SESSION 9: Experience in Digital Practice Implementation

Picture Archiving and Communications Systems (PACS) in Private Practice: St. Paul Radiology PACS Project

Ross T. Sutton, Robert G. Rasmussen, Mary Beth Kester, Kay L.K. Bruni, and Jack D. Rietschel

While much of diagnostic radiology is practiced in a private setting, many of the papers and presentations describing picture archiving and communications systems (PACS) implementation to date have been sponsored by university and government health facilities. We will present a 4-year retrospective review of a private practice PACS project. The challenges, benefits, and cost analysis of the PACS project will be presented.

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ST. PAUL RADIOLOGY (SPR) is a large, private radiology group located in St Paul, MN. In the spring of 1997, we incorporated a picture archive and communications system (PACS) into daily operations. The initial justification was to reduce the number of radiologists on call by establishing a central night-read program. Secondly, soft-copy interpretation of the images would, hopefully, allow the radiologist to become more productive. Finally, there was hope that we would reduce overall operational costs.

Several issues concerning the implementation and support of the PACS project will be presented. These include training issues, work flow changes, Digital Imaging and Communications in Medicine (DICOM) standard challenges, and software upgrades. Additionally, a cost analysis including intangible benefits will be presented. This analysis contains such factors as film, courier costs, technologist's and radiologist's productivity and associated costs, as well as professional fee increases due to growth at remote sites.

The presentation will demonstrate benefits gained from the project including decreased film usage and courier costs. The program allowed for the creation of a central night-read site, reducing

radiologist's time on call. We realized reduced report turnaround time for referring physicians. Also demonstrated was increased productivity for technologists and radiologists. The network permitted the electronic transfer of images from remote sites, increasing professional fees. Radiologists felt that there was the potential for better interpretations due to the easy manipulation of images on the diagnostic workstations.

With this presentation, we hope to provide a unique private radiology group perspective into implementing and maintaining a successful PACS project.

The challenge was to implement a new electronic workplace while maintaining, and eventually increasing, an already extremely efficient and streamlined workflow. In a private practice setting, we realize an increased sense of responsibility and urgency in utilizing a system such as this. Since the project was completely funded by the group without aid from outside sources, it was imperative that the entire practice use the system effectively and obtain this goal very quickly.

Initially, the PACS system included five workstations, two servers, one archive, and a private network that connected each of the seven hospitals served by and the three imaging centers owned by the group. Subsequently, we have upgraded our main PACS server and archive. We have added six diagnostic workstations, multiple view stations, PACS/radiology information system (RIS) integration, modality work lists, and a web server for electronic delivery of reports and images to referring physicians. Additionally, we now support nine hospitals, six imaging centers, and four independent cross-over PACS.

The implementation team was faced with the formidable task of creating an environment to deal with the unusual political sensitivities of SPR's practice. The PACS system spans three large, competing medical management groups in addition to several independent healthcare providers. The privacy of patient data and the interests of each

From St. Paul Radiology, St Paul, MN.

Address reprint requests to Ross T. Sutton, MD, St. Paul Radiology, 250 Thompson St, St Paul, MN 55102. E-mail: rsutton@stpaulrad.com.

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competing group needed to be weighed and measured against patient care and image interpretation at every phase of the project. The success we have had in dealing with multiple healthcare organizations is due in large part to the implementation of a fully private wide area network. A high-performance, secure network was designed to handle the specific needs of the practice including, eventually, the implementation of subspecialty interpretation (Fig 1). The data volume pushed across this backbone is enormous, handling approximately 200,000 examinations per year. Limitations of the scanner vendors in their networking abilities was found to be the largest, single deterring factor in this portion of the project. Switched, segmented networks were installed to help ease the stress of the infrastructure, and to increase speed between components with high speed capabilities. The clinical members of the project team worked very closely with Information Technology (IT) team members to explain their needs and desired system outcomes. This alliance created a solid, scalable backbone for current medical imaging needs and

continued growth. Additionally, over time and with experience, you learn that the "DICOM standard" can differ from vendor to vendor, and the result is problems interfacing different imaging systems. It is of the utmost importance to have a good working relationship with your PACS vendor and to have knowledgeable technical staff to interface with scanner and PACS representatives. With persistence, these difficulties can be overcome.

At the same time the network backbone was being perfected, Radiology staff analyzed the current department workflows in use and redesigned them to take full advantage of the new technology. Soft-copy reading caused many changes to the radiology departments. Each department was addressed individually and then re-examined as a whole. Every associate is affected to some degree by electronic imaging. Obviously, the greatest degree of change is felt by the radiologists and technologists. The predicament was to take an extremely efficient, high-volume group and redesign workflow while maintaining the high quality of patient care and high volume of radiologic

Table 1. Film and Courier Cost Savings

Year	% Increase in Exam Volume	Total Annual Savings
1996	Base year/pre-PACS	0
1997	+26%	\$209,207
1998	+15%	\$373,554
1999	+16%	\$415,693
Totals	+57%	\$998,454

studies. It was decided to run the system concurrently (manual and electronic) while blending the work flows. As radiology staff became familiar with the new processes, manual procedures were dropped. This method proved to be very effective. It offered the fastest possible implementation with the least interruption to the practice. This approach also minimized workflow changes and slow downs from using new technologies and procedures.

In response to questions raised regarding the cost effectiveness of PACS, SPR's financial and operational departments prepared an expenditure and cost -savings analysis covering a 4-year timeline (Table 1). The costs included annual IT expenditures for equipment and expenses, as well as the internal costs of salaries and benefits for staff to maintain PACS. Cost savings included reductions in film costs and courier expenses, as well as reductions in technologist and radiologist costs due

Table 3. Radiologist Productivity

Year	Effective Physician FTE Productivity Savings
1996	Base year/pre-PACS
1997	0.4
1998	0.8
1999	1.2
2000	1.4
Totals	3.8

to improved productivity (Tables 2 and 3). In addition to the actual dollar savings, the team highlighted intangible benefits of PACS, such as the creation of a central night read position, elimination of printing and hanging films, reduced report turnaround time for referring physicians, improved quality of interpretations, and access to images from distant sites. The conclusion of this study showed that at the end of 4 years, total savings from PACS exceeded the cost of the project. Despite spending more than 4 million dollars during the course of the project, savings from PACS approached 1 million dollars. At the same time, SPR has created an extensive medical imaging infrastructure that will support future growth and new technologies.

SPR's Chief Executive Officer, Mark Kleinschmidt, reviewed the study and stated that he had originally been skeptical of the purported cost savings due to PACS, but that he felt that the analysis presented was in fact an accurate evaluation of its costs and benefits. The cost savings shown would indeed be lost if we did not have PACS. He concluded that PACS was cost effective.

Now, 4 years since implementation, we have a fully functioning system that has allowed SPR to increase the quality of service in the radiology component of the overall healthcare experience.

Table 2. Technologist Cost Savings

Year	% Increase in Exam Volume	FTE Savings
1996	Base year/pre-PACS	0.0
1997	+26%	2.0
1998	+15%	1.6
1999	+16%	1.9
Totals	+57%	5.5

Abbreviation: FTE, full-time equivalents.