The role of IT in the NHS

In the first article in a series from the Society's IM&T committee, Allan Somerville and Peter Hogg introduce its work, and set the scene for the use of IT in radiography.

Introduction

The introduction of Radiology Information Systems (RIS) in the 1970s, originally designed to replace paper-based records of room booking, attendances, etc, was the first widespread IT application used in radiology departments. Picture Archive and Communication Systems (PACS) emerged from the early 1980s with small local projects – enterprise-wide PACS solutions have been a more recent development.

Other developments in this timeline include clinical applications like 3D reconstruction software, cardiac packages and orthopaedic templating software, while more general developments include digital dictation and voice recognition. Although outside the scope of the Society and College of Radiographers' (SCoR) IM&T committee, the influence of IT in the development of modern modalities has been revolutionary and should not go without mention.

Departments external to radiology, such as laboratory departments, have experienced similar advances with developments in IM&T and, increasingly, these traditionally 'stand alone' systems across all disciplines are integrated with each other to share patient data and clinical information.

The proliferation of computer-based technologies across all aspects of the NHS over the last 20-30 years is unprecedented in terms of extent and timescale. The resulting change has been significant and proved to be the building blocks for large scale national IT programmes, eg, Connecting for Health in England, the national PACS programmes in Scotland and Northern Ireland, and the national RIS programme in Wales. Their introduction has changed many aspects of the radiographic profession and of the service provided by its members.

The impact of this is considered later in the article – however, the need for professional bodies and members to understand the principles of IT technology and its application in health services has never been greater. The knowledge and skills required range from basic computer skills, to enable staff to operate user-friendly interfaces on applications, to the expertise of PACS or RIS managers requiring an understanding of the database management, knowledge of database integrity requirements, and the ability to apply principles of information governance. Only with the knowledge, skills and ability to apply them can professions enable the NHS to realise the benefits available following the introduction of IM&T.

Governmental bodies have previously indicated the need for all professions to be proficient in information technology. The Department of Health has identified the need for a '*systematic approach to information management and technology*' and has identified '*priorities for developing the future health and social care workforce*'.

One key objective for NHS staff and educational consortia to meet this target is that: '*organisations should work together to ensure that all staff develop confidence and competence in information handling, so that health and social services have an information proficient workforce communicating and using information better*'.

In addition, the national eHealth programme in Scotland aims to: *'exploit the power of electronic information to support clinical decision making and communication, as well as knowledge management'.*

Ahead of the game

There are many examples where the SCoR has identified the need to address these issues. Consider the guidance document *Information Management and Technology: Implications for the Radiography Workforce* as an example, which states that: *'radiographers must lead the way in developing and maintaining skills and competences to ensure this technology is used appropriately. Training standards should be agreed and implemented at all levels of the workforce'.*

One purpose of the SCoR IM&T committee was to facilitate members in the attainment of these goals and was a key contributor to the above guidance.

The origins of the committee can be traced to a meeting of the Clinical Professions Information Advisory Group in 1997, a multidisciplinary group established to focus on the future of IT in the NHS. In an effort to support the SCoR representatives, the chair of the group proposed that the SCoR establish an IM&T committee, the original aim being to enable the SCoR to keep abreast of change and inform members of the profession of both specific and wider IM&T issues.

Members of the committee have varying but key roles in NHS IM&T and have an in-depth understanding of the issues and developments in all aspects of the NHS from across the UK. The committee's Terms of Reference are clearly defined and are available on the SoR website (*www.sor.org/members/imt/index.htm*), but they broadly fall into four main categories:

◆ **Communication**: a principle aim of the committee is to inform members of events and developments in IM&T which are relevant to the radiographic profession. In addition, it aims to affect influence

over the strategic direction of national IT programmes and developments which have the potential to influence, or to have an impact on, the profession.

The committee disseminates information to members through seminars, educational forums, and via professional journals or publications. Examples of this include forums like *Demystifying Clinical IT*, articles in *Radiography* and *Synergy*, the IM&T group web pages, and by advising members or local groups directly to aide the development of policies, handbooks, etc. The committee also has membership on the IM&T scientific committee of UKRC.

◆ **Information/education:** the committee aims to increase awareness of IT principles throughout the profession and to highlight areas which require further skills or knowledge of systems or applications introduced through technological change in order to ensure their optimal and safe use. It also aims to increase awareness of patient safety issues related to the use of IT systems in the profession and to provide information and guidance to members whenever and wherever necessary.

