Clinical & Scientific letters

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Picture archiving and communications system (PACS): the benefits and problems of digital imaging in the NHS

Introduction

Under the Department of Health's (DH) £20bn information technology project for England, Connecting for Health (CfH),[1,2] all hospital trusts have been obliged to take contracts for the installation of picture archiving and communications system (PACS) with local service providers (LSPs), with similar programs in Scotland, Wales and Northern Ireland. PACS is a network of computers programmed for the storage, retrieval and transmission of digitally acquired medical images, and will replace all hard-copy images with digitally stored electronic information which can only be viewed on screen. This has major implications for clinicians throughout the UK, and the *sine qua non* of a new system of such importance is that it should be at least as clinically reliable as the system that it is replacing. We therefore surveyed a large group of regular X-ray image users in order to gauge the extent of PACS implementation and to enquire about perceived benefits and problems.

Methods

A postal survey of 782 members of the British Thoracic Society (BTS) was carried out in the first quarter of 2006, using all names listed on the BTS consultant database at that time. The survey covered 290 hospitals across the UK.

The questionnaire [available on request] was designed:

- to obtain information about the current availability of PACS in acute hospitals in the UK
- for those hospitals with PACS in place, to gauge respiratory consultant involvement in its introduction
- to obtain balanced feedback, both positive and negative, on clinicians' experience with PACS
- for hospitals without PACS, to obtain data about the anticipated timing of PACS installation.

Results

The response rate from consultants was 75% (584/782) and from institutions, defined as at least one responder per hospital, 99% (287/290). 30% (87/287) of responding institutions were university teaching hospitals (UTHs). 70 per cent (200/287) were described as district general hospitals (DGHs) or district general hospitals affiliated to university teaching hospitals. 47% (134/287) of respondents' main institutions had undergone either a complete (34%), or a partial (13%) transition to PACS. 33% (29/87) of responding UTHs and 34% (68/200) of responding DGHs had undergone a complete transition to PACS. Consultants in hospitals using PACS recorded either personal or respiratory consultant colleagues' involvement in discussions leading to implementation in 66% (88/134) of hospitals (71% of UTHs; 63% of DGHs). 277 returns were included in the following analyses since 10 respondents from hospitals with PACS chose not to answer all the questions.

Clear majorities of consultants recorded positive experience in response to questions concerning:

- ability to manipulate images with PACS (83%)
- speed of access to stored images using PACS (77%)
- fewer lost images when using PACS (71%)
- the use of PACS as a teaching or research tool (68%)
- the ability of PACS to reduce clerical time (64%)

- the ability of PACS to facilitate discussion of an image between colleagues within the same institution at different workstations (61%).

However, a clear majority of PACS users (68%) noticed no benefit in the ability of PACS to facilitate discussion of an image between colleagues in different hospitals nationwide.

Sizable minorities of consultants recorded problems in response to questions concerning:

- difficulty transferring images to other hospitals (48%)
- difficulty obtaining good quality images on the wards (44%)
- delay in displaying images on screen (40%)
- difficulty obtaining good quality images in outpatient clinics (35%)
- difficulty obtaining adequate training and technical back-up (29%).

When questioned about viewing previously stored (archived) images, sizable minorities of consultants recorded problems:

- obtaining images still filed or stored as hardcopy film on or off site (47%).
- obtaining archived images from PACS (33%)
- obtaining such images digitized onto PACS from hardcopy film (30%)
- obtaining such images uploaded onto PACS from CD-ROMs (29%).

108 respondents with access to PACS made free text comments, 13 (12%) of which were positive and 95 (88%) negative. The most common complaints (56%, 53/95) concerned poor quality or lack of availability of monitors followed by problems transferring images to other hospitals, reflecting the strength of feeling about these shortcomings of PACS.

53% (153/287) of hospitals had no form of PACS (either complete or partial), comprising 48% of UTHs and 56% of DGHs.

