Construction

Advances in Imaging Technology and Emerging Patient Care Models Drive Healthcare Facility Design

Flexible designs will accommodate changes in technology and patient care strategies at minimal cost and disruption to operations

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Recent advances in fully digital imaging technology have dramatically affected the planning and design of diagnostic and interventional radiology facilities. Requirements for image display and multidisciplinary consultation have created new criteria for lighting, acoustics, workstation ergonomics and telecommunications. Moreover, as imaging has developed as a critical element of patient diagnosis and treatment, state-of-the-art imaging departments have become a competitive advantage in attracting patients, as well as recruiting and retaining qualified staff. Indeed, in many ways, imaging has become the heart of today's hospital.

A look at the evolution of imaging from the traditional imaging department to today's fully digital department reveals major changes in key characteristics of these facilities. The traditional film-based department (circa 1990) contained a dark room, large file room, large central technical work area, and a minimal preparation and recovery area. The hybrid digital and film-based department (circa

1993) eliminated the dark room, stored files in a remote archive, had a large central work core for daylight or digital image reading, and enlarged the preparation and recovery area.

The fully digital department (circa 2000) uses a virtual digital archive. It requires a smaller central work core, which is organized around imaging and treatment clusters and a central preparation and recovery area. Diagnostic and interventional imaging and surgery suites are often colocated. Images can be transmitted and remotely read anywhere.

In fact, today's picture archiving communication systems, or PACS, require a telecommunications infrastructure capable of rapid transmission of large data files to workstations throughout the hospital, physicians' offices in the community and even consulting radiologists halfway around the world.

In addition to technology, planning and design of imaging facilities must take into account staffing and patient care. Shortages of qualified physicians, nurses and technologists have heightened the need for health care facilities that aid in recruitment and retention, as well as enhancing productivity.

Both outpatient and inpatient acuity levels are expected to be higher today than in the past, and there is a growing need for sophisticated diagnostic and treatment services. At the same time, patients are becoming savvy health care consumers who demand state-of-the-art care, good communication and a comfortable environment. Facilities are being designed to enhance patient care and comfort at the same time they reduce facility operational costs and improve staff productivity.

Facilities must also be planned and designed for maximum flexibility. That is, they must be able to accommodate future changes in patient care models and imaging equipment, both economically and without significant disruption of operations.

Diagnostic Imaging Center

These issues have a significant impact on the planning and design of diagnostic imaging facilities. The design should take into account opportunities to geographically consolidate equipment and personnel into one area, while separating inpatient and outpatient traffic. This approach creates space and staffing efficiency, while preserving the optimal environment for infection control and the overall comfort, privacy and well-being of patients.

The public side of the diagnostic radiology service is a dedicated registration area, central viewing room and consulting rooms. The outpatient waiting area can be shared with other adjacent services for space or staffing efficiency. A separate dedicated inpatient holding area should be provided to avoid holding patients on gurneys in the hallways, which compromises their privacy, or in recovery areas, where they may become anxious viewing other recovering patients.

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Diagnostic imaging procedure rooms should be organized around a central work core that contains digital processors, technical work areas, offices, supply rooms and the like. This area will provide staff access to procedure rooms and back-of-house support areas. The design is derived from a clustered “operating room clean core” concept, in which a central clean and work core is surrounded by radiology procedure rooms, other invasive procedure rooms and operating rooms. Visibility between work areas is essential to support efficiencies and patient safety.

A multifunctional pre- and post-procedure unit, or observation unit, should be easily accessible for acutely ill outpatients and those who are being prepped for or recovering from more invasive diagnostic procedures.

Procedure rooms should provide maximum flexibility for various procedures. Standardizing the size and colocating similar rooms offers flexibility with minimal construction costs and downtime. Similarly, soft space should be strategically located so it can easily be converted to procedure rooms if needed.

Radiology rooms have special requirements, including a minimum floor-to-ceiling height of 9 feet (ideally, 9 feet, 6 inches), structural systems designed to carry appropriate equipment loads and appropriate radio-frequency clearances. For example, MRI equipment has special construction requirements, including a path of transport that can handle the load during delivery and installation. Open MRI requires larger radio-frequency clearance. Radio-frequency procedure rooms require proper shielding for radiation protection. Specialty rooms and CT should be equipped for telemetry monitoring. There should also be provision for medical gases for acutely ill patients.

