SESSION 1A: Practice Re-engineering and Human Factors

New Facility Picture Archiving and Communication System Implementation Strategy

John Romlein, David Lyche, Anna Chacko, Michael Cawthon, David Vanderburgh, and Ron Stokes

Strategies for deployment of picture archiving and communications systems (PACS) in new hospitals often involve the establishment of initial PACS operations. Such a strategy is flawed in the sense that the clinical and radiological users must adapt to PACS operations, while being faced with several other new facility learning curves. This increases the complexity and risk of the radiological services. A strategy of implementing PACS operations in the old facility and performing a zero-downtime transition into the new facility offers several advantages to this method. The successful undertaking of such a project will support not only the physical movement of the existing PACS, but the accomplishment of other re-engineering goals associated with the new hospital. This report will describe the strategy used in two successful transitions of PACS into newly constructed hospitals.

Copyright © 2000 by W.B. Saunders Company

IN 1996 AND 1999, two separate hospital-wide picture archiving and communication systems (PACS) were moved from existing hospitals into newly constructed replacement hospitals. In both cases, the hospitals established partial filmless PACS operations in the old facilities before the move. The transition¹ of the PACS operations required that a complex plan be developed that addressed all aspects of the desired utilization of the PACS in the old and new facilities, as well as the details of the zero-downtime movement. Modality integration, PACS upgrades, hospital information system (HIS) interface connectivity, local area network (LAN) and facility design changes, simultaneous operations in both facilities, and failure mode planning were a few of the issues addressed in the transition plans. The goals and steps of this strategy were developed in a joint effort between the hospital staff, the PACS and modality vendors, the facility project managers, and the PACS consultants.

PACS TRANSITION GOALS

The goals included in the design of the PACS transition plans from old facilities into a new

replacement hospitals included the following:

- Design and implement procurement of a PACS that interfaces to all new imaging equipment in the new facility
- Incorporate the latest technologies into the new facility PACS
- Modify the new hospital design as needed to accept the PACS
- Modify the new facility design to implement re-engineered workflow for imaging operations
- Modify the procurement specifications of imaging modalities to interface with PACS operations
- Modify the hospital LAN design to accommodate PACS operations
- Develop and implement a coordinated PACS installation plan that matches the hospital transition schedule
- Develop and implement failure mode plans to support all radiological operations in case of PACS failures
- Develop and implement a PACS training plan that enables seamless transition from one facility to another
- Establish a link between PACS operations in both facilities so that departments can operate out of both simultaneously
- Coordinate the movement of existing PACS components and imaging modalities from the old facility to the new
- Coordinate the new PACS start up and testing with the installation of new imaging equipment and movement of departments into the new facility

From InformaTech-Telemedicine Services, Frederick, MD; Brooke Army Medical Center, San Antonio, TX; and Elmendorf Medical Center, Anchorage, AK.

Address reprint requests to John Romlein, InformaTech Inc, Telemedicine Division, Frederick MD, 21703. E-mail: john.romlein@iti-tmed.com.

Copyright © 2000 by W.B. Saunders Company

0897-1889/00/1302-1067\$10.00/0

doi:10.1053/jdim.2000.7070

- Support potential delays in the new facility opening date through a flexible plan and schedule
- Develop and implement quality-control plans²⁻⁴ that maintain imaging quality during the transition
- Develop and implement an acceptance test plan that supports the transition scenario for the hospital and the PACS.

IMPLEMENTATION PROCESS

In 1996 the Brooke Army Medical Center transitioned into a newly constructed 450-bed facility in San Antonio, TX. In 1999, a similar movement of the Elmendorf Air Force Medical Center was successfully accomplished in Anchorage, AK. Both moves were implemented in a long-term process that integrated the existing radiological operations in the old facility with the eventual movement to the new hospital. The procurement of a "starter PACS" in the old facilities with the planned upgrade of those PACS as part of the new hospital equipment plans was a key factor in the overall strategy.

With the starter PACS in place, the old facilities built up a digital archive through the implementation of digital imaging operations with as many modalities as was possible.⁵ Soft-copy reading and varying degrees of filmless radiology services were achieved in both cases. The hospitals were well used to PACS operations when the time to move into the new facility arrived.

