User Acceptability—A Critical Success Factor for Picture Archiving and Communication System Implementation

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The Department of Diagnostic Imaging at the Hospital for Sick Children (HSC), Toronto, implemented a picture archiving and communication system (PACS) during the last year. This report describes our experience from the point of view of user acceptability. Based on objective data, the following key success factors were identified: user involvement in PACS planning, training, technical support, and rollout of pilot projects. Although technical factors are critical and must be addressed, the main conclusion of our study is that other nontechnical factors need to be recognized and resolved. Recognition of the importance of these factors to user acceptance and clear communication and consultation will help reduce negative user attitudes and increase the chance of a successful PACS implementation.

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USER ACCEPTABILITY, defined as capable and consistent use and positive acceptance of a picture archiving and communication system (PACS) installation, depends on both technical and nontechnical factors. During the implementation period of a PACS system, ensuring positive acceptance can be difficult, especially when a parallel film-based system is still being maintained. Users are often reluctant to change established habits, especially when technical limitations are still in the process of resolution. We examined which factors were of importance in increasing user acceptance.

PACS IMPLEMENTATION PROCESS

The Hospital for Sick Children is a pediatric academic health center with an international reputation for health care, research, and teaching. Our PACS installation was intended to enhance the range and level of service provided by the Radiology Department. The mission of the PACS Project Team was to initially implement PACS within the Radiology Department and then the clinical areas of the hospital serviced by Radiology. Our installation was to be in a controlled, systematic, and timely manner, paying particular attention to the workflow and operational and user impacts.

During the past year, our staff in Diagnostic Imaging have had to deal with an enormous amount of change, not only due to the introduction of a

PACS system, but also the implementation of a new radiology information system (RIS) and extensive process improvements. During the transition period, as the implementation of PACS was initially only in the department, films continued to be printed, being required by extra departmental clinics and referring physicians. Only recently have we started the hospital-wide PACS implementation. Therefore, our transition toward a filmless radiology department was a complex process with different stages. As a cost-saving measure, historical examinations were not loaded in PACS, so radiologists could use either the PACS and/or hard copies as desired.

USER INVOLVEMENT IN THE PACS PLANNING

Knowing that the greater the degree of change, the more flexible the organization has to be to adapt quickly, our implementation plan was developed to avoid the risks associated with introducing too many new variables too soon to an unprepared user population. Everyone who would be affected by PACS implementation was involved in the planning process. All users were kept fully informed of planning decisions and representatives (eg, charge technologists, radiologists) were consulted to ensure the plans were practical from their perspective (eg, type and position of diagnostic review workstations, suitable workflow, and functional soft-copy reading process).

We had many PACS presentation sessions, in which we demonstrated to staff that the new system could meet their objectives: acceptable response times, widespread availability, consistent user interface, user-friendly system. Both the utility and usability of a PACS system must be clearly under-

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stood by users in order for their attitude towards PACS to be positive.

TRAINING

The training process was started by defining the training needs:

- identifying the total user population for PACS;
- identifying main target groups who will use the information system regularly and others whom will need to be aware of the functionality and outputs available from the system;
- analyzing the current skills and competencies available within the target groups;
- establishing a profile of the training needs within the target groups;

The next step was to develop specific training plans based on the identified training needs, as well as on the following items:

- equipment and training facilities needed;
- use of materials available from the PACS vendor;
- requirements for in-house development of training materials;
- the overall timetable of PACS implementation;
- the number and types of staff to be trained.

Delivery of the identified training solutions according to the plans, which have been drawn up, is the main element of the next stage of the training process. However, training delivery needs to take into account a number of considerations, including:

- the availability of and the time constraints on the various target groups;
- the necessity for maintaining the ongoing activities of the diagnostic imaging department while part of the staff undergo the PACS training;
- the marketing of the training throughout the department.

The last step means a continuous review of the training strategy. This step is often ignored, but it is important for many reasons, including:

- confirmation that the original objectives in the strategy are being addressed;
- assurance that the required levels of performance are being achieved, not only on an individual basis, but on an organizational level as well;

- assurance that problems or difficulties experienced either by trainees or trainers are picked up at an early stage.