The reading area should be configured to allow for multidisciplinary teamwork, except for angiography and neurology, which have different equipment requirements. High-quality, remote viewing locations should be provided within the service and throughout the facility, including nursing units. Universal access for data and image retrieval is crucial. Indeed, technology is critical for the highest level of patient care and to be as operationally efficient as possible. In fact, it is advantageous to include IT directors in planning.

Facilities also should maintain separate and yet efficient flows of patients, staff, equipment and materials. The first priority is to minimize patient movement by locating high-volume procedure rooms closest to access points. There should be easy patient elevator access into the service area, as well as separate trauma elevators.

There should also be effective, convenient flow of staff and materials from procedure rooms to processing, sorting, viewing and filing areas. Equipment and supply storage areas should be easily accessible to staff. Portable machine and stretcher and wheelchair storage areas should be located so that equipment is secured and convenient for easy transport to and from other areas of the Hospital.

Interventional Imaging and Surgery Converge

Planning and design of interventional imaging facilities also pose unique challenges. In particular, the convergence of interventional imaging and surgery is having major effects on facility design.

Traditional departmental boundaries between surgery, radiology and cardiology are eroding as surgery becomes less invasive and imaging becomes more interventional. Today, many procedures require multidisciplinary collaboration. As a result, lines between the traditional operating room, diagnostic imaging room and interventional procedure room are fading.

Increasingly, interventional imaging and invasive procedure rooms and operating rooms are being colocated. For example, the integrated interventional suite colocates the cardiac catheterization and interventional CT, angiography, interventional MRI and surgery, allowing for shared patient intake, prep and recovery, and observation unit or level 2 recovery. The benefits of this approach include immediate access to an operating room when necessary; a sterile environment throughout; shared facility, staff and support resources; and enhanced patient care.

Interventional imaging procedure rooms themselves are being designed and planned to provide maximum flexibility, both by standardizing the size and colocating similar rooms and by providing many of the same features and safety provisions as operating rooms. Procedure rooms are being constructed with lead lining, medical gases and independent temperature and humidity controls. Safety provisions include electrical hazard control, emergency power, radiological exposure hazard control, isolation capability, aseptic environmental characteristics, controlled access, demarcation lines, graphics/physical barriers, and waste gas exhaust systems.

The 23-hour observation unit will provide pre- and post-procedural care for most patients, while some will require care in the operating room recovery. A separate, fully monitored recovery area should be located directly adjacent to the procedure rooms for patients requiring immediate, high-level care.

Advances in imaging technology and patient care models have had significant impacts on health care facility planning and design. In many ways, radiology and related services are the heart of today’s hospital. With capital construction costs a small percentage of a health care facilities’ operational costs, planning and designing for maximum flexibility is a must.

Private Rooms can Assist Care and Boost Occupancy

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Private rooms are a growing trend in hospital planning and design. Single-occupancy patient rooms facilitate the service innovation of patient-centered care, which favors bedside procedures over transporting the patient to other departments. Single patient rooms allow the family to be involved in care, which facilitates the family-care-center model and makes it easier to maintain patient confidentiality.

Research has found benefits for both the hospital and patient. Studies have linked private rooms with higher occupancy rates and, therefore, similar per diem costs compared with semi-private rooms, with reduced risks of cross infection and medication errors, and with increased patient satisfaction. For example, research conducted by the Georgia Institute of Technology concluded that private patient rooms reduce patient transfers, trim the risk of hospital-acquired infections, enhance patient privacy, lower stress for patients and their families, and improve staff communication with patients.

Optimal Private Room

The optimal single-occupancy patient room is designed for staff and operational efficiency, as well as patient and family comfort. The room has three distinct, yet adjoining areas: a patient care area near the door, a patient area in the center and a family and visitor area in the rear by the window.

A “mid-board” bathroom design — that is, two toilet and shower rooms for each patient room placed back to back at the center rather than at the door (“in-board”) or rear of the room (“out-board) — improves visibility from the nursing station to the patient and increases family and visitor space.

The room is furnished with an armoire containing the TV, a private patient locker and shelves for personal items, such as framed photos and cards. In the family area, a long, cushioned window bench with blanket and pillow storage beneath is a space-saving alternative to a sleep sofa and more comfortable than a reclining chair. The bench serves as a seating surface for family and visitors during the day and a sleeping surface for a family member at night.

Individual room temperature and lighting controls, within a pre-set range, provide the patient and family with greater comfort and a sense of control over their environment. A telecommunications cable port with Internet access allows patients and family to use their laptops to maintain contact with business associates, family and friends. Another alternative is to provide a PC with Internet access that can be used both by patients and by staff to access medical records, with individual access codes to maintain security and Privacy.