Intermediate steps included the installation of the upgraded PACS servers in the new facility computer rooms and the cross connection of those servers to the archive, workstations, imaging modalities, and HIS interface in the old facility. This phase established the support of radiological operations in the old facility from the core of the new facility PACS. Following this, the new facility imaging modalities, workstations, and laser printers were connected, configured, calibrated, and tested. The new facilities, during this phase, grew to support both their old and new facility PACS components and modalities. This provision of continuous operations of the Radiology Departments in a near-filmless mode while fully supporting the simultaneous testing of modality interfaces in the new facilities was another critical element in the strategy. Successfully achieving this step meant

that the eventual migration of clinical services from the old hospital to the new was to be truly seamless.

The final phase in the process involved the controlled migration of clinics and inpatients while providing a single, continuous, PACS environment across both facilities. This was supported seamlessly in three ways: (1) a single PACS was supporting both facilities; (2) the pre-positioning of modalities and workstations in the critical clinical departments as part of the radiology equipment plans and PACS upgrade; and (3) the synchronized migration of existing modalities and workstations as they became available. One of the last PACS components to move from the old hospital to the new was the PACS archive containing the digital images. Following this final phase, final testing of the entire new PACS in the new facility was performed.

Each hospital transition plan was a multiphase and multistep process. While a complete listing of all steps in the process will not be provided here, the key steps are listed below.

Key Transition Process Steps

1. Install starter PACS in the old hospital
2. Build the digital image archive for as long as possible
3. Establish a PACS quality-control program in the old facility
4. Review and modify the design of the new facility and new modalities to be PACS-compatible
5. Design an upgrade of the starter PACS that includes the support of the old hospital radiology department off of the upgraded PACS in the new facility
6. Connect the old and new facilities PACS systems computer rooms early in the transition process
7. Test the PACS in the new facility in stand-alone mode
8. Run the old hospital PACS operations from the new hospital PACS core
9. Add connections to the new imaging modalities to the new facility PACS while it is supporting both facilities
10. Add the new workstations to the new PACS in a prioritized sequence
11. Perform a "pretransition" test of the new PACS while supporting all new devices, as well as the old facility

12. Validate the PACS quality-control program in both the old and new facilities
13. Move the old facility PACS components into their new locations in the new facility as the need for them in the old facility ends
14. Move the old facility modalities into their locations in the new facility as the need for them in the old facility ends
15. Test the final operations of the new facility PACS after all transition is completed.

CONCLUSION

The requirement for PACS migration from old to new facilities is inevitable as PACS implementations increase and facilities age. The process of PACS movement is complex but manageable if issues are identified and planned well in advance. Proactive planning of the transition goals and steps leads to the development of a comprehensive transition plan. While the exact process must differ, depending on the PACS architecture and the facility transition plans, the basic sequence of using a

“starter PACS” in the older facility with a subsequent upgrade that establishes a single PACS environment across both facilities, which finally consolidates in the new facility in a near-filmless mode. This strategy spreads the PACS costs over time, eases the PACS learning curves, reduces the film management and storage tasks, optimizes the new hospital design, and simplifies the clinical and radiological migration into the new facility.

REFERENCES

1. Romlein J, Weiser J, Willis C, et al: Transitioning process of a film-based radiology department to direct digital imaging. SPIE 2165:850-857, 1994
2. Romlein J, Weiser JC, Sheehy MR, et al: Acceptance testing design for a large scale PACS. SPIE 1899:441-451, 1993
3. Romlein J, Norton GS, Lyche DK, et al: PACS acceptance test, quality control warranty and maintenance continuum. SPIE 3662:111-119, 1999
4. Norton GS, Romlein J, Lyche DK, et al: The task allocation chart: Quality control of a picture archive and communication system. SPIE 3662:409-413, 1999
5. Vanderburgh DF: PACS and teleradiology at the 3rd Medical Group, Elmendorf AFB, Alaska. PACMEDTek Proceedings, Honolulu, HI, August 1998