smoking must be prohibited within 25 feet of entries, outdoor air intakes, and operable windows. Providing additional ventilation and installing a monitoring system to ensure the ventilation system maintains the requirements of green design are more opportunities for LEED points. Several points in the LEED-CI rating system emphasize the comfort, productivity, and well-being of occupants within an office space. An indoor air quality management plan, both during construction and before occupancy, can help provide superior indoor air quality, which can add to the well-being and comfort of patients and staff. Other elements that enhance comfort and earn credits are to provide access to daylight and views to the outside and to install accessible lighting and HVAC controls that enable adjustments to meet individual needs.

Two smaller categories in the LEED-CI rating system are *Innovation in Design* and *Regional Priority*. Innovation in Design emphasizes and rewards exemplary performance as well as the attempt of one of the many USGBC pilot credits, which are new or revised LEED credits that are tested and evaluated by project teams for possible inclusion in future rating systems. This category may also allow a design team to earn a point for an innovation that achieves "significant, measurable environmental performance using a strategy not attempted in the LEED" rating system. A point is also provided if at least one of the main participants of the project is a LEED Accredited Professional. Under Regional Priority, points are earned by a project having environmental importance to a region, as defined by the USGBC. It is clear that this is a complicated process that requires dedication and endurance in its pursuit but one that is well worth the effort.

HEATING, VENTILATING, AND AIR CONDITIONING

The mechanical requirements of medical and dental offices are quite specialized in that the physical comfort of staff and patients is very important, and there are a great many variables in terms of room function, often within a small area. An *examination room*, for example, is typically 8 × 12 feet in size, and the patient (who spends more time in the room than the doctor) is usually undressed. The *waiting room*, by contrast, is designed to accommodate many people, and often they have sweaters or coats on their laps, which add to their body warmth. Not only does this room have a higher density (one person per 16 to 20 square feet compared with one person per 96 square feet in an exam room), but the occupants themselves generate heat.

A *nurse station* or *business office*, where fully clothed persons are busily moving about, has yet a different requirement. The *dental operatory*, typically 100 square feet, usually has three occupants and a high level of illumination. These rooms each have different comfort requirements in terms of temperature and varying load characteristics. In states where energy conservation legislation has been enacted, the allowable watts per square foot have been slashed to the point where it can be quite a challenge to light clinical rooms adequately. In California, for example, exam rooms are allowed 1.2 watts per square foot, a business office, 0.9 to 1.1 watts, corridors 0.6 watts, and waiting rooms 1 watt. This can be supplemented by task lighting, which falls outside these allowances. Refer to Chapter 12 to see how advances in lighting technology have addressed the challenge of energy conservation.

The factors that must be considered in designing a functional heating, ventilating, and air-conditioning (HVAC) system are

1. Lighting load
2. Room occupancy
3. Equipment load
4. Comfort level based on room function

The capacity of the mechanical system should take into account requirements of such special tenants as a sports medicine facility, ambulatory surgical center, or clinical lab.

The type of HVAC system (equipment and method of distribution) may vary, but often it is a ducted air system that supplies heated, cooled, and fresh air. The system should be designed with maximum concern for sound control. Thus, each room may have its own supply and air return; undercutting doors and the use of transfer grilles for return air are to be avoided. Sound carried through the ducts of a ventilation system can be reduced in a number of ways.

A certain amount of sound will naturally be absorbed in the duct wall lining, and some will pass through the duct walls into the plenum. Additional insulation, duct linings, or package attenuation units can produce an even greater degree of sound control. However, a certain amount of white noise produced by the mechanical system is desirable for masking conversation from room to room.

Performance Spec

It is advisable to write a performance spec for the HVAC system to define goals about room zoning and after-hours operation (physicians often work late and on weekends) and to analyze equipment costs, projected energy use, and operating costs.

The need for after-hours HVAC operation must not be underestimated. Surgeons who live far from the hospital may sleep in their offices if called to the hospital late at night for an emergency. Others may open their offices on weekends to treat a sick patient. Extended evening and Saturday hours are fairly common for many dental and medical practices in order to accommodate people who work.

CONTROL OF ODORS

To prevent the spread of odors from endoscopy scope processing rooms, toilets, cast room, laboratory, staff lounge, or other areas, the ventilation system should be designed so that negative air pressure, relative to adjoining corridors, is maintained. This can be accomplished by exhausting more air from these rooms than is supplied to them and by reversing this procedure in the corridors. Exhaust in these rooms should be at least 2 cubic feet per minute per square foot.

PLUMBING

Plumbing in a medical or dental facility is not much different from that in other types of commercial buildings, but, by their very nature, medical office buildings have a high density of plumbing fixtures, and provisions must be made to locate them anywhere except along the perimeter of the building. No area should be too far from drainage to accommodate a slope of ¼ inch per foot within the given plenum depth. Plaster traps should be supplied in sinks for cast rooms, clinical laboratories, barium prep areas, dental laboratories, and sometimes in minor surgery rooms. Clinical laboratories should have acid-resistant waste piping. All medical and dental offices must be sprinklered.

MEDICAL GASES

Certain suites—dentists, oral surgeons, plastic surgeons—require medical gases. Building and fire codes are very strict regarding where and how medical gases are stored. Gases may be stored in mobile tanks that are wheeled from room to room as needed, or gases (nitrous oxide and oxygen) may be stored in tanks in a nearby room designed for that purpose and piped through degreased, sealed copper tubing (using only silver solder) to a flow meter in each room where gases are needed. If gases are located outside the suite, a pressure gauge must be located within the suite to monitor the supply. The reader is referred to Chapter 10 for a discussion of this topic. Building codes are very specific about the storage of medical gases with respect to construction of the room and the required ventilation and fire protection.

Certain suites require compressed air and central suction. These tenants will usually have a vacuum pump and air compressor located in a small mechanical equipment room within the suite, but some medical buildings provide these utilities and pipe them to the suites. Vacuum piping is PVC Schedule 40. Suites requiring these utilities include dentists, oral surgeons, clinical laboratories, dental laboratories, endoscopy suites, ambulatory surgical centers, and plastic surgery suites.