Liaison with academia is an essential part of the remit of the committee in order that the curriculum equips radiographers with the necessary skills to operate in an IT driven radiographic profession. Again, workshops, seminars and educational forums are used as the primary means of meeting these objectives.

The introduction of IM&T across all healthcare introduces a number of opportunities for CPD. This pervades the radiography profession, along with the creation of new career or development opportunities through the creation of PACS and RIS manager posts as well as opportunities for project management.

◆ **Representation:** the committee undertakes to represent SCoR members through attendance at national IT, radiology forums and meetings. Members have recently presented at national conferences, eg, UKRC; have representation on IHE-UK meetings, Connecting for Health technical and user groups; and chaired national NHS IM&T user groups, National Health knowledge networks, national clinical advisory groups, and many more.

◆ **Resource:** the committee aims to act as an educational and reference resource on IM&T issues for the profession. The knowledge base is developed through the sharing of information between members of the committee as well as among the members of the SCoR.

A great deal of work has been undertaken by the committee since it was established. However, given the widespread and dynamic nature of the influence of IM&T, it is recognised that much work remains to be done.

The impact of change

Technological changes, trends towards systems integration, increased dependency on IT systems, and the global nature of future IM&T systems have already had a significant impact on many of the traditional roles of the radiographer and on the profession in general – eg, the introduction of computed radiography or PACS. The impact extends beyond both the roles and duties of the radiographer and the walls of the imaging department, as systems link within hospitals and, increasingly, with systems across whole countries.

A review of literature, some personal experience, and group discussions, identified the following areas most directly affected by the introduction of IT: image generation; patient identification; patient safety; information governance; and role development (eg, system management and administration).

◆ **Image generation:** the production of a diagnostic image is a key part of the radiographer's role. However, the introduction of PACS means that images are no longer routinely stored on the permanent media of film. On the whole, photon generation remains unchanged through the ages, but the production of the resultant image has moved from traditional film-based technology to being generated electronically, transferred via digital networks and stored in electronic format.

In addition, the development of digital modalities and increased computational power has enabled post processing and reconstruction of images, along with a new generation of modalities capable of generating huge volumes of raw data. Radiographers now carry out many of their traditional roles in a digital environment, eg, quality assurance of images, image transfers to remote sites, and new enhanced roles like digital image post processing, 3D reconstructions, etc.

◆ **Patient identification:** a key responsibility of the radiographer has always been the identification of the patient both prior to and after the examination, and with final storage of images. Traditionally, a comparison of details handwritten on a request card with those offered by the patient would result in the correct demographic information being permanently imaged on the film.

An advantage of this practice was that the details captured at the time of examination were permanently fixed with the images and only changed by physical means, eg, cutting sections from the film, in itself a rudimentary audit trail of change. A limitation is the fact that patient details were never updated to reflect changes in personal details, eg, a name change.

Modern, well managed PACS/RIS solutions automatically update historical image records. The benefits of this are obvious but, given the radiographers'

accountability for correct identification of images, a basic understanding of the system workflows and message transfers is essential in order that the integrity of both image and patient data is maintained.

◆ **Patient safety:** the scope of this article allows only a brief address of patient safety issues, but it will be covered more fully in subsequent articles. As highlighted above, the image capture and subsequent quality assurance process has changed radically as a result of IT developments, essential changes to radiographers' workflow, and IT-driven patient identification processes – all have the potential to introduce risk to the patient through poor image quality or misidentification.

◆ **Information governance:** an umbrella term which covers a number of different individual areas when applied to IM&T, its aim being to provide a framework to ensure that information is handled in a confidential and secure manner.

All NHS establishments and employees must comply with the relevant legislation and guidelines, including The Data Protection Act, 1998, Caldicott Guidelines, Information Security Standards, Freedom of Information, and Data Quality Assurance, to name but a few.

Most, if not all, of the guidelines and legislation now apply to all information gathered or stored, be it paper based or electronic. However, the nature of electronic data storage increases the potential for large scale breeches of privacy, etc, and opens opportunities for unauthorised access from remote sites. As a result, electronic data storage tends to be subject to more restrictions and controls.

