

PACS: Do clinical users benefit from it as a training adjunct?

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Abstract

Background. Over the past four years, Steve Biko Academic Hospital has been in the process of implementing and refining the use of a picture archiving and communications system (PACS). As part of a post-implementation refining process, it was necessary to evaluate user-perceptions in order to improve on good system qualities and correct flaws.

Aim. The aim of this study was to assess whether medical clinicians perceived PACS as a positive adjunct to training and teaching opportunities – specifically those opportunities related to radiological image viewing and interpretation as part of patient case discussions.

Method. Standardised questionnaires with ‘free text’ and ‘option selection’ questions were distributed to clinicians who, as part of their training, rotated at Steve Biko Academic Hospital (where a PACS is in place) as well as other teaching hospitals without a PACS. Between February 2009 and May 2009, approximately 400 questionnaires were distributed. As a result of constant academic rotations, leave schedules of medical staff and posts vacated, questionnaires could not be distributed to the entire target population that was estimated to be in the region of 550 medical clinicians (comprising senior medical students, interns, medical officers, registrars and consultants). Of the 400 questionnaires distributed, 189 completed questionnaires were returned. Completion of the questionnaires was voluntary and anonymous.

Results and conclusion. Although a PACS relates specifically to the archiving and retrieval of radiological images and reports, it became clear from the feedback received from medical clinicians (who are ward-based, theatre-based or clinic-based users of a digital system) that many other factors, such as lack of adequate hardware and sub-optimal personal IT proficiency, contributed to some of the negative PACS-related perceptions and ‘lost teaching opportunities’ reported. Negative comments specifically related to PACS as a training adjunct included the frustrations associated with PACS downtime (especially during the period in 2009 when many electrical power cuts were experienced nationwide, resulting in network interruptions) and slow image retrieval during peak work-flow times. The advantages of PACS as a

positive training adjunct were highlighted in the areas of multi-site viewing and consultation, the possibility of image manipulation and measurement tools, and better overall image quality. Clinicians felt that their training experience was also enhanced because of better patient follow-up made possible by access to all previous radiological imaging of a particular patient. Of the clinicians who completed the questionnaires, 63.5% felt that the PACS at Steve Biko Academic Hospital contributed positively to their training by creating more overall learning opportunities than other training environments without a PACS.

Introduction

Although the implementation of fully digitised hospital imaging archiving systems is still in its infancy in the South African (and African) setting, advances in the expansion, assessment and refinement of digitised archiving systems in developed countries are at the forefront of current radiological and information technology research.

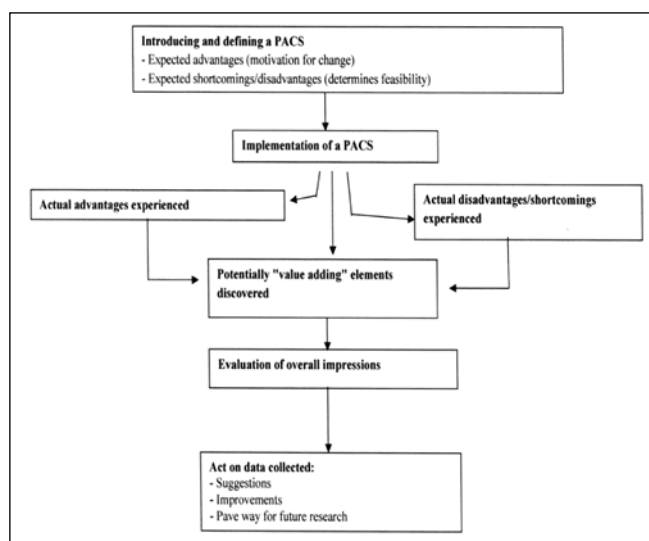


Fig. 1. A schematic representation of the events following implementation of a PACS.

Steve Biko Academic Hospital (SBAH) is a government-funded academic hospital with a fully digitised imaging archiving system in place. Over the past four years at SBAH, the process of implementation, integration and refinement of the PACS has been an on-going project co-ordinated by the Department of Radiology, the Department of Information Technology, the vendor involved, and the key roleplayers at hospital administration level.