Sound Control

Sound control is of utmost importance in a medical office, especially in examination rooms and consultation rooms. Unfortunately, all too many medical buildings are constructed with profit rather than function as the prime motivation, and partitions terminate at the finished ceiling and have no sound-attenuating properties. There are, however, several ways to reduce sound transmission without spending great sums of money:

1. All partitions should terminate 6 to 8 inches above the suspended ceiling. Thus, each room has its own ceiling, rather than dropping the suspended acoustic ceiling over the entire suite, with only the demising walls continuing above it.
2. Sound can be absorbed near its source through the use of carpet, wallcoverings, and acoustic ceiling tile.
3. Solid-core hinged doors (not barn doors) should be used with smoke gaskets on all doors.
4. Fiberglas batting should be added inside partitions between studs.
5. To control the passage of sound through walls, floors, and ceilings, acoustical "holes" should be avoided, such as those created by the use of pocket doors or when electrical outlets on opposite sides of a partition are positioned too close to each other, when doors are poorly fitted, when plumbing pipes or heating ducts are improperly fitted, or when partitions do not make proper contact with the ceiling.
6. A certain amount of white noise from the ventilation system will mask soft conversation from room to room.
7. A piped-in music system will also mask usual conversation. A CD player located in the business office with speakers in the waiting room and corridors is preferable to prerecorded background music. Another option is a plenum- mounted sound masking system.
8. Certain rooms, such as psychiatrists' consultation rooms and audio rooms for hearing tests, need a high level of sound control. There are a number of ways to create a sound-attenuating partition. Creased Thermafiber insulation, application of sound board, isolation through the use of resilient channels, and staggered studs are four methods commonly used.
9. Return air grilles should not be located near each other. If the building has a plenum return, the grilles should have a minimum 4-foot sound boot (16-inch-diameter flexible ducting open at the other end). Open ends of sound boots should be turned away from each other.

MEDICAL/DENTAL OFFICE COMMUNICATION SYSTEMS

The reader is referred to Chapter 10 for a discussion of communication systems specifically for the dental office. Also refer to Chapter 3 for discussion of medical offices.

Many offices of more than 1,500 square feet have some sort of interoffice communication system other than the telephone intercom. There are four conditions that may require signal notification:

1. To tell the doctor which room has the next patient
2. To call the doctor to the telephone

3. To call a nurse or aide when the doctor is in the examining room
4. To tell the staff where the doctor is

A small panel of signal lights mounted above exam room doors can indicate to the doctor when a patient has been prepared for examination. When the patient is ready, the nurse turns on the light code for a specific doctor. When the doctor enters the room, he or she turns off the light. This system requires additional modification for large busy practices, since several patients may be prepared and waiting for an individual doctor, who will need some way of knowing the sequence.

There are a variety of other interoffice communication systems available. Dealers who sell these products also install them. They can design a system to suit the needs of the individual office and can furnish the designer with the electrical specifications.

FIRE PROTECTION

Special consideration must be given to the type of fire-extinguishing system used in such suites as radiology or clinical labs, which contain a great deal of expensive computer-based equipment. Sprinklers would do considerable damage.

CHECKLIST

The following is a checklist of odds and ends to jog the designer's memory. It is not intended to be a complete inventory of requirements.

Code review

- Occupancy type
- Occupancy load
- Number of required exits, separation of exits
- Radiation shielding
- Fire separations
- Handicapped bathrooms and other accessibility requirements
- Structural floor loading

Partitions

- Sound control
- Continuation above suspended ceiling
- Fiberglas batting
- Verify construction of partitions with contractor when planning offices in a building not designed by the space planner (one may find that the contractor, in order to come in with a low bid, based his bid on 2½-inch studs, giving a finished wall that has to be "thickened" wherever plumbing and recessed plumbing accessories occur as well as any number of things that may be recessed such as a specimen pass-through in toilet rooms)
- Verify or specify texture of finished wall
- Spec low sheen eggshell finish for walls for durability and cleanability
- Spec special ceiling heights, if required
- No texture on walls that will receive wallcovering
- Spec blocking in walls (or ceiling) to support dental operatory lights and X-ray heads, special light fixtures, casework, certain pieces of medical equipment, and for TV brackets

Doors

- Solid core
- Pocket doors (avoid use of)

- Door closers, smoke seals
- Hardware, keying of locks, function of locks
- Door finish: painted or stained, plastic laminate
- Door stops
- Type of door frame
- Spec width and height of doors
- Spec carpet height for cutting doors
- Door assembly ratings (20 minute, 90 minute, and so forth), as required

Plumbing

- Plaster traps (where required)
- Infrared, wrist or foot-pedal control faucets
- Acid-resistant waste pipes
- Spec sizes of sinks; porcelain or stainless steel
- Separate shutoffs for each fixture
- Floor drains in PT/OT workrooms for ice machines and other equipment, hot-water heater room
- ADA compliance for toilets

Communication systems

- Telephones
- Avoid overhead paging
- Signal lights
- Annunciator panel
- Music system: locate speakers
- Location of telephone terminal panel (requires electrical outlet and grounding)

Mechanical systems

- Locate air compressor and vacuum
- Locate medical gases, natural gas
- Locate hot-water heater (if electric, requires outlet) and floor drain
- Exhaust fans (bathrooms, kitchens, break rooms), scope cleaning/processing rooms, labs, cast rooms, staff lounges)

Casework

- Spec style of construction, types of drawer glides, hardware, hinges
- Detail handicapped accessibility at reception counter and sink locations
- Trash slots in exam cabinets, as required
- Upper cabinets—to provide or not

Lighting/ceiling

- Do switching diagram, locate switches
- Spec dimmers, as required (fluorescent fixtures require dimming ballasts)
- Spec color temperature and CRI fluorescent lamps, also LEDs
- Spec lamp wattages
- Spec lenses of fixtures
- Spec color of grid (spline) suspended acoustic ceiling
- Illuminated exit signs

Electrical

- Note special outlets, 220-volt lines, floor receptacles
- Spec height of outlets
- Outlets over countertops should be located horizontally
- Locate circuit breaker panel
- Locate intercom and phone, note wall phones
- Outlets should not be located back-to-back (locate in different stud bays)

Miscellaneous

- Locate scale spaces, as required, noting any that are to be recessed in the slab
- Fire extinguisher cabinet
- Cross check locations of thermostats, horns, strobes, speakers, and all other utilities to not interfere with signage or art locations

CHAPTER 14

Researching Codes and Reference Materials

Codes are designed to ensure life safety. As healthcare services have become more complex and sophisticated, the design and construction of these facilities have become more specialized. Paralleling the increasing complexity of diagnostic and treatment procedures is the development of numerous codes and standards designed to limit risk and make buildings relatively safe.