All staff must be aware of their obligations to comply within the information governance framework. For radiographers, this includes some simple requirements like logging off from computers and protecting passwords, to the importance of adherence to local patient identification protocols and accurate data entry on information systems.

The role and remit of IT systems managers, eg, PACS or RIS, requires them to ensure that the data captured and stored on these systems is accurate at time of entry and that procedures are in place to keep this information up to date. Secure Operations Policies will be in place to outline the practices to protect the data from unauthorised access and from loss due to disaster, etc.

◆ **Role development:** in particular, the role of PACS manager. This role developed incrementally with the introduction of mini PACS, and was often deployed to facilitate electronic reporting. These systems required very little management beyond some simple administration and fault resolution. Over time, PACS systems extended to hospital-wide solutions, integrated with other systems, and became the main archive for image storage.

The role of the PACS manager has extended in line with system development and levels of integration, and has become a key link in the provision of the modern service. Many of the roles and responsibilities of this post have been touched on already and include database management and administration, information security, system and application training as a minimum. It is often shared with that of RIS manager, particularly on smaller sites.

The model candidate for this role is an experienced radiographer, familiar with workflows and with broad experience in radiology – a post-graduate IT qualification including database management would be ideal. At the time of writing, there are no formal qualifications specific to PACS management and few dedicated training courses. Training typically relies on 'on the job' training whilst shadowing a colleague, with no objective measure of proficiency at the end of the process. Given the critical nature of the work carried out by the PACS manager, this needs to be addressed through the SCoR IM&T committee in liaison with academia.

Conclusion

Several key action points have been identified in this article, namely:

◆ The need for radiographers to increase their awareness of IT principles and technology

◆ The need for the radiography academic curriculum to further accommodate information technologies

◆ The need for certified or post-graduate courses on IM&T and PACS management to be developed

◆ More consideration of patient safety issues, particularly related to information governance issues.

A national audit of IM&T understanding and knowledge amongst SCoR members was undertaken in 2008 and public release of the final report is imminent. A number of the recommendations are aligned with the points outlined above and an action plan is currently in development.

Hopefully, this article has provided an insight into the purpose and workings of the SCoR IM&T committee – this will be continued in a series of articles in successive issues of *Synergy* aimed at increasing awareness of IM&T issues for the radiographic profession in the 21st century.

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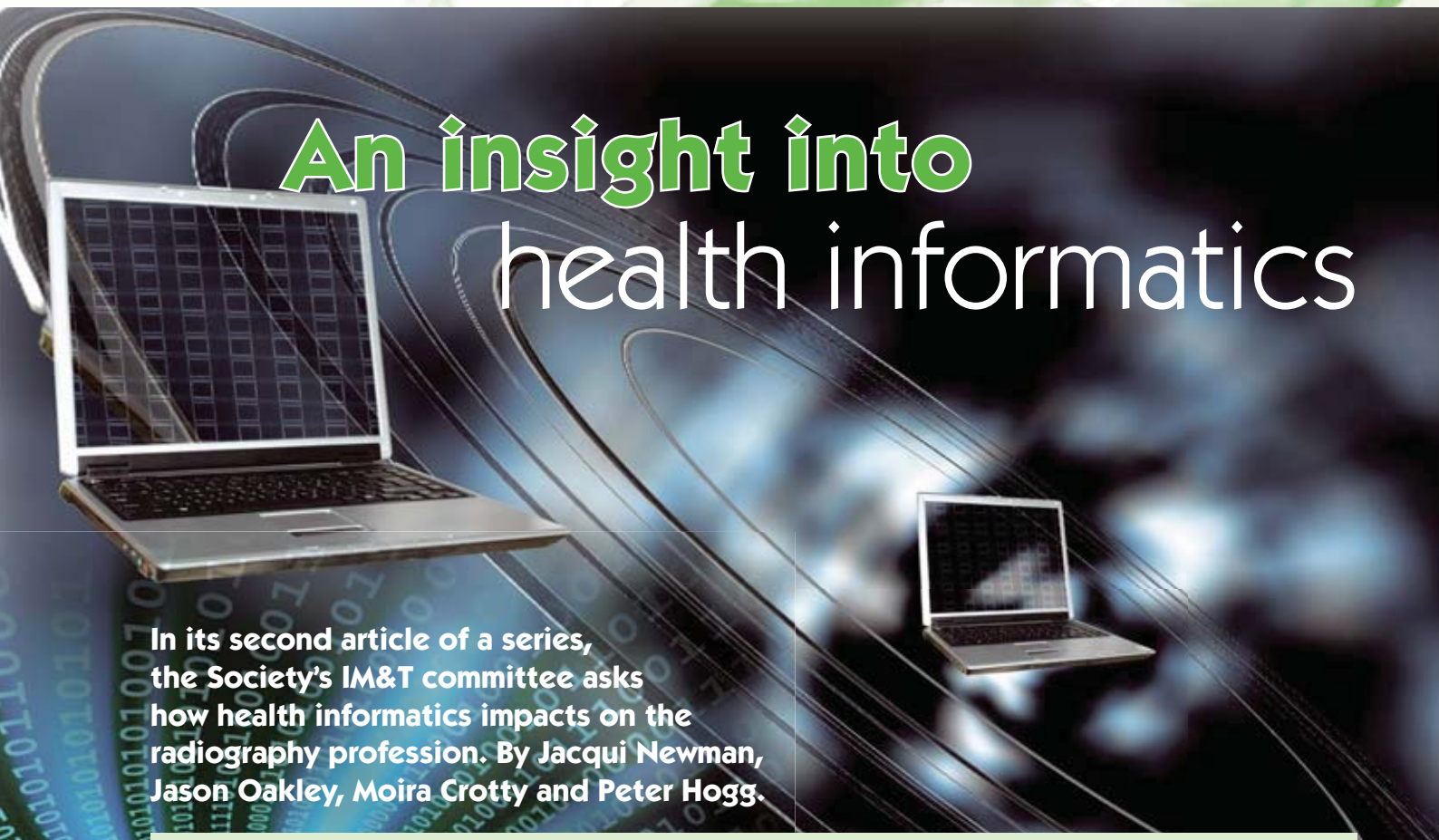
IN NEXT MONTH'S SYNERGY: Health informatics and the radiography profession