The African *status quo* currently lags about 10 years behind our first-world counterparts. This is clear from early American and European post-PACS implementation quality assessment literature published from 1999 to 2002.¹⁻⁶ Subsequently, as the development and refinement of those PACS systems proceeded, literature pertaining to the 'added value' aspects of PACS came to the forefront from around 2005 to 2007.⁷⁻¹⁰ Despite this time lag, our current experiences echo theirs. A process of planning, implementation, use, evaluation and improvement is clearly reflected.

The process of change from a hardcopy imaging system to an integrated, digitised archiving system follows a certain natural course – see Fig. 1. Predicted pre-implementation advantages and disadvantages have previously been described in South African literature.¹¹

At SBAH, we are now entering our fourth post-PACS implementation year. On reaching this milestone, it has become necessary to objectively assess the advantages and disadvantages of the implemented PACS as perceived by users. We aim to use our findings to improve on perceived advantages and to act to correct flaws.

For medical and surgical clinicians training at an academic hospital, each step of patient interaction contributes to the overall learning experience. This includes viewing of radiological imaging studies and reading the attached radiology reports during ward rounds, clinic days, theatre procedures and formal patient case discussions.

The function of a PACS pertains particularly to the storage, archiving and retrieval of radiological images and reports. The system is linked to, and forms the back-bone of, both the hospital information system (HIS) and the radiology information system (RIS). Because training medical and surgical clinicians and students come into contact with both of these information systems (HIS used in clinics, wards and theatres, and RIS for interface exposure during inter-departmental case discussions hosted by the Department of Radiology), this study aimed at evaluating the perceptions regarding the core application of digital image and report archiving and retrieval, regardless of the system interface used.

For this reason, the study focuses particularly on PACS as a training adjunct to medical and surgical clinicians and students who are rotating at both a teaching hospital with a PACS as well as teaching hospitals without a PACS.

As the process of improvement and re-assessment continues, more optimal use of the 'value added' aspects of PACS (that we have only recently started to delve into) will be further developed; these include the use of tele-radiology (possibly linked to other tertiary institutions) and the development of a comprehensive digital image library for training.

Materials and methods

An analytical cross-sectional survey was conducted between February 2009 and May 2009 to evaluate the effects that the integrated PACS had on training opportunities as perceived by clinicians rotating at SBAH during their training.

Standardised questionnaires with free text questions as well as 'option selection' questions were distributed to clinicians training and teaching at SBAH. These clinicians included consultants, registrars, medical officers, interns and senior medical students working in general surgery, orthopaedic surgery, paediatric surgery, cardio-thoracic surgery, neurosurgery, ophthalmology, ENT, urology, dermatology, internal medicine, cardiology, neurology, pulmonology, rheumatology, gastro-enterology, paediatrics, obstetrics and gynaecology, as well as trauma medicine.

The questionnaires gave the clinicians the opportunity to state their perceptions and suggestions regarding the PACS as a positive or negative contributor to training opportunities created at SBAH, compared with their experiences at other training hospitals where they rotate during their training and do not have imaging archiving systems.

Although the entire target population was estimated to be in the region of 550 medical and surgical clinicians and students, only about 400 questionnaires were distributed as a result of clinicians' academic rotations, leave schedules and unforeseen post vacations. Of the questionnaires distributed, 189 completed questionnaires were returned. Clinicians completed the questionnaires voluntarily and anonymously.

Results

Demographics

The post descriptions and age range of clinicians who completed the questionnaires demonstrated a demographic distribution similar to the overall demographics in a training hospital – a larger numbers of students and junior doctors than the number of senior specialist consultants (Figs 2 and 3).

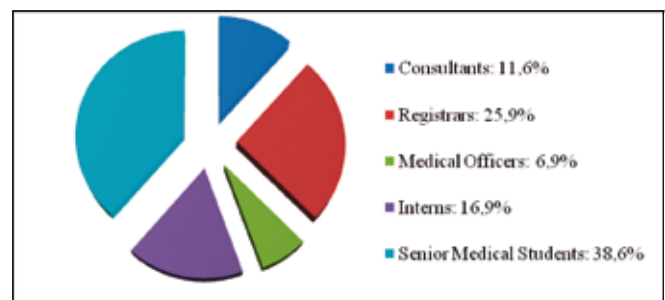


Fig. 2. Post descriptions of clinicians participating in the study.