The vendor provided two training sessions: an early training session with 29 participants (17 technologists and 12 radiologists) and a training sessions when PACS was completely installed and the RIS-PACS link implemented with 42 participants (14 technologists, 13 radiologists, 4 fellows, and 11 other users).

Several in-house training sessions were provided for 86 Diagnostic Imaging users: 18 radiologists, 13 fellows, 10 residents, and 45 technologists. Many users took part in several training sessions in order to learn both the PACS basic skills and the special functions and options (eg, presets, worklists, reporting functions, displaying protocols). The average number of training sessions received by the radiologists, residents, and fellows is three. The radiologists also took part at advanced training sessions, learning how to read a large number of examinations on the workstation or examinations with a large number of images.

TECHNICAL SUPPORT

There are many technical factors that are important for a successful PACS implementation: network design (to ensure a high-speed image distribution), storage capacity (to ensure an optimal functionality from the image request load point of view), external interfaces (with modalities and RIS), placement and number of diagnostic workstations, and workstation software (to ensure diagnostic quality of images and quick display of images from the online storage system).

We provided the technical support from the first stages of our PACS implementation, having a dedicated information technology person among Diagnostic Imaging and a vendor representative. During the training and technical support sessions, all users were again encouraged to discover the benefits of PACS.

Many health care professionals still lack a good understanding of the fundamentals of medical information systems. The presence of an information technology specialist during the PACS implementation helps bridge the gap between technological innovation and radiological practice. For example, it is known that it is vital to radiologists that display times are sufficiently rapid. But those

radiologists who are familiar with all functions and tools of the system are the users who exploit PACS to its full capacity and, therefore, can see more quickly the main advantages of soft-copy reading.

ROLE OF PILOT PROJECTS

Pilot projects were run in all modalities. During the pilots, we tried to balance user expectations to realistic levels, and we have listened to all comments from all users (including those who are pessimistic about the effects the system will have). Their concerns were addressed to increase their satisfaction during soft-copy reading.

RESULTS

Currently, the radiologists are divided into three major groups regarding the acceptance of PACS. The first division consists of six radiologists who like the PACS and are using the PACS systematically. The second division of eight radiologists have some concerns regarding the present level of PACS development, but are still using the PACS for soft-copy reading. The final division of four radiologists use the PACS rarely. Residents and fellows are more uniform in their approach, almost all using the PACS on a day-to-day basis.

We performed a statistical study in which we compared the users' acceptability subdividing the radiologists into two groups of users based on the number of training sessions they attended. The first group, represented by those radiologists who received several instructional lessons before PACS being completed installed, started the soft-copy reading activity before beginning the pilots (Fig 1). The second group received only limited training without any initial exposure to soft-copy reporting.

Fig 1. The difference between the users who received systematic instructional lessons and those who did not receive instruction at the beginning of pilot projects.

Fig 2. The difference between the 2 groups of users after 6 months.

The results of the study demonstrated that a positive communication within the radiology department (and later within the hospital), a well-designed training program, and a full-time user support ensures rapid user acceptability.

The study was repeated after 6 months. No significant difference between the two groups of radiologists was noted after this interval (Fig 2).

CONCLUSIONS

Many lessons have been learned in the last year from the PACS implementation point of view. Users acceptability has been evolving continuously during this period of time. Some radiologists have been slower in their acceptance of the PACS for routine use. There are some key success factors for a PACS implementation from the user acceptability point of view:

- training must be integrated with other plans and programs related to PACS implementation;
- communication among the Diagnostic Imaging staff must be systematic and PACS benefits must be identified by all users;
- the resource requirement for adequate trainers, training materials and facilities must be met.

Systematic training at different project stages should be provided. We have noticed that the training needs must be clearly assessed and resourced for different PACS users' categories (radiologists, technologists, and clinicians), but also on their developing expertise. This is an area that is often underestimated, and which can have a critical effect on a PACS project.

Implementing PACS (a major information system) is concerned with changing the "culture" of

an organization, not just about installing a computer system. Recognition of initial users' skepticism and fear of change has to be overcome in the early stage of a PACS implementation. Although technical factors are extremely important, the way PACS implementation is presented to the organization and the users kept informed of developments is vital to its success.

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