The problem is that codes occasionally contradict one another, and the language is frequently subject to interpretation. Often, the level of protection is a value judgment. The minimum standards per code may be inadequate for a facility serving the elderly, for example. Or the corollary may be true: The minimum standards may occasionally be excessive for a particular project. The cost of implementing them may make the project unfeasible. Thus, codes must be evaluated in terms of the following: (1) *What is an acceptable level of risk in terms of life safety?* (2) *Is the cost of that level of protection warranted or within the budget for the facility?* (3) *Are the codes or standards applicable to that facility redundant?*

Further complicating these issues is the fact that codes are written by one body and enforced by another. The local inspector, who is responsible for interpretation and compliance, does not always understand the intent of the codes, and inspectors within the same office may disagree on interpretations. Nevertheless, codes are an important part of healthcare design, and designers need to be familiar with them. If anything, the next 10 years will bring more codes and regulations, not fewer. However, the introduction of the *International Building Code*, which is in use or has been adopted by 50 states, will do much to minimize the differences in codes among jurisdictions.

Codes cover the general areas outlined below.

FIRE PROTECTION

1. *Flammability of Materials:* especially carpet, wallcoverings, draperies, upholstery fillings and fabrics, and carpet and wallcovering adhesives
2. *Exiting Requirements:* number of exits, travel distances between doors of exit, corridor separations, sizes of doors and stairwells, construction of doors and walls, and illumination of fire exits
3. *Storage:* how and where medical gases are to be used and stored; storage of combustible solid supplies
4. *Fire-Fighting Equipment:* locations of wet and dry standpipes; chemical fire extinguishers; and, in high-rise buildings, smoke evacuation shafts and central control station for fire department use
5. *Electrical Systems:* standards for wiring, equipment, and emergency power systems
6. *Fire Detection Devices:* locations of sprinklers, smoke detectors, and alarms

ANSI STANDARD 17.1-ADAAG

The Americans with Disabilities Act of 2009

Disabled persons are defined broadly to include the visually and hearing impaired; those with motor or neurological disorders; and individuals with arthritis, asthma, and cardiac insufficiency. The goal is to create spaces that are universally accessible to persons of different stature (height), age, and abilities. The Americans with Disabilities Act (ADA) is civil rights legislation enacted to ensure equal access in public accommodations. Title III contains accessibility guidelines specifically related to building access. (Both federal and state codes provide for creating accessible places.) Note that some jurisdictions enforce ANSI over ADA. Some states have adopted ANSI as state accessibility standards. In designing accessible toilet rooms (see Appendix) it is wise to add a few inches to the required clearances since the thickness of materials like ceramic tile will impinge on the space.

The ADA is enforced through the U.S. Department of Justice (DOJ) through complaints of private citizens and other organizations. There is no "ADA police," but there are individual citizens or organized citizen groups and attorneys who file complaints with the DOJ. There are also disabled attorneys who "test" the accessibility of public places. Architects and owners who fail to provide the required access may find themselves at a settlement conference.

The ADA affects the following facilities: restaurants and cafeterias; medical care facilities; businesses; retail shops, civic buildings, libraries; transient lodging; transportation; judiciary, legislative, and regulatory facilities; detention and correctional facilities; public housing; and public right-of-way areas.

1. Location of ramps, curb cuts, parking stalls; placement of exits and design configurations
2. Dimensions of elevators and restrooms, door widths and setbacks, and placement of restroom fixtures and accessories
3. Heights of countertops and work surfaces, sinks, public telephones, and drinking fountains
4. Audible and visible warnings at elevators and stairs
5. Elimination of protruding objects in corridors or lobbies

SANITATION

1. Cleanability of wallcovering, flooring, and other interior finishes
2. Asepsis (ability to support bacteria) of interior finish materials
3. Homogeneous character of materials to eliminate pores or cracks that may support bacterial growth

MINIMUM CONSTRUCTION REQUIREMENTS

1. Minimum sizes of rooms and minimum sizes of various departments (within a licensed clinic or hospital, for example), location and number of windows, minimum ceiling heights, and relationship of various rooms to one another
2. Planning and programming decisions with regard to function (e.g., separation of clean and soiled functions in surgical facilities)
3. Accommodation of equipment: spaces for gurneys, drinking fountains, and public telephones. Minimum requirements for laundries, kitchens, laboratories, operating rooms, and so forth

ENERGY CONSERVATION/ENVIRONMENTAL IMPACT

State and local codes govern energy conservation and the ecological impact of a proposed building on its environment.

National Codes and Standards

The aforementioned code classifications may fall under the jurisdiction of city, county, state, or federal codes, in addition to the following nationally recognized standards:

Life Safety Code 101 and NFPA 99 (published by the National Fire Protection Association)

Uniform Fire Code

National Electrical Code (published by the National Fire Protection Association)

The Joint Commission

Americans with Disabilities Act, Title III

Guidelines for Design and Construction of Hospital and Medical Facilities (published by the Facilities Guidelines Institute)

American National Standards Institute (ANSI)

American Society for Testing and Materials (ASTM)

Underwriters' Laboratories

International Code Council

Recognized state building codes include the International Building Code. This is a model code that, through a legislative process in each state, will either be adopted with amendments or in full and that becomes the state's building code.

