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Commentary

Installation of a PACS system

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This is a personal view of a Picture Archiving and Communication System (PACS) installation but there will no doubt be resonance with the experience of others who have gone through the process and hopefully some useful pointers for those who are about to embark on the journey.

At St George's Hospital we have been through a process of PACS procurement and implementation, which has been tortuous and at times difficult with differing demands from various NHS bodies which moulded the process over the past 5 years. This is a very individual experience but much was learned on the way. Fortunately, 18 months post implementation I can say that we would do it all again as PACS has revolutionized the way we work and has increased our organizational efficiency as nothing else could.

From late 1999 when we started out we progressed from a single Trust project to a South West London Sector Project (at the behest of the Regional Health Authority) to the installation of PACS at St George's only in June 2003. This was not because the Sector Project was problematic as six Trusts worked together in an exemplary way and unanimously selected a preferred supplier showing that a large project with mutual shared benefit can succeed. However, the establishment of the Strategic Health Authority resulted in re-evaluation of the project at a late stage and the National Programme for Information Technology (NPfIT) was looming into view. St George's implemented largely because of the imminent opening of a Neurosciences and Cardiothoracic PFI build designed to have PACS. Hopefully the remainder of the sector will now progress within NPfIT as all of the groundwork has been done.

It was, in our view, absolutely essential to appoint a member of staff to oversee the project and we appointed a Project Manager at the outset. This greatly assisted progress as other members of staff were already too busy to take on this huge extra task. The sector project also had a Project Manager which kept the entire sector on schedule. The employment of external consultants to assist with planning, consultation and outline and full business case was extremely helpful.

In the early stages clinical colleagues were involved in focus groups and later two were incorporated into the PACS Project Board, one a cardiologist and the other an orthopaedic surgeon. A neurosurgeon was involved in the final selection process of the system. It is essential to involve other disciplines and make the project a hospital project rather than a radiology one. PACS alters everyone's working environment and practices. It is, however, difficult to maintain the interest of clinicians over a lead up time as long as ours, but it is important at least to keep the PACS Board members informed of progress and consult with them when necessary.

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The technical specification was drawn up partly using our own knowledge from reading, attending conferences and asking others about their experiences with PACS. We also employed an external consultant who had had involvement with other PACS installations and Medical Physics advice proved invaluable. IT upgraded the network to the satisfaction of PACS suppliers and we have a virtual local area network (VLAN) reserved for PACS. All storage is on RAID (Redundant Array of Independent Disks), which is a hard disc system, with backup on digital linear tape (DLT). The sector project specified a central DVD store with all examinations in working storage, but this aspect has not been resolved for the St George's site alone. Having everything in working storage is undoubtedly an advantage.

Resources were always to be a big issue and there were several reviews of the specification to make the project as affordable as possible. Most PACS now only include software for a web browser application as most modern PCs are capable of running the application and are usually available throughout Trusts. Standard PC screens have improved over recent years making them adequate for viewing most PACS images. Extra PCs for the wards were funded from monies to decrease junior doctors' hours and special consideration was given to A&E, intensive care areas, the chest clinic and rheumatology and orthopaedic outpatients as well as neurosurgery theatres. Viewing facilities throughout the Trust are web browsers with larger, high resolution dual monitors in the key areas. No major items were left out in looking at affordability and the system delivered has adequate numbers of CR readers, connectivity with all equipment and sufficient dedicated radiologist reporting stations (Table 1) for efficient working. The network upgrade, which was necessary regardless of PACS, was not included in the cost of the project.

Reduction in staffing to offset PACS costs is an issue which requires very careful consideration. There is a need for fewer filing clerks, but there are other tasks, such as scanning in request forms, producing CDs of images for outside hospitals and importing images and CDs from outside and allocation of reporting which will redeploy some processing technicians and clerks. Secretarial efficiency is undoubtedly improved by PACS and digital dictation.

The tendering process was managed by the sector project team who provided invaluable support. St George's expended a large amount of effort in producing the Output Based Specification which included all issues of

Table 1. Distribution of radiologists reporting stations

Area	Number of radiologists reporting stations
All X-ray areas (except mammography)	11 with 2 reporting monitors
Mammography	1 with 2 reporting monitors
CT	2 with 2 reporting monitors
MRI (general)	2 with 2 reporting monitors
Nuclear medicine	1 with 2 reporting monitors
Neuroradiology	4 with 4 reporting monitors
Ultrasound	1 web browser monitor per room

performance and site-specific requirements as well as a benefits analysis. The responses from the companies were assessed and scored. The tendering process initially reduced the companies who could meet the specification from 4 to 2. Further evaluation and visits resulted in the selection of the preferred supplier. With consultant and project management support this process went smoothly.

One of the most important issues to consider as far as responsibilities of the vendor is concerned is prime contractor status, whereby the vendor takes overall responsibility for the PACS system. Interfaces, especially with existing radiology computer systems are of vital importance and there is absolute necessity for the buck to stop rather than be passed on. In our experience this was one of the most difficult technical issues and although there was some amelioration from our PACS provider having prime contractor status, some ongoing issues remain.