To comment on this article, please contact Rachel Deeson at *racheld@synergymagazine.co.uk*

An insight into health informatics



In its second article of a series, the Society's IM&T committee asks how health informatics impacts on the radiography profession. By Jacqui Newman, Jason Oakley, Moira Crotty and Peter Hogg.

Introduction

For as long as information technology (IT) has been in general use, the National Health Service (NHS) has attempted to harness its potential to gather, organise, analyse and transmit medical information to improve patient management and care. This is reflected in government opinion too: for instance '*…we are helping the NHS to deliver new computer systems to improve patient care and safety*'[1].

In a recent government review of health informatics (HI), it was noted that clinical staff need immediate access to patient information, regardless of where the patient was previously seen. Alongside this, it has become apparent that the public and patients alike expect clinicians and managers to make effective use of information and therein take decisions that are reliable and based upon quality evidence. Computers have become essential in these processes.

As the capability and use of IT has increased, it has become more important within our healthcare systems – to a point where we now have complete reliance upon it. For instance, when new IT systems are introduced, they can have a significant impact on the way we work, a fact that has been noted in many radiology departments during the transition to PACS.

However, whilst technology is important, we should not regard it in isolation of the people who play key roles in its successful implementation – without suitably trained and educated professionals, healthcare improvements would not be realised. Consequently, in this article, we consider technological and human factors.

What is health informatics?

HI is considered to be one of the fastest growing areas in healthcare, and it has exciting projects that seek to use IT in creative new ways. Categories of the HI professions have been suggested as[2]:

- **Clinical informatics (CI)**
- **Information & communication technology (ICT):** this is related to infrastructure[3]
- **Information management:** data retrieval, analysis, interpretation and presentation, enabling the planning and delivery of patient services and care[4]
- **Knowledge management:** the support of health professionals and management staff in their education, training and development and professional practice[5].

In this article, we only consider clinical informatics, which involves the acquisition, transmission and use of patient data and healthcare knowledge at the point of care and in the general support of care. Implicit in this is the effective application of electronic tools to deliver these ambitions. It also has indirect benefits, including, for instance, enabling clinical governance. CI is increasingly important in ensuring that the NHS provides dependable evidence-based high-quality care[6].