CERTIFICATE OF NEED

Prior to building a state-licensed healthcare facility or remodeling or expanding an existing one, the local health systems agency (HSA) must endorse the project and, in some states, a Certificate of Need (CON) must be obtained from the state. The CON is designed to prevent duplication of highly specialized facilities and equipment and to keep a lid on rising healthcare costs. States receiving federal funds under the National Health Planning and Resource Development Act of 1974 were required to introduce CON programs. Currently, 36 states have some type of CON regulations; however, a number of states have abandoned their CON programs.

ISSUES RELATING TO OUTPATIENT MEDICAL FACILITIES UNDER A HOSPITAL'S LICENSE

Hospitals often develop clinics or specialized outpatient facilities in MOBs on the hospital campus. Usually, these are barely distinguishable from non-hospital-based facilities of similar function or specialty, but—designer beware—these will be subject to levels of scrutiny and regulations that may, at times, seem excessive, or even capricious, for outpatient facilities. Some of these issues concern levels of infection control appropriate for hospitals but unusual when viewed within the context of an outpatient facility.

Most outpatient facilities operated under the hospital's license will be subject to Joint Commission accreditation, which means they will be surveyed against the FGI *Guidelines for Design and Construction of Hospital and Healthcare Facilities* and will also be inspected by the local department of health services.

CODES RELATING TO MEDICAL OFFICE BUILDINGS

Code requirements for medical and dental offices are minimal compared to those for hospitals. The local building code will help determine the type of construction for a specific medical building and site, the zoning requirements, and the fire resistance.

Author's Disclaimer: The information provided here is general and should not be relied upon without verification before proceeding with design or space planning.

The following items are generally pertinent to planning individual medical and dental offices within a medical office building:

- Building type, number of floors, and square footage
- Minimum width of corridors
- Number of exits
- Accessible bathrooms
- Separation of exits
- Maximum length of dead-end corridors
- Minimum ceiling heights
- Construction of partitions
- Fire separations
- Radiation shielding
- Fire detection devices or sprinklers

Some of these items apply only to suites in excess of a specified square footage. Suites having an occupant load of 50 or more (generally 2,900 square feet or larger), for example, in the *International Building Code*, 2010 edition, must have at least two exits "separated by a distance equal to not less than one-third the length of the maximum overall diagonal dimension of the area served measured in a straight line between the center of such exits, or along the path of travel" and no more than a 50-foot dead-end corridor when the building is fully sprinklered. Due to the few fatalities attributable to fire in a "B" office occupancy in a fully sprinklered building, the 2010 IBC has deleted the requirement for corridors to be rated. (Note: The IBC 2013 edition will be available by the time this book is published.)

With an occupancy load of 100 or more, the suite would have to have corridors of one-hour fire-resistive construction. Codes applying to medical office buildings deal mainly with fire prevention and exiting in case of fire, as well as handicapped accessibility. The following principles are easy to understand in terms of space planning and construction.

ISOLATION OF RISK

If a facility is divided into sections by corridor separations, fire-resistive stairwell enclosures, and sealed vertical openings, the fire may be contained and prevented from spreading.

REQUIRED EXITS

The number of exits is based on the proposed occupancy load or the number of people using the space. Approved exits must lead directly out or to a means of egress, and exit access doors may have to open in the direction of egress (depending on the occupant load). Exits may not be through kitchens, storage rooms, or spaces used for similar purposes. Thus, people will not be trapped in a building, and all exits must be clearly marked and remain accessible at all times in case of fire.

SEPARATION OF EXITS

When more than one exit is required, each must be separated by a specified distance proportional to the size of the space to provide alternate access if one exit is blocked by fire.

STAIRS AND DOORS

Stairwells with fire-resistive enclosures and self-closing fire doors are intended to be smoke-free evacuation towers in case of fire. The stairs must be sufficiently wide to enable people on stretchers to be evacuated if necessary.

FIRE-WARNING OR FIRE-EXTINGUISHING DEVICES

Sprinkler systems are required in all facilities, particularly in laboratories, boiler rooms, large storage areas, or hazardous areas that are often unoccupied. Smoke or heat detectors and alarms are good warning devices where sprinklers are not feasible.

FLAMMABILITY TESTING

Building codes, regulations, and local ordinances are designed to restrict the use of flammable materials on walls, floors, and ceilings of buildings. The flammability characteristics of various interior finish materials influence the behavior of a fire. Although it is impossible to make a building and its furnishings absolutely “fireproof,” it is desirable to limit the risk to a reasonable standard by ensuring that the major interior finishes will not support flame or generate smoke. The NFPA 101 Life Safety Code specifies the flame spread, smoke density, and fuel-contributed standards for floors and walls of hospitals and healthcare facilities.

CARPET

The flame retardance of a carpet is a significant factor in its selection for a healthcare facility. Carpet fibers have different melting points: Acrylics melt at 420 to 490°F; nylons, 415 to 480°F; Polypropylene fuses at 285 to 330°F; wool, which does not melt, scorches at approximately 400°F. Four factors affect the flammability of a carpet.

1. Type of face yarn
2. Type of construction and texture
3. Pile density
4. Underlayment or pad

There are two tests of carpet flammability.

The Pill Test (ASTM D-2859–96). A methenamine pill (a timed burning tablet) placed on the carpet is used to determine if a carpet will burn when ignited by a small incendiary source. Since April 1971, all carpet sold in the United States must pass the pill test.

Flooring Radiant Panel Test (ASTM E-648). This is the most widely used test for carpet flammability. The radiant panel test evolved from extensive corridor fire test programs. The test measures the *critical radiant flux* (the minimum radiant energy necessary for a fire to continue to burn and spread) in watts per square centimeter (watts/cm^2). The lower the number, the greater the capacity for flame propagation.

> 0.45 watts per square centimeter is the minimum critical radiant flux recommended within corridors and exit-ways of hospitals and nursing homes. Class I = 0.45 watts per square centimeter or higher.
>
> 0.22 watts per square centimeter is the minimum critical radiant flux recommended within corridors and exit-ways of other occupancies except one-family and two-family dwellings. Class II = 0.22 to 0.44 watts per square centimeter.