The convergence of the agreement that the contract could be signed and the opening of the St George's Hospital PFI building resulted in a very rapid implementation period which is not to be recommended. In the existing part of the hospital the removal of processors and building works for PACS coincided with the installation of the CR readers. This resulted in a congested, noisy and dusty environment which was good neither for the equipment nor the staff. The CR system went live in the main part of St George's Hospital 6 weeks after the commencement of the installation. During the 6 week period almost all modalities were connected to PACS. The Neuroradiology Department in the PFI building opened 2 months later with PACS and a filmless environment.

During this short implementation period training for all staff inside and outside radiology was carried out. The radiographers clearly require extensive and detailed training as theirs is the most difficult task in the change to CR. Radiologists need less training but the 1 h which most of us had left us less than proficient with some of the more subtle features of the system – learning has been ongoing. Key workers in the clinical areas of the hospital were trained initially including some who had no computer skills whatsoever. Junior doctors who have started work in the Trust more recently are given basic information by their colleagues but the system is intuitive and for every day use, anyone who is computer literate can easily navigate the system – it is very user friendly.

The plan at the time of going "live" was to print film for 6 months while building a PACS archive. This permitted a transition from film to PACS and gave the users throughout the hospital the opportunity to become familiar with PACS without being totally dependent upon it. It also allowed problems to surface after our rapid implementation. It had never been the intention to scan in historic images to provide an archive – this is expensive and time consuming and of little benefit. The film archive is pruned year on year as previously and will diminish over the next 4 years. 18 months after implementation X-ray packets are not issued automatically but only to outpatient clinics, which have positively asked to continue to have old films.

The integration of the Patient Administration System (PAS), Radiology Information System (RIS) and PACS was always regarded as a major factor in a satisfactory PACS installation, but this has been one of the most difficult issues and continues as a relatively minor difficulty in comparison with earlier problems. It has emphasised the absolute necessity for the PACS provider to have prime contractor status. Integrated RIS and PACS from one manufacturer would be the simplest solution, but that will not be the reality for most sites and this issue must be a top priority in the implementation. A demonstration that integration can work does not guarantee a fully functional system with satisfactory messaging between RIS and PACS.

Downtime for PACS has been greater than expected and has had a number of causes from Trust network and computer room problems to PACS failures and planned downtime. There have been times of great inconvenience, but no clinical disasters caused by PACS failure. A very unusual and unexpected disc failure in the RAID caused the most difficult problem, fortunately before St George's became completely filmless. Concerns regarding a high level of reliability of the system postponed the date of going filmless from December 2003 until March 2004 and the major failure occurred in January 2004. Planned downtime has significantly exceeded that stated in the contract and this remains an issue. During periods of downtime films are printed but previous imaging is not available. The examinations performed during these periods are subsequently loaded into PACS.

Overall, PACS has been well received by clinicians in the Trust as one of the major disadvantages of the old system was lack of availability of films for outpatient clinics and wards, the latter often being because the Radiology Department had the films for reporting. The system is more dependable than in the early days and at one stage there was concern regarding image availability in key areas such as neurosurgery theatres. A great deal of work has gone on in the background by members of all staff groups in the Department to make the system as good as it can be and there are now only a few remaining issues. One of the problems for the clinicians has been lack of availability of reports on PACS, part of the interface/messaging issue. This is much better, but not yet 100% reliable.

The very rapid deployment of PACS was difficult and an implementation period of 6 weeks before going "live" is definitely not to be recommended. Looking back over the past 18 months the difficulties have largely been centred around interface issues between RIS and PACS. The near catastrophic disc failure in January 2004 was a rare one-off event (hopefully). Progress in some areas has been very slow and it has been interesting to find that, when a problem is raised, there is often not an easy off the shelf solution. It appears that some difficulties have not been

envisaged and a solution has to be developed. There have been a few scenarios where patient safety has been an issue, such as the attribution of examinations to the wrong patient record, and vigilance is essential. Awareness of such potential problems and their rapid remedy is vital. The addition of administrative work stations for management of workload has been vital for the safe working of PACS and these were not initially considered necessary by the vendor.

I am pleased to say that the efficiency of the Radiology Department and the Trust has improved and we are now in an excellent position with a system that, despite a few difficulties which we continue to resolve, works very well. The Department and the Trust would not go back to the days of film packets. Images are almost always available anywhere in the hospital and this enhances patient care as well as clinical meetings when all imaging is available for discussion. PACS, thanks to our chief clerical officer, has given us a system where all examinations are allocated and reported and we are reminded on a regular basis of the workload which we have not yet dealt with. St George's does not have electronic requesting and request forms are scanned into PACS. This has been of huge and unexpected benefit in speeding up reporting, such that we are almost always completely up to date with our "hot" reporting. Clinicians can form time-limited worklists of their own patients and review reports and imaging on PACS as a means of ensuring that all reports are read. These Clinical Governance aspects are not necessarily at the forefront of everyone's mind in relation to PACS installation, but they are a very helpful contribution to safe patient care.

I did not expect that a PACS installation, particularly into an existing department, would be easy but it was significantly harder than envisaged. My colleagues were hugely supportive throughout the project, with no dissent about the desirability of PACS and that helped greatly in difficult times. I can, however, end on a "high" and say that we are delighted to be working with a PACS system and even the large volumes of plain film reporting are not a chore.