HI and day-to-day radiography

According to the government's Health Informatics Review (2008), by the end of June 2008, 640,764,000 medical images were captured, stored, displayed and distributed with 32,000 broadband connections being made[7]. The use of computer technology within medical imaging is therefore already at a high level, and is set to rise further. Coupled with increased use comes the requirement for a greater understanding by those who use it, thereby placing an obligation upon the radiography profession.

With this in mind, as noted previously by Oakley[8], our understanding and skill should be focused in four main areas: interfacing (making IT systems talk to each other); communication (transmission of information across boundaries); audit (analysis of departmental and individual performance); and research (acquiring valuable information to improve knowledge and outcomes).

◆ **Interfacing:** today, we expect digital communication systems to interface easily with each other – for instance, when we send a text message we expect it to get to the recipient quickly, and without any quality loss. For PACS-based data sharing, we are some way off having an ideal solution for the seamless transfer of medical images. Interface standards such as DICOM (digital imaging and communications in medicine), HL7 (health level 7) and XDSi (cross enterprise document sharing for imaging) are now becoming more and more critical to digital workflow.

To most clinical radiographers, these solutions that support the transfer of image data are of little importance, but for those who implement and manage PACS and other clinical radiology IT systems, there is a need to understand and influence these standards (and systems design) so that better use of the technology can be realised. Radiographers have important operational and strategic roles to play in PACS, from inception to decommission.

Whilst IT and software specialists are of fundamental importance when designing an electronic ordering system, a radiographer who understands how a request needs to come from A&E and the importance of the various steps taken is far more able to facilitate the process – therefore, involving end-users is essential. For the past decade, this has been well documented in the literature, most notably in the early 1990s when the notion of *dynamic systems development methods* was introduced in a widespread fashion for software creation and implementation[9,10].

The radiographers' input would be used in the formative and beta testing. As well as system design, one of the most important areas for radiographers to become involved is the implementation of the systems, so as to maximise the clinical benefits of new technologies – either in improving existing services or developing new ones. We would encourage clinical radiographers to become involved with implementing new IT systems because it really does give you a new view on how the department you are used to working in really works.

It is always better to be at the forefront of any change that will directly involve your working practice and this is why we argue for an increase in the visibility of HI within the radiographic profession. If the profession can be mobilised to further involve itself in IT-enabled change then the IT systems we will have to work with in the future will better suit our needs and those of our patients too.

To substantiate this argument, in a report on Digital Healthcare in 2006, The Royal Society made the following recommendation: '*healthcare professionals and their professional bodies must seek to be involved in the design, implementation and evaluation of healthcare ICTs*'[11].

◆ **Communication:** in our modern society, we rely extensively on digital communications in all walks of life, and the widespread use of internet technologies has made the transfer and sharing of data easy. One of the goals of Connecting for Heath (CfH) is to have all NHS institutions communicating digitally with each other; in the case of radiology, CfH will help organisations to transfer images and reports.

◆ **Audit:** this has become an essential part of clinical activity and can be used to monitor effectiveness of care and management, efficient use of resource, and whether standards of care have been met. The IT systems that are in use and the radiological data that is analysed has a direct effect on the outcome of an audit[12]. However, do remember that the information that can be analysed and extracted is only as good as the information that is inputted (the notion of 'garbage in-garbage out').

◆ **Research and evidence-based practice:** the ability to enhance our clinical understanding is crucial to the development of professional knowledge, and evidence-based care is a requirement of modern clinical practice – the evidence upon which practice is based can only come from having readily accessible sources of organised and validated information. Not surprisingly, clinical IT systems can provide comprehensive information and there is significant potential for highly sophisticated data mining of many sources, including patient records.

For the latter, data protection and security are paramount, and the need to comply with various regulatory requirements are essential. This can confound access to data and what can be done with the data, particularly when applied to educational and pure research purposes (eg, some policy and regulation can inhibit access and use to certain data types, thereby limiting the effectiveness of research and education). Presently, the details on how the NHS will allow greater accessibility to clinical data for educational and research purposes is not clear, but it is widely recognised that such access will have tremendous benefit to our patients and staff.

What challenges lie ahead?

In relation to our profession and HI, Oakley[13] in 2002, indicated that '*we live in exciting times*', with the caveat that '*we must be cautious of trying to achieve too much too quickly without the right experience and skills needed to lead this change*'. In 2006, the Society of Radiographers recognised[14] that there needed to be more emphasis placed on what might seem the *accessory IT* we use in our day-to-day routine, such as the radiology information system (RIS) or patient administration system (PAS).

