Reconfiguring Hospital Diagnostic Services

By Cynthia Hayward

Planning space for diagnostic services, and assessing the need for equipment, can be complicated from many perspectives. Some equipment is becoming miniaturized, portable (even handheld), and more affordable so that it can be easily used at the patient's bedside, in the physician's office, or even in the patient's home. Other equipment continues to require a large footprint, unique design features, and a big investment, and is increasingly specialized. Imaging services no longer reside within the boundaries of the "radiology department" but instead are provided in many locations throughout the healthcare enterprise — often replacing other testing modalities that once occupied their own departments. The challenge is not only to determine what equipment to purchase but where to locate it.

BACKGROUND

Hospitals were traditionally designed with a large central radiology department to provide services to inpatients as well as outpatients. As new diagnostic modalities were developed, each was typically designed with its own "storefront" and dedicated space which resulted in a significant amount of space allocated to diagnostic services. During the late 1980s and 1990s, many healthcare organizations developed separate outpatient diagnostic centers, often located in an off-site medical office building. At the same time, the use of large, central diagnostic departments in hospitals by inpatients declined as lengths of stay decreased and more patients were tested prior to admission. The miniaturization and increased mobility of equipment also allowed more testing to be conducted at the point of care. As a result, many hospitals were left with significant surplus capacity — particularly for imaging services.

CURRENT TRENDS

Today, radiography, fluoroscopy, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound are routinely provided in the outpatient setting, and mammography is performed almost exclusively outside the hospital. However, the acute care hospital continues to be the nexus for new resource-intensive hybrid imaging technologies and interventional procedures that require a significant investment of dollars and a substantial market share to justify the investment. Some less resource-intensive diagnostics also continue to thrive in the hospital setting due to legislation limiting physician self-referrals, staff shortages, and limited reimbursement for outpatient services, which deters physicians from competing for outpatient business. To improve responsiveness, some services may be decentralized to the point of care — such as the emergency department (ED), outpatient clinics, or patient care units — either through the use of portable equipment or the creation of a satellite facility. Radiography, CT, and even MRI are commonly provided in large EDs.
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NEW FACILITY COMPONENTS

As a result, hospital diagnostic services are being reorganized and reconfigured with flexible space to support today's integrated service models with shared staff, equipment, and space. Smaller hospitals are being designed with a single "diagnostic center" with common reception, waiting, and pre-procedure preparation and post-procedure recovery areas. Large medical centers are being redesigned with separate centers for diagnostic imaging and interventional imaging while other diagnostic services may be located in a shared suite, dedicated space, or decentralized.

- **Diagnostic imaging center.** Because radiography was the first imaging modality, many healthcare professionals continue to use the term "radiology" when referring to all types of imaging, even though, over the years, alternative imaging methods have been developed that do not rely on radiation, such as ultrasound and MRI. Interventional radiology, once a subspecialty of radiology, is now an independent medical specialty. The most common types of imaging exams within a hospital are radiography, fluoroscopy, CT, MRI, and ultrasound. These are frequently grouped into a diagnostic imaging center with common patient intake space that supports dedicated procedure suites for each modality. Nuclear medicine is sometimes located in a separate area due to its unique safety protocols regarding the handling and disposal of radioactive materials.

- **Multidisciplinary interventional suite.** Interventional radiology was traditionally located within the radiology department while separate suites were developed for interventional cardiology and other endovascular procedures as each specialty demanded its own turf. Today, the types of diagnostic and interventional procedures that interventional radiologists, interventional cardiologists, vascular surgeons, and neurosurgeons perform not only increasingly overlap, but the procedure room, support space, and sometimes, even the equipment are essentially the same, whether a procedure is performed to assess heart function, brain function, or other vascular issues. The trend is to create a single interventional suite that can be shared by all specialties. Even if the actual procedure rooms have dedicated equipment, their co-location will provide optimal future flexibility as specific procedures and techniques evolve over time and equipment is upgraded. The sharing of patient intake, preparation, and recovery space accrues savings in capital as well as operational dollars.

- **Convergence of diagnostic and interventional imaging and surgical procedures.** Further co-location of the interventional suite with the surgical suite can provide additional flexibility with the melding of interventional radiology and minimally invasive, image-guided, and traditional open surgical techniques. While imaging procedures are becoming more interventional and no longer are limited to diagnostic uses, surgery is becoming less invasive. For many years, mobile ultrasound or endoscopy units or c-arms (their name derived from their shape) have been a standard part of surgical operating rooms. Today, hybrid operating rooms have permanently installed equipment, such as intraoperative CT, MRI, and fixed c-arms, which are typically used in conjunction with cardiovascular, thoracic, neurosurgery, spinal, and orthopedic procedures to enable diagnostic imaging before, during, and after surgery.
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This setup enables the surgeon to assess the effectiveness of the surgery and perform further resections or additional interventions in a single encounter. Many equipment vendors offer highly specialized, proprietary imaging systems that are permanently integrated with operating rooms while others offer designs that position the CT or MRI unit so it can be used independently for diagnostic procedures when surgery is not in progress.

- **Other diagnostic services** — such as respiratory therapy, pulmonary functional testing, and neurodiagnostics — continue to be performed within the hospital to serve the inpatient population although the equipment is typically portable and does not require dedicated procedure rooms. On the other hand, there is a growing demand for sleep disorders testing. Although “sleep centers” serve outpatients predominantly, they are often located with the hospital to address staffing and security issues because they operate overnight.

The figure below illustrates the current trend in organizing hospital diagnostic services. The grouping of related services into distinct “centers” not only provides future flexibility and efficient space utilization as technology changes but also facilitates wayfinding for outpatients and family members when they access services within the hospital.

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