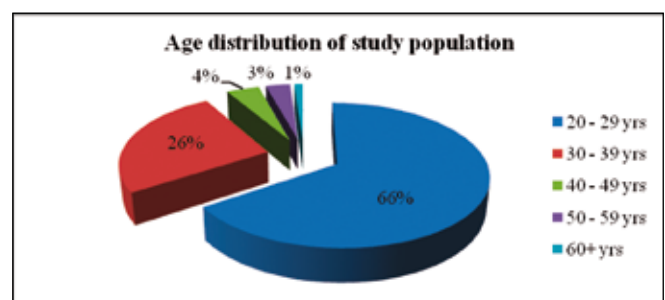


Fig. 3. Age distribution of the study population.

Due to the fact that this study aims to assess the perceived efficiency of the PACS at SBAH as a training adjunct (as perceived particularly by medical and surgical clinicians and students in training), the demographic distribution of the survey respondents is appropriate – the largest proportion of recipients being clinicians and students in training.

Duration of PACS usage (bearing in mind that total PACS implementation time is currently entering its fourth year)

Feedback from the study population indicated that 35% had been working with the PACS for more than 2 years, and 63% indicated that they had been working with the PACS for less than 2 years. Of the group that had been working with the PACS for less than 2 years, 13% had been working with the PACS for 6 months.

General pre-existing computer proficiency of clinical users

The majority (45%) of clinicians felt that their pre-existing computer proficiency was good (Fig. 4).

When asked to comment on their perceived use of the PACS, 43.4% of clinicians experienced the digitised archiving system as easy to negotiate from the start; 51.3% of clinicians experienced the archiving system as difficult to negotiate initially, becoming easier with continued use; and 3.7% of clinicians experienced the system as difficult to navigate, despite continued use.

Amount of clinicians who had frequent image viewing and associated learning opportunities

Clinicians were asked to mark whether or not the existing image filming and archiving infrastructure allowed frequent image viewing

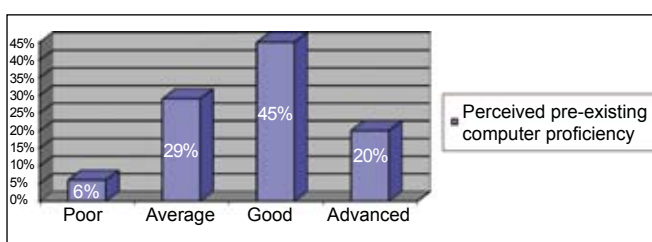


Fig. 4. Pre-existing computer proficiency as perceived by individual clinicians.

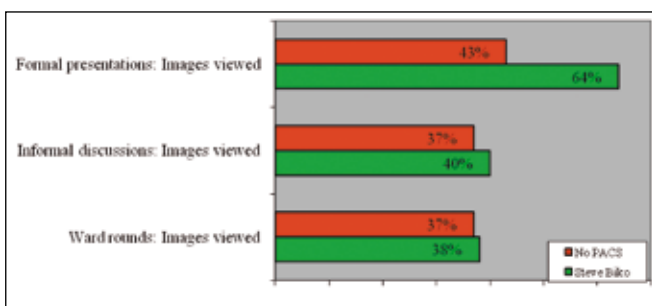


Fig. 5. Percentage of clinicians who had the opportunity to view images more than half the available teaching time at institutions without and with a PACS.

opportunities during various academic case discussions for the period of their rotations at either SBAH or at the other training hospitals without a PACS. Frequency was described as 'more than half of the time' and 'less than half of the time'. Fig. 5 demonstrates the percentage of clinicians who had image viewing opportunities more than half of the available teaching time at the various institutions (the balance of clinicians viewed images less than half the time).

From Fig. 5, it is clear that, in most of the academic teaching scenarios, a larger percentage of clinicians reported image viewing opportunities at SBAH (using the PACS) than at other training institutions without a PACS. The largest discrepancy in image viewing opportunities was noted regarding formal inter-departmental case presentations. Sixty-four per cent of the respondents reported that they viewed images during formal presentations more than half the time at SBAH, while 43% indicated that they had similar frequency of image viewing opportunities during formal case presentations when working at other teaching hospitals without a PACS.

A smaller discrepancy was demonstrated with informal discussions, where 40% of clinicians felt that they frequently had image viewing opportunities during informal discussions at SBAH, and 37% felt that they had frequent image viewing opportunities during informal discussions at other teaching hospitals without a PACS.

Image viewing opportunities during ward rounds at SBAH v. other teaching hospitals without a PACS, differed by only one per cent. The reason for this low figure is directly related to a lack of available appropriate hardware for optimal ward-based image viewing – as outlined by the free-text comments received (see Table I below).

Additional perceptions regarding PACS as a training adjunct

Other feedback was that 94.7% of clinicians felt that the multi-site viewing of images on the PACS make inter-departmental consultations much easier. Also, 94.2% of clinicians felt that digital picture archiving made patient follow-up more efficient by having all the previous imaging studies available for immediate display. The majority of clinicians (97.4%) found the display tools (image manipulations and measurements) helpful when studying images, and 75.1% of clinicians felt that digital images had better resolution than hard copy images.

Fig. 6 shows positive responses received by the majority of respondents regarding PACS as an overall positive adjunct to medical education by creating more training opportunities.

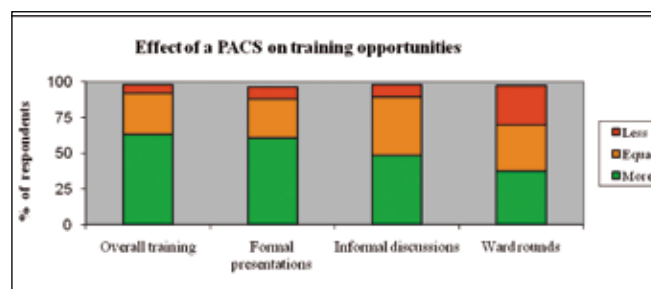


Fig. 6. The effects of a PACS on various training opportunities as perceived by respondents.

Table I. Summary of 'free text' comments received

Positive attributes	Negative attributes
Easy image viewing	Slow image retrieval during peak workflow times.
Easy image retrieval	PACS down-time (especially at times of power supply interruptions and system upgrade difficulties).
Conveniently accessible images	Difficulties encountered during ward rounds and student examinations due to absence of a bedside mobile image viewing solution e.g. computers on wheels (COWS).
Images can be viewed at several sites simultaneously	Some clinicians reported that it was difficult for large groups attending ward rounds to appreciate pathology on the ward-based viewing stations due to small screen size and sub-optimal screen resolution (especially for more specialised investigations such as high-resolution CT chest scans).
Better time management	Some clinicians expressed frustration about broken/stolen hardware.
Access to all previous imaging studies of a particular patient	Frustrations also expressed about theatre viewing screens that were not fully functional.
The benefit of large image-viewing during formal inter-departmental conferences	
Better image quality resulting in better appreciation of pathology during formal inter-departmental conferences	
The digital nature of the images makes it possible to use them for Powerpoint presentations	

Conclusion

In the setting of a teaching hospital such as SBAH, every aspect of patient contact contributes to the medical or surgical clinicians' and students' training – from patient history taking and examination to the optimal evaluation and appreciation of radiological images and reports. To this end, a well-administrated PACS plays a pivotal role in the amount and quality of medical education offered and learning opportunities created.

From this study, the value and potential of a PACS as a training adjunct is highlighted. This is reflected in the fact that the majority of respondents felt that there are aspects of a PACS that contribute positively to the level and amount of training opportunities created, particularly during patient consultations, informal case discussions and formal inter-departmental case-based conferences. However, this post-implementation qualitative survey also clearly outlines that the implementation and use of a PACS is a dynamic process. As imaging, display and digital technology advances, user needs (and therefore system needs) concomitantly change. This demands a continuum of planning, implementation, use, evaluation and improvement that necessitates input from all PACS administrators, vendors and, most importantly, end-users.

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