At a recent CfH clinical engagement event, which was attended by many allied health professionals (AHPs), Yvonne Pettigrew[15], an occupational therapist, extolled the virtues of knowing more about IT and the wide ranging benefits that this knowledge can bring. Not surprisingly, we hope that the radiographic profession can be further mobilised to get further involved in HI and be given the support it requires from government to affect change, rather than be at the end of change that has been imposed.

continued overleaf

◆ **Education of radiographers within the HI arena:** there are both formative (undergraduate/pre-registration) and continuing education (CPD/post-registration) concerns here. Quite recently, the IM&T group published a document[16] that would help with both, by giving advice to university staff when planning the undergraduate curricula, and clinical managers and radiographic staff organising CPD needs.

For those radiographers wishing to develop their career to be more IT-focused, such as the PACS manager, there are a range of general university-based educational opportunities available but seemingly little that has direct value to the post per se. Maybe this is a limited educational market, which can adversely influence the availability of bespoke education and training. Should this prove to be the case, then maybe there is a need for PACS managers to lobby for more appropriate educational opportunities to be made available to them and their successors.

◆ **Taking our HI agenda forward:** the IM&T group aims to assist radiographers, managers, and education providers to embed IM&T into everyday practice[17]. Information on the work of this group can be found on *www.sor.org/members/imt/index.htm*, where there is a wealth of information directly related to radiography and IM&T. It is a good starting place to get involved in the subject area in easily-understood language.

In 2006, the SCoR released the document *Information Management and Technology: (IM&T) Implications for the Radiography Workforce*[18]. It recognises the need for radiographers to have a high profile in any NHS IT planning, and states that radiographers must lead the way in developing and maintaining skills and competences to ensure this technology is used appropriately. Also, that training standards should be agreed and implemented at all levels of the workforce. This document provides us with a good basis from which to build and we should consider using it when planning operational and strategic ways forwards.

We feel that there would be merit in reviewing the roles of PACS managers and radiology IT managers, to understand the similarities and differences that exist between seemingly similar roles at different clinical sites. This information could be used to provide advice on some of the expectations that would be required from people holding these positions. Currently, there is no nationally defined KSF for PACS manager/radiology IT manager/radiology information analyst, so there is very little in the way of a recognised structure to entice radiographers into this crucial area of career progression.

The CfH agenda seeks to provide PACS in every hospital in England (different countries are likely to have their own variation on this) and this has made the role of the PACS/RIS manager a crucial part of any x-ray/IT department's human resource. Clarifying their role and career pathway therefore becomes paramount.

Summary

NHS IT, in some shape or form, has been used for many years, but has recently entered into a fast-moving and rapidly-changing environment. The clinical IT systems used by the majority of our profession have immediate and longer benefits to our patients in terms of the care and management they are afforded. Radiographers, at all levels, should try where possible to engage with the development, testing and implementation of clinical IT systems that affect our work, so as to take a proactive and influential stance in their evolution and use.

In relation to the HI agenda, we acknowledge that radiographers, both pre-registration and qualified, have a wide-ranging knowledge and skill requirements and we would encourage university tutors and qualified radiographers alike to acknowledge and use the guidance recently compiled by the SCoR IM&T group.

Finally, we hope that the post of PACS manager will be more clearly defined in terms of progression (career structure) and in the requisite entry skill and knowledge that should be attained prior to appointment.

IN NEXT MONTH'S SYNERGY: Report on an Information Management & Technology by Cardiff University for the Society of Radiographers

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References for this article can be found under 'Synergy resources' at *http://www.sor.org/members/pubarchive/synergy.htm*

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Suggested reading

IM&T group pages and articles: *www.sor.org/members/imt/articles.htm*

CfH website for an overview of NHS IT: *www.connectingforhealth.nhs.uk/*

CfH AHP pages: *www.connectingforhealth.nhs.uk/engagement/clinical/ncls/ahp*

E-Health Insider, a useful resource for healthcare related IT news: *www.e-health-insider.com/*

UKCHIP, health informatics professionals' web resource: *www.ukchip.org/*

Data Protection Act: *www.ico.gov.uk/what_we_cover/data_protection.aspx*

Department of Health: *www.dh.gov.uk/en/index.htm*

How skilled

The third article in a series from the Society's IM&T committee reports on an audit designed to identify radiographers' knowledge and skills in this area. By Dr Shaaron Pratt, Hywel Rogers, Dr Tina Gambling and Dr Paul Brown.

