
PART ONE

OVERVIEW

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Design Considerations for Imaging Facilities

The architecture of a medical imaging facility reflects an image of its medical providers, the neighborhood surrounding the facility, and the community of patients and families who come to the facility for medical care (figure 1-1). Good design increases a medical provider's visibility and also provides a productive and supportive environment that will help attract and retain healthcare employees.

Like medicine, architecture embraces both science and art. Subject to the laws of gravity and the effects of weather, the facility must endure over time. Healthcare architecture must go beyond just serving the needs of patients, staff, and the public; it must promote interaction among people, between people and technology, and between people and their communities.

Unfortunately, the need for supportive human interaction within a medical imaging facility sometimes is difficult to satisfy as planners and designers wrestle with the myriad technical requirements that challenge them daily. Consequently, medical imaging facilities too often are viewed simply as places for advanced technology. Such a view fails to consider the human aspect of the imaging environment and therefore does not address design requirements in their entirety. It is vital that design professionals do not focus on technology requirements so closely that they forget the needs of the people who will use that technology. Coordinating the technical demands of medical equipment often usurps precious design time that the designer originally allocated for less technical tasks. When this happens, the design team can become reactive instead of visionary, creating architecture that merely solves immediate or short-term problems. The overarching design goal for medical imaging facilities is producing solutions that create opportunities for human interaction and support the healing process.



Figure 1-1 Architecture reflects the quality of care provided within. © Richard Barnes. Architect: Anshen + Allen.

As imaging technology becomes more complex, so does the challenge of integrating form and function. One way to prevent functional requirements from overpowering design is for the architectural team to thoroughly understand both the processes and the equipment used for medical imaging, and for the medical team to understand how the design process will be orchestrated. Using this approach, design professionals learn what questions to ask and when to ask them, and healthcare professionals are better prepared to provide input into the design of their facility. Armed with this knowledge, the architectural and medical members of the project team can set the stage for quality healthcare architecture that meets the needs of both patients and staff. This chapter focuses on identifying those needs.

Special Needs of Medical Imaging Facilities

How does the design of a medical imaging facility differ from those of other building types? It must accommodate the special needs of imaging patients and their families, the needs of imaging personnel (including radiologists,

technologists, other healthcare providers, administrators, clerical personnel, and housekeeping staff), and the needs of equipment in terms of its function, installation, maintenance, modification, and replacement.

The Needs of Patients

Patients and their families have many needs that can be addressed through effective medical imaging facility design. Some of these include the efficient flow of information, stress reduction, comfort, dignity, and privacy. If these requirements are seamlessly accommodated while patients are being treated at the imaging facility, patients will have a head start toward their ultimate goal of coping with their medical condition and attaining wellness.

Most patients come to an imaging facility to solve a medical mystery. Ultrasound, magnetic resonance, computed tomography, or any number of other imaging modalities make it possible to visualize what otherwise would be invisible. Information provided by these imaging modalities is relied upon by the medical staff to determine a patient's course of treatment. Facility design must take into account the imaging equipment and its proper installation. Failing to do this not only risks damage to the equipment itself but has dire consequences for the reliability, accuracy, and timeliness of the results upon which patients and caregivers depend.

Solving a medical mystery can be stressful. The diverse array of machinery that enables radiologists and other physicians to diagnose and treat otherwise unknown conditions often appears foreign and even frightening to many patients. The odd postures patients must assume, the duration for which they must hold still, and the overall sense that their health and well-being may be determined in part by an electronically rendered illustration of their inner anatomy and physiology can be intimidating. However, usually it is not the instrumentation itself that patients are most frightened of but rather what it will reveal about them.

There are severe anxiety-related reactions associated with magnetic resonance imaging (MRI). Patients who experience such reactions may disrupt the examination or move so much that the image is degraded. This experience may also influence patients' perceptions of the quality of care they receive.¹

Designers should account for the high degree of stress patients often have upon arrival at an imaging facility. The architecture should provide inherently clear wayfinding, minimize the need for patients to make unnecessary navigational decisions, afford privacy and dignity throughout the course of an imaging exam, and provide reassuring positive distractions to enable patients to momentarily take their minds off their immediate medical concerns. Facility design that adds difficulties—circuitous circulation, unnecessarily long routes of travel, or impersonal settings for interaction with caregivers—only heightens patients' levels of anxiety.



Figure 1-2 Waiting areas should be large enough to for families to be together, yet intimate to reduce anxiety. © Erich Ansel Koyama. Architect: Anshen + Allen.

Patients often feel alienated in imaging facilities. Therefore, general waiting areas should be comfortable and personal, large enough to allow family members to be together yet intimate enough to reduce patient anxiety (figure 1-2). Additional gowned waiting areas should be located adjacent to procedure rooms, to minimize the need for patients who have already changed into gowns to travel through the corridors. Patients undergoing a nuclear medicine procedure may need to ingest or be injected with radioactive substances before their scans, and those waiting for ultrasound scans may need to drink large quantities of water. Therefore, toilet rooms should be appropriately located near waiting areas and procedure rooms.

A well-designed imaging facility supports a patient's right to respectful treatment. When asked to remove their clothing, patients may feel that their sense of dignity has been diminished. However, when the surroundings afford privacy and are appropriately illuminated, patients tend to feel more self-assured and secure. Beyond the basic privacy mandates of HIPAA (Health Insurance Portability and Accountability Act), patients appreciate additional privacy amenities, such as doors and partitions that enhance visual privacy, and offices and public spaces that are treated with sound-absorbing materials to prevent their conversations with caregivers from being overheard. Patient privacy also is enhanced when acoustic separation of patient and staff areas restricts the sounds of business within work areas.

Procedure room design should integrate function with ambience. For example, high ceiling heights, dictated by equipment clearances, provide ample opportunities to vary the ceiling plane—which patients lying in a

supine position may see more than they will see wall surfaces. Similarly, many procedure rooms benefit from external windows and views to landscaped courtyards. Procedures that involve viewing a monitor within the procedure room, however, require control of the daylight admitted through exterior windows.

The Needs of Staff and Faculty

If based solely on the needs of equipment, the enclosures for medical imaging services would be dark and monolithic. Too often, the weight of equipment and requirements for radiation, radio-frequency, or magnetic shielding result in windowless subterranean environments. However, faculty and staff work long hours and perform difficult tasks. Their work environment affects how they respond to each other and how they serve patients. Facility layout should include both an “off-stage” zone where staff can speak freely to each other without concern of being overheard and an “on-stage” zone where they can comfortably interact with patients and family members without disturbing other staff. For example, break rooms and private offices are best placed with views to the outdoors and ample natural daylight. Staff areas such as reading rooms and control rooms—while best designed without exterior windows—deserve the same attention to detail and their unique lighting requirements that public lobbies and waiting areas do (figure 1-3). Supportive staff work environments have been shown to improve staff satisfaction and thus help improve the quality of care administered by staff. Consequently, a well-designed work environment can improve both patient and staff satisfaction.



Figure 1-3 Staff areas deserve the same attention to detail as do patient areas.
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Architect: Anshen + Allen.

Flows of people, data, supplies, and equipment must be carefully planned in order to enable imaging facility staff members to perform their functions effectively. Each form of traffic moves with different characteristics and at different rates. Facility design greatly impacts the variety of traffic patterns and work flows within the environment. Enhancements to the design can have positive effects on staff productivity. Other factors that allow staff members to perform their work effectively are adequate task lighting, the correct size and configuration of treatment rooms, close proximity of treatment rooms to their associated support spaces, and adequate space for housekeeping and maintenance activities.

The Needs of Equipment

As imaging equipment becomes more computer-based, the need for “clean” uniform power and efficient air-conditioning systems is magnified. Therefore, infrastructure systems designed by engineers must be sized for excess capacities and carefully coordinated with architectural and other engineering design requirements.

Medical technology is changing at an increasingly rapid rate, and the need for flexibility in every aspect of design becomes more crucial. Therefore, alternatives for future growth and modification should be part of the initial design, not an afterthought. For example, power and cooling system requirements tend to double or triple, rather than increase by a small margin, when new technology is introduced.

Although some imaging equipment itself is shrinking in size, the capabilities of any single piece of equipment are expanding. As a result, multiple ancillary instruments may be used in the exam room. Therefore, needs for both examination space and support space (such as patient preparation areas and equipment storage rooms) are likely to increase even as individual equipment components become more compact.

Note

1. R. McKenzie, C. Sims, R. G. Owens, and A. K. Dixon, “Patients’ perceptions of magnetic resonance imaging,” *Clinical Radiology* 50, 3 (1995): 137–43.