These values provide a level of safety for a carpeted hospital or clinic corridor equal to or in excess of that now provided in the NFPA 101 Life Safety Code. Note that smoke density is as important as flame spread, since many people are killed by the smoke generated by a fire. The smoke density test is ASTM E-662.

WALLCOVERINGS

Interior finish materials (including wallcoverings) are grouped into three classes, according to their flame spread and smoke development characteristics. The Steiner Tunnel Test (ASTM E-84) or NFPA 286 is the standard test of flame spread for wallcovering and ceiling materials. Codes qualify rooms by occupancy and specify which class of finish is applicable.

Class A Interior Finish. Flame spread 0–25, smoke developed 0–450

Class B Interior Finish. Flame spread 26–75, smoke developed 0–450

Class C Interior Finish. Flame spread 76–200, smoke developed 0–450

Where Class C is specified, Classes A and B are permitted; where Class B is specified, Class A is permitted. Where an approved and properly maintained sprinkler system is in place, the specified flame spread classification rating may be reduced by one classification, but in no case shall materials having a flame spread greater than 201and smoke developed greater than 451be used.

Wallcoverings are also classified according to weight and texture. Continuous smooth surfaces equal to enamel plaster—less apt to support bacterial growth or collect dirt—are required for operating rooms, recovery rooms, and sterilization areas. Textured wallcoverings may be used in waiting rooms, corridors, offices, and examination areas.

It is the designer's responsibility to verify the codes pertinent to a specific project. If local codes stipulate minimum flammability standards for finishes in a room, an exit corridor, or an area of a medical suite, then all interior finish materials must be evaluated with respect to vendor-provided laboratory test data supporting the flame spread classification claimed.

Wallcovering Specifications. Fabric-backed vinyl wallcoverings are classified into three general categories.

Type I. In accordance with federal specification CCC-W-408a, Type I must weigh a minimum of 7 ounces per square yard and may weigh up to 14 ounces per square yard. It usually has a lightweight scrim backing. Type I materials are acceptable for light commercial use such as in offices and corridors with moderate traffic.

Type II. In accordance with federal specification CCC-W408a, Type II must weigh a minimum of 13 ounces per square yard and may weigh up to 22 ounces per square yard. It usually has an Osnaburg or drill tear-resistant fabric backing. Type II materials are suitable for general commercial use in public corridors of hospitals, lobbies, waiting rooms, dining rooms, cafeterias, and other areas of high traffic and above-average abuse.

Type III. In accordance with federal specification CCC-W-408a, Type III must weigh in excess of 22 ounces per square yard. It usually has a broken twill fabric backing for maximum strength and tear resistance. Type III materials are suitable for areas receiving exceptionally hard wear and abrasion such as elevators, stores and shops, and hospital corridors. Fire exit stairwells require nonflammable materials.

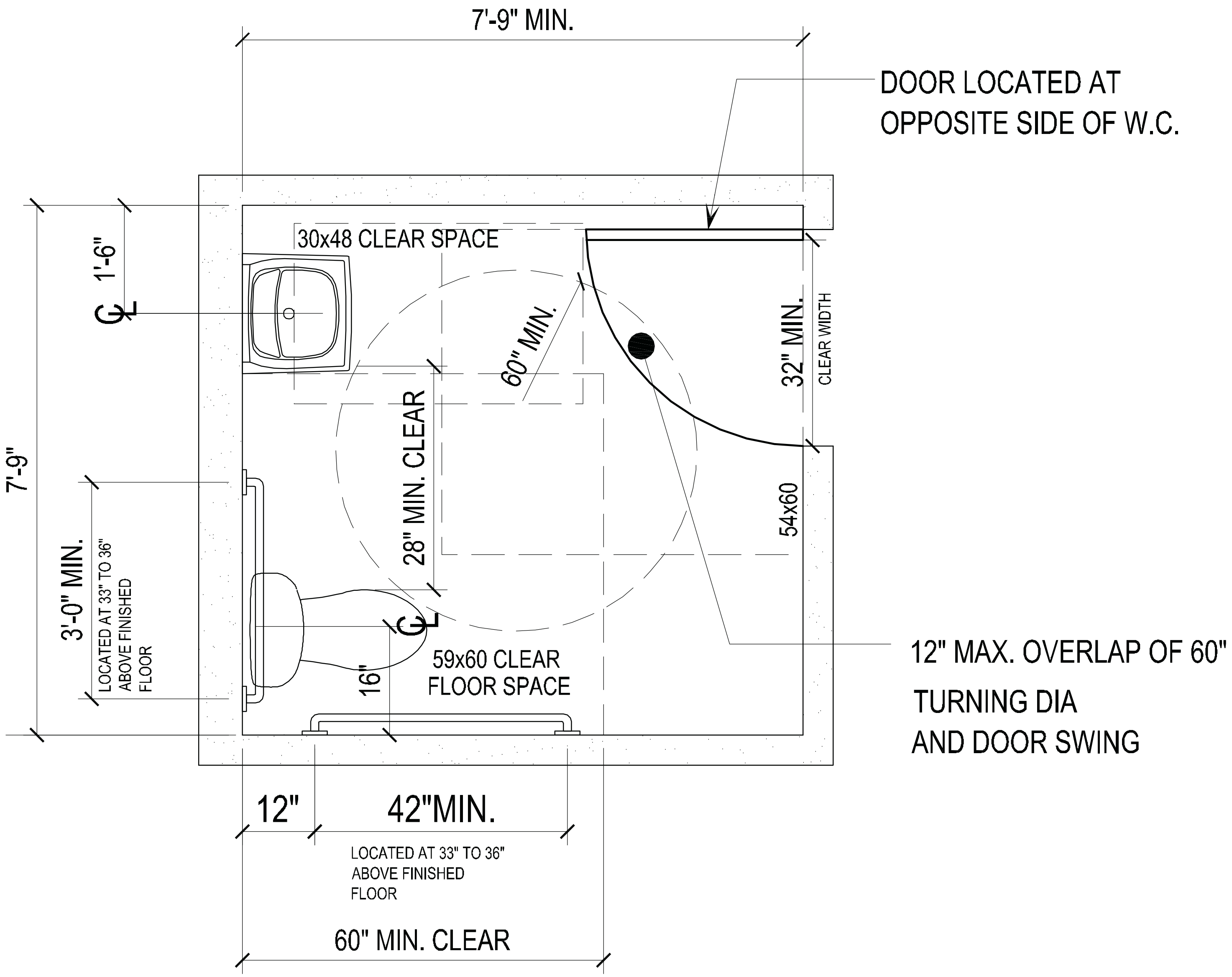
Wallcoverings in high-traffic areas can be ordered with a Tedlar® coating to give walls even greater protection. Tedlar is a tough preformed film of polyvinyl fluoride, which is laminated to the face of the vinyl wallcovering to make it resist stains such as lipstick, ballpoint pens, silver nitrate, and other indelible substances. Even harsh solvents and cleaning solutions will not mar the Tedlar coating, making it ideal for use in psychiatric hospitals, pediatric facilities, and other healthcare occupancies where walls are subject to graffiti and high abuse.

CODES—FOR THE GOOD OF ALL

While codes are important for life safety in every type of occupancy, they are especially so in healthcare settings where people may not be capable of self-preservation during treatment or so anxious that they fail to notice what may be obvious in a less stressful setting. The enforcement of codes can occasionally seem capricious when, in two identical situations, two different officials may have differing opinions or may request something in excess of a strict reading of the code but, as frustrating as this is, buildings do get approved and built. Fortunately, in the United States, the level of safety is outstanding due to restrictive building codes and firm interpretations of those codes.

Appendixes

Appendix 1



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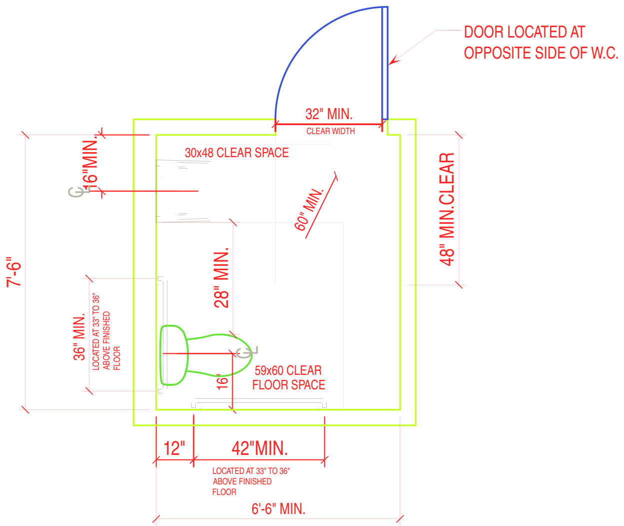

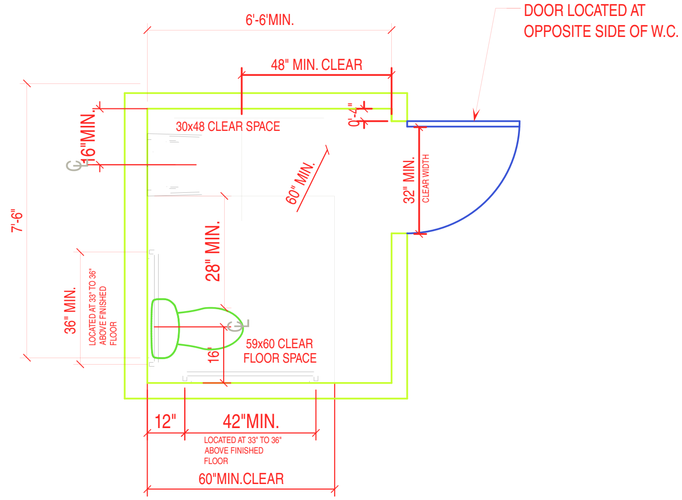

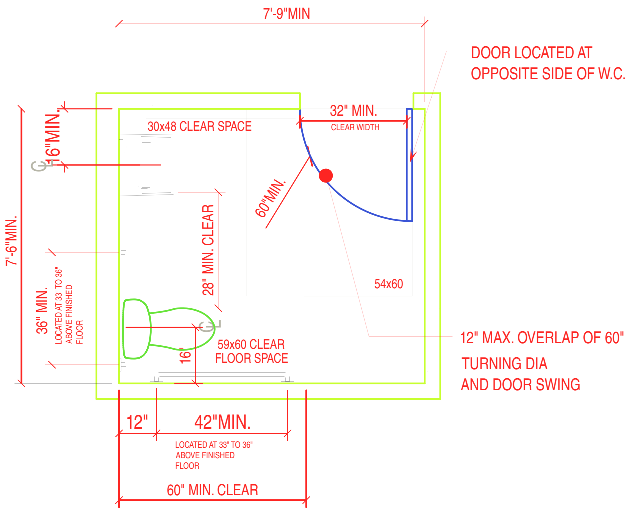

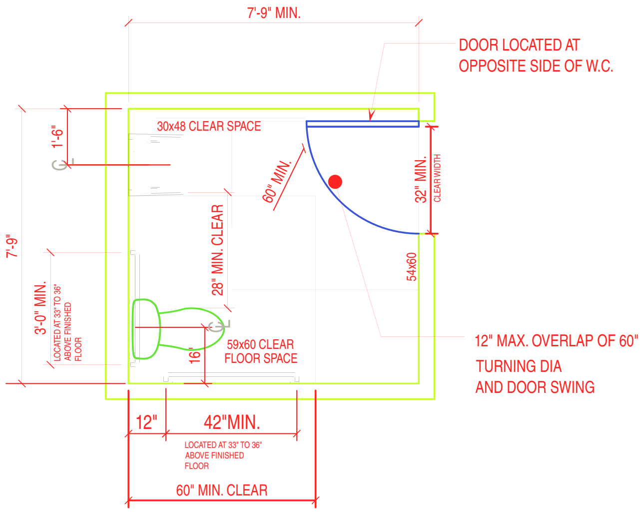

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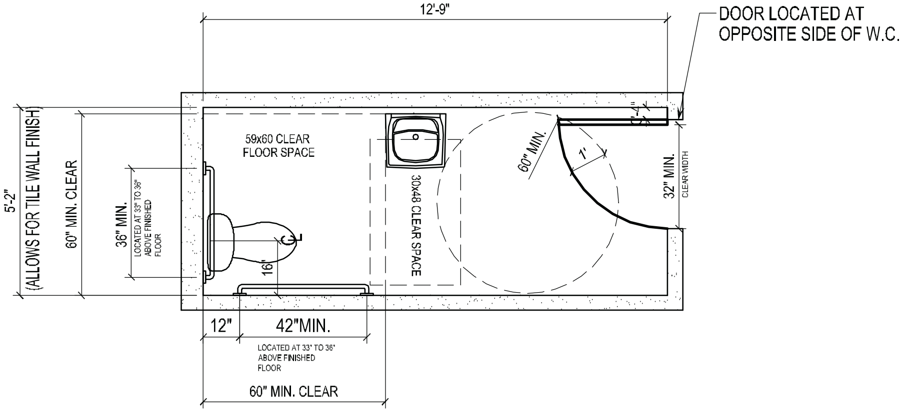

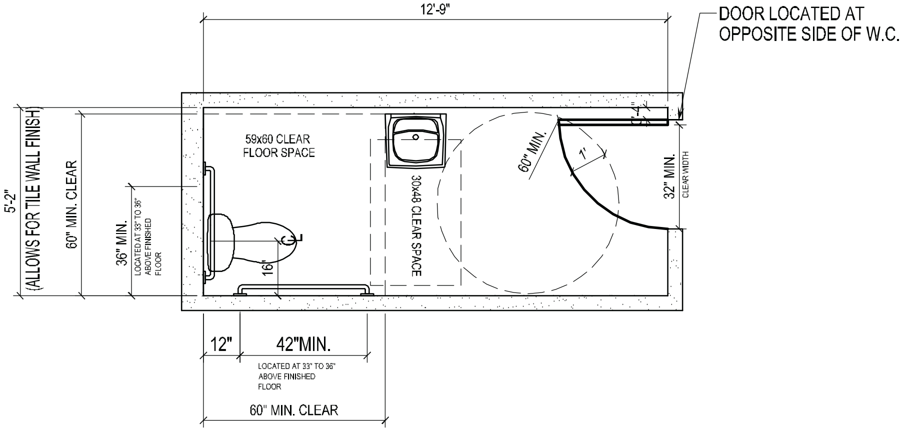

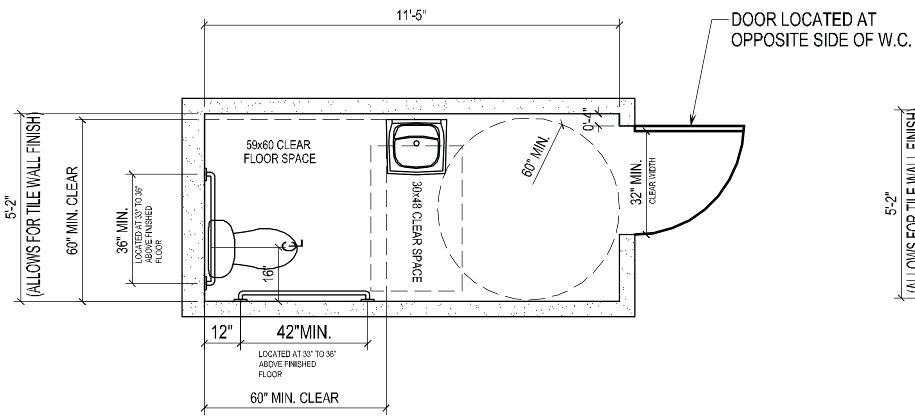

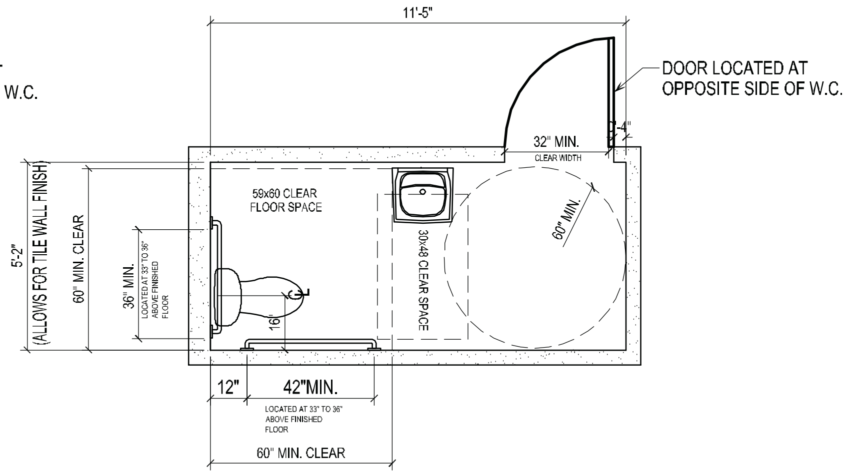

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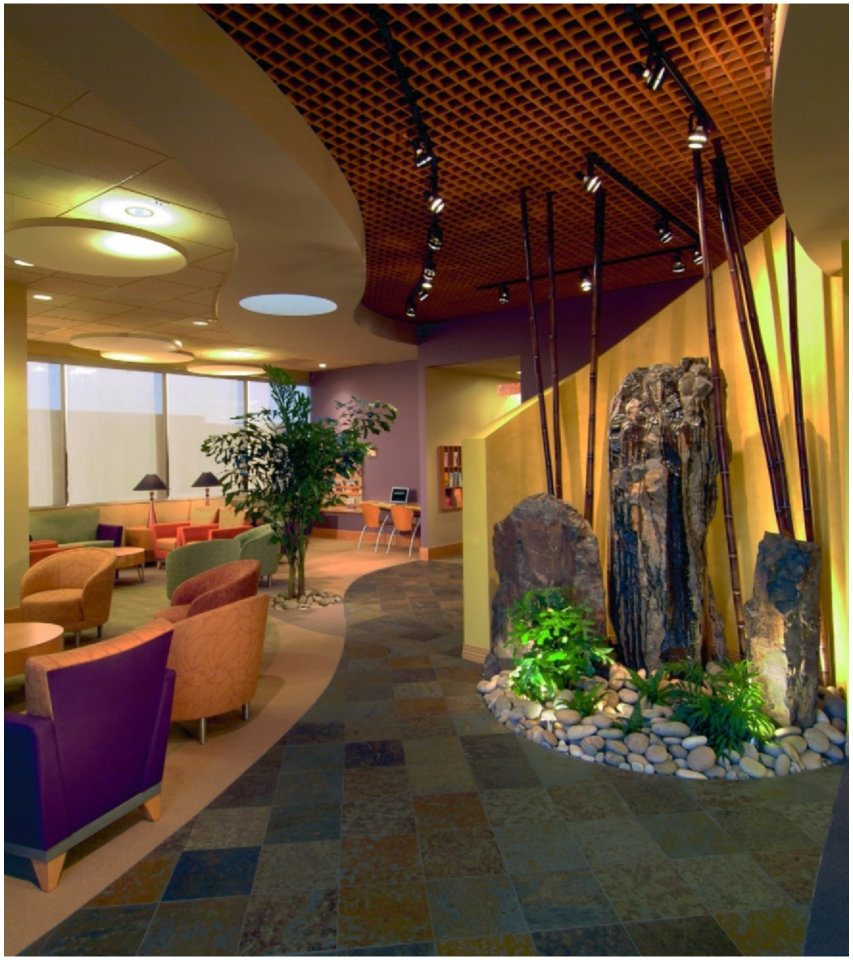

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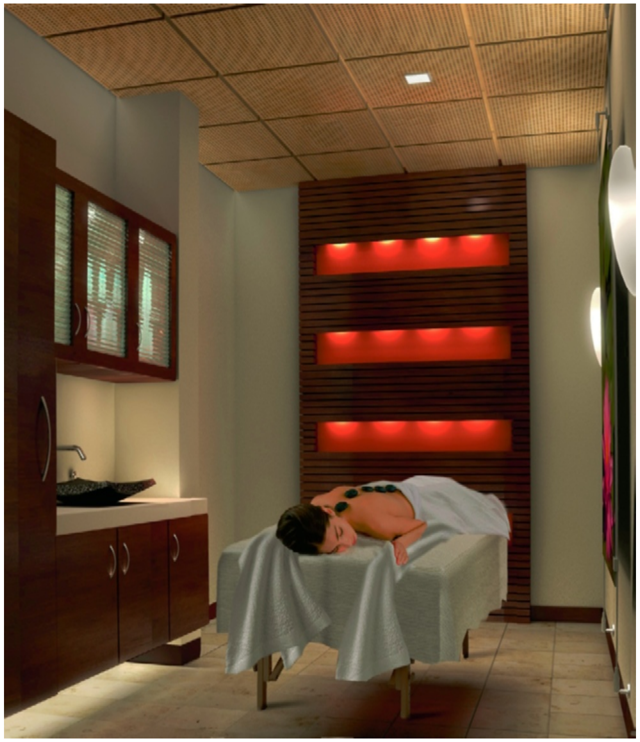

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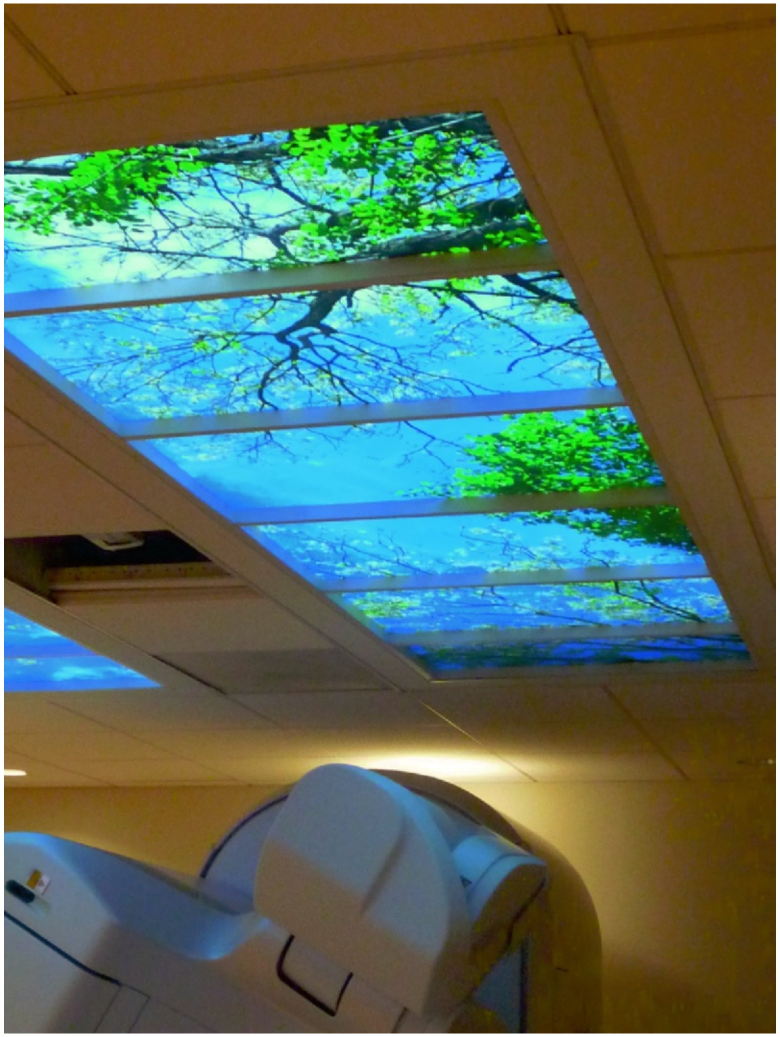

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