Background

In the last decade, the scope of practice for radiographers has moved forward rapidly[1]. The Society and College of Radiographers (SCoR) has recognised radiographers' dependency on information management and technology to support practice[2], and PACS and digital acquisition technologies for projection radiography have become commonplace in radiotherapy and diagnostic imaging departments across the UK[3].

Requardt[4] suggested that the optimisation of healthcare workflow is dependent on the whole chain of events, from diagnosis to treatment, so optimum healthcare delivery is therefore focused on a service using the latest technology and capable of delivering high quality, patient centred care.

The SCoR commissioned Cardiff University to undertake an audit of the current information management and technology (IM&T) knowledge and skills of the radiography workforce. An online survey was completed by radiographers, academics, educators, and radiography managers, primarily employed in the NHS, the independent sector, or higher education in the UK. The aims of this survey were to:

- Identify radiographers' engagement in clinical systems, eg, radiotherapy planning systems, RIS, PACS, and computed verification systems;
- Identify radiographers' engagement in clinical support systems, eg, audit, governance, research and evidence based practice, electronic requests, prescribing, coding, and e-booking;
- Identify radiographers' engagement in general IM&T systems, eg, word processing, email and internet usage;
- Determine future IM&T needs and developments;
- Identify training needs and standards to be implemented at all levels of the workforce.

Method of the survey

The nature and aims of the audit suggested that a questionnaire was the most appropriate method of gaining the required information. After consideration of the constraints on resources (time, finance, researchers) and the informants to be targeted, it was concluded that an online questionnaire would keep distribution costs to a minimum while maximising engagement with the radiographic workforce. Additionally, using the Bristol Online Survey (BOS) as an electronic method of data collection facilitated the consideration and analysis of results. A postal questionnaire was made available on request.

One of the limitations of this research could be that the opinions from people having real difficulties with IM&T may have been missed because of the nature of the data collection process. In addition, while some conclusions can be drawn from informants' self-assessment of their ability and confidence, it must be recognised that individuals may be operating within the confines of their own level of ability and are unaware of the knowledge and skills that they could achieve in specific applications.

are you?

Findings

1443 people replied which, while not fully representative of the 19,250 (approximate) SCoR members at that time, was considered a high response rate when compared to other online surveys commissioned. This may be due to the emotive nature of the topic and the difficulties that informants are experiencing with the ongoing developments in IM&T. It is evident that IM&T is a topic which the radiographic workforce considers crucial, because 90% rated it as *important/very important* in the workplace, with no particular differences relating to age and band – there was engagement with IM&T across the board in a wide variety of applications.

The majority (70%) of informants rated their general ability and confidence as *fairly high*. Those respondents in higher bands considered themselves to have a higher aptitude for IM&T: on a scale of one to six, the vast majority of those at band 8 and above rated their ability at over four, significantly higher than those in other bands. Although there were no major differences with age, those under 40 years of age rated their ability higher than those over 40. Several informants commented that those in the 'older' age group had difficulties with IM&T, while those in younger age groups were more at ease and found applications easier.