Respondents from these 153 hospitals anticipated installation of the system within one year in 47% (72/153) of hospitals (49% of DGHs and 43% of UTHs), within one to two years in 31% (48/153) of hospitals (27% of DGHs and 43% of UTHs), in over two years by 8% (12/153) of hospitals (8% of DGHs and 7% of

UTHs). Respondents from 14% (21/153) of hospitals (16% of DGHs and 7% of UTHs) expressed uncertainty.

Discussion

Although PACS is being implemented nationwide in NHS hospitals, there is little published information on the extent of progress in the five designated regions or 'clusters' in England (where LSPs have been contracted to install and commission the service) or in other UK countries.

By targeting a large group of acute clinicians whose daily practice is highly dependant on radiological information, this survey has established a 'snapshot' of PACS implementation in the first quarter of 2006 across the whole UK, having achieved a hospital-wide response rate of 99%. A narrow majority of hospitals still had no form of PACS but of these it was anticipated that just under half would commission PACS within a year and a further third within two years. If these expectations are fulfilled nearly all hospitals will have PACS by 2008.

The majority of current PACS users were positive in their responses about the ability of the system to facilitate the manipulation of images, to achieve fast access to stored images and to reduce the loss of images which could occur with hard-copy film. PACS also has majority approval from respondents as a teaching or research tool and as a means of facilitating discussion between colleagues within the same institution at different workstations, as well as reducing clerical time.

Difficulties in transferring images from one hospital to another, however, existed for most PACS users at the time of the survey. One of the stated aims for PACS within CfH is to facilitate such communication,[3] an aspiration that has clearly not yet been realised. It is also intended with CfH that each regional cluster of NHS facilities should have a central archive for the storage of old images off site so that these can be retrieved and communicated to other hospitals if necessary. There is, however, no such central archive currently available for any cluster.

Since most NHS facilities do not have inter-hospital links for transferring digital images they have to be transferred physically by sending the information in stored format such as a compact disc. These must be produced from PACS in DICOM (digital imaging and communications in medicine) format in order for the information to be properly displayed by the PACS system of the receiving hospital.[4] Other image storage modalities such as JPEG file format and AVI that are commonly used on personal computers/web browsers contain data in compressed form with loss of quality and these formats are incompatible with PACS.

Complaints of poor quality images on the wards, and to a lesser extent in the clinics, were another concern among PACS users. Clinicians currently base important decisions in part on the appearance of conventional images before these have been reported by a radiologist. 'Primary radiological diagnosis' is used routinely in acute medical units and emergency departments and decisions on unreported images are also commonly taken in other settings in particular chest, rheumatology and orthopaedic clinics. The quality of PACS images should be at least as good as the hard-copy radiographs they are replacing. Unless this primary condition is fulfilled the many other advantages of PACS may become meaningless.

Although PACS can produce images as good as high-quality images on conventional film, this comes at an economic cost.[5] There may have been a misconception with the budgeting of PACS that primary radiological diagnosis would take place only in clinical imaging departments so that high resolution workstations would be centred in these areas only and that the provision of inexpensive lower quality imaging equipment with a radiologist report alongside it would suffice for clinicians. In fact, careful thought needs to be given to the provision of computers, monitors and software that are of sufficient quality to produce good diagnostic images at appropriate locations with optimal ambient lighting conditions outside the clinical imaging departments in order to meet the clinical needs of patients.[6]

It is of concern that in one third of hospitals with a respiratory physician had not been involved in discussions leading up to the implementation of PACS. Such involvement may be especially necessary in times of financial constraint in the NHS. Central funding for PACS in hospitals is capped and trusts have to meet any necessary additional costs from other budgets; furthermore the cost of any upgrades once PACS has been installed will not be met by CfH.

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MRCP(UK) Part 2 clinical examination (PACES): examiners reflections

PACES: The training

The over-solicitous introduction is followed by affected concern for the patient's comfort. Patients *are* real people, but the 'Can I now examine your hands? Can I now take your pulse? Can I now look at