Digital Radiology Equipment Acquisition and Installation Procedures: A Team Approach at Mayo Clinic, Rochester, MN

Suzanne Ramthun, Claire E. Bender, Beth A. Schueler, Jerome Taubel, Nicholas J. Hangiandreou, Scott Williamson, Dan O'Neill, Doug Leimer, and Michele Back

Digital imaging system integration is a complex process. A project team and a defined process for system planning, evaluation, and implementation can improve the chance for success. In this presentation, our project team relates their experiences.

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A FEW YEARS AGO, radiology equipment acquisition and installation were simple: (1) purchase the equipment; (2) have vendor install it, (3) conduct acceptance testing, and (4) perform patient examinations.

Our department recently experienced digital imaging equipment installation culture shock and technostress. We selected computed radiography (CR) chest vendor components in the same manner as usual for conventional radiographic equipment and set up delivery dates. The installation and acceptance testing should have taken 2 weeks, but due to lack of planning for digital system integration, the process lasted 4 months.

We encountered communication problems within the system: for example, our Radiology Information System (RIS) did not talk to the acquisition equipment and allow the Digital Imaging and Communications in Medicine (DICOM) worklist to function, the laser printer did not receive images to print, and images would not transfer to the picture archive communication (PAC) system.

DISCUSSION

We resolved to improve our process for the next digital equipment purchase and proceeded to plan our new procedures. A multifunctional group was assembled to review issues and formulate a reasonable plan of action. Table I outlines our “project team” and function of each member.

In the initial meetings, the project team discussed the components, connectivity, and functions of a digital imaging system. The group quickly realized the interdependency of each member within the team. Important observations made regarding the overall digital equipment evaluation to installation process were as follows:

- **The need to collect more than just the DICOM conformance statement information from the vendor.** The document “Imaging Modality Connectivity and Interoperability Requirements Worksheet” (IMCIRW) was developed and is now given to the vendor very early in the equipment evaluation process. Examples of questions from this multiple page document are shown in Fig 1.

- **The need to be proactive with system evaluation and integration.** During the CR chest unit installation we made unverified assumptions about component interactions and also assumed the multiple vendors were responsible to integrate their components with each other. We learned there are no dumb questions and we now plan site visits or clinical trials for thorough system evaluation.

- **The need for a project team to manage the process and a point person within the team to act as the communications contact.** During the CR chest unit installation several people talked to the vendors, resulting in a variety of confusing messages being relayed to the group. We wasted time sorting out messages and circulating pertinent information to the appropriate people.

Following a series of group meetings and input from all of our equipment purchasing parties (supervisors, directors, engineering, etc), an optimal
### Table 1. Digital Imaging Acquisition Equipment Project Team

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<th>Team Member</th>
<th>Function</th>
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| Medical Physicist | 1. Provides theoretical level expertise in equipment specifications and functionality  
2. Utilizes modality connectivity knowledge  
3. Manages vendor negotiation and creates purchase agreements  
4. Manages regulatory compliance issues |
| Medical Imaging Technical Services (MITS) | 1. Provides applications level expertise in equipment specifications and functionality  
2. Performs equipment acceptance testing  
3. Provides an applications perspective to workflow analysis |
| Imaging Equipment Services (Bioengineering) | 1. Coordinates installation with vendor  
2. Provides support and service information  
3. Advises team on needs for installation |
| Information Services (IS) Analyst Programmers | 1. Provides RIS functionality and connectivity expertise  
2. Analyzes modality and PACS connectivity needs  
3. Provides interface analysis and development as needed |
| Radiology Director | 1. Interfaces with vendor for quotes and price negotiation  
2. Serves as the initial team facilitator until a point person is identified |
| Radiology Supervisor | 1. Provides a user perspective to workflow and facility design  
2. Provides end user equipment functionality expertise |
| Radiologist | 1. Advises group and vendor regarding image quality needs  
2. Provides committee approval support |
| Radiology Systems Coordinator (RSC) | 1. Provides a systems perspective to the workflow analysis  
2. Coordinates RIS to modality and image display interactions |
| Facilities Project Services | 1. Analyzes and provides electrical and remodeling needs  
2. Coordinates any remodeling or construction  
3. Provides floor plans and facility information to vendor  
4. Works with Imaging Equipment Services to provide required facility elements |

### Table 2. Digital Imaging Equipment Acquisition and Installation Procedure

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<th>Phase</th>
<th>Activity</th>
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| Pre-Installation | • Initiate vendor discussions and collect equipment specifications, DICOM conformance statement and IMCIRW  
• Define and assemble project team to discuss equipment specs, evaluation needs, and vendor follow-up  
• Conduct site visit or clinical trial as needed  
• Project team creates a common report of findings and equipment evaluation (performance, connectivity, interface issues, or other system needs to fit existing environment) |
| Approval (as purchase order is issued) | • IS, PACS, and Imaging Equipment Services determine system support interaction needs  
• Project team develops the equipment integration test plan |
| Construction | • Project team participates in construction planning and room design meetings  
• Radiology manager, MITS, and RSC perform workflow analysis of proposed room design (workstation and network jack locations, optimal space, and patient flow for examinations, etc)  
• Radiology manager and RSC identify technologist training needs and follow-up with vendor to arrange applications training |
| Installation | • Imaging Equipment Services and MITS work with vendor on installation and verify equipment components with checklist procedure  
• Radiology manager and RSC collaborate on system training schedule and communicate with vendor to set training dates  
• Debugging of system is done by individual component support groups (IS, MITS, RSC, Equipment Services, etc) and problems are documented and communicated to vendor  
• Test images are created and sent through the digital imaging management and display components to ensure functionality and image quality on installed unit |
| Post-Installation | • Acceptance testing report is written by the project team  
• Project team members define ongoing system support roles |