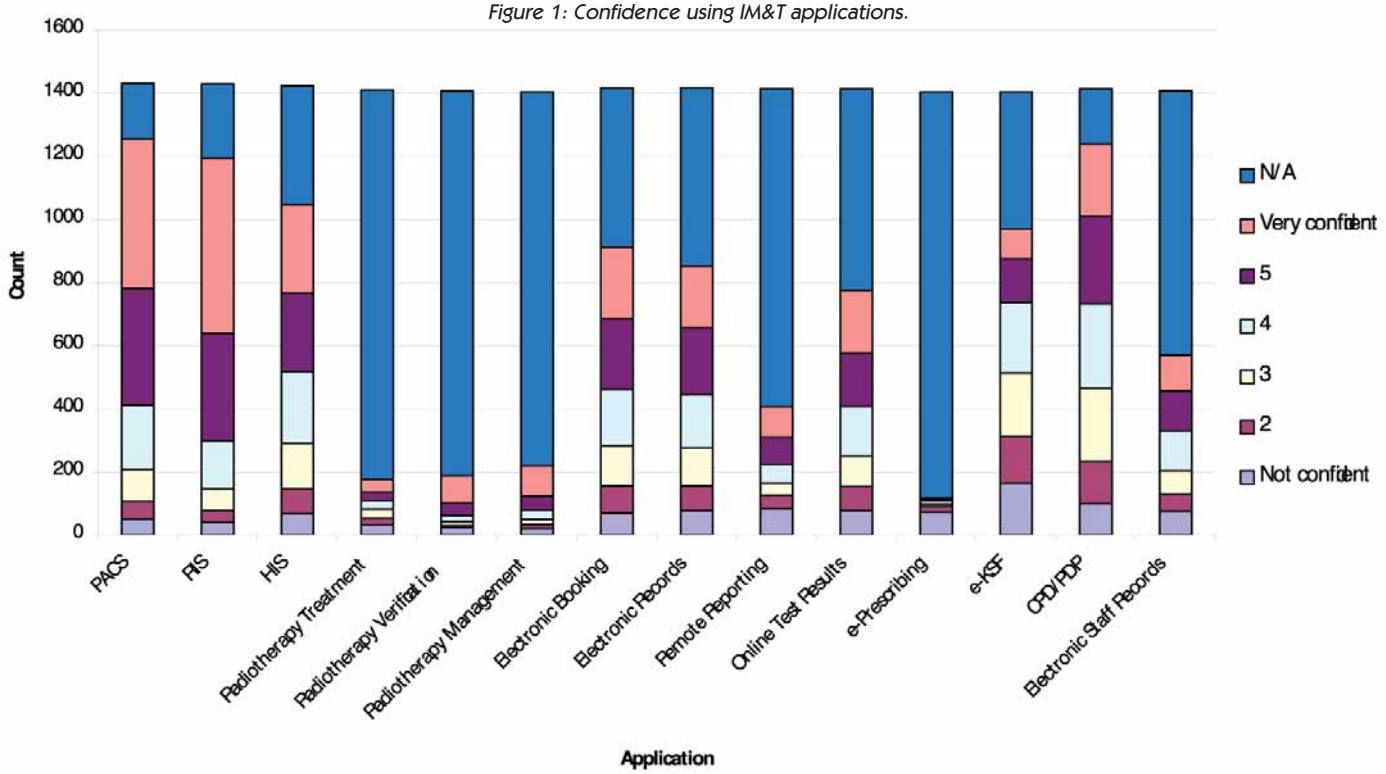
Across the age groups, most radiographers indicated that they were generally confident with IM&T. When looking at specific age groups versus confidence in using IM&T, a higher percentage of those in the 30-39 age group rated themselves as *confident* and *very confident*. As with aptitude, confidence also appeared to be dependent on Agenda for Change bandings, with those at band 8 or above showing greater confidence than those in the lower bandings. It is suggested that this confidence has developed from the level and degree of engagement, since those in higher bandings demonstrated greater usage than those in lower bandings. Additionally, those in higher bandings will be required to manage and solve problems associated with IM&T, may have responsibilities to train others, and are likely to have management responsibilities requiring greater engagement in audit and databases. Informants employed in the NHS showed greater confidence in clinical applications than those employed in independent/private sectors.

Email, internet, intranet and word processing were the most commonly used applications in the workplace. Others, such as Excel, databases, and PowerPoint, were used less frequently. When considering engagement in clinical applications, the most common applications for daily use were RIS, PACS and HIS. For radiotherapy applications, patient management record systems followed by radiotherapy treatment verification systems, were most widely used. The clinical systems that were used least frequently were virtual training systems and e-prescribing, which are relatively new applications and not yet utilised in every department.

When informants were asked about their confidence in using these clinical applications, they reported high confidence for applications that were used daily (eg, PACS, HIS, RIS, patient management record systems). Conversely, where applications were only rarely used, confidence was much lower, for example using electronic booking systems, electronic remote reporting, online test results and e-prescribing. See figure 1 for more detail.

Transmission of data within departments and Trusts was widespread. As expected, the restrictions of data protection meant that few had

Figure 1: Confidence using IM&T applications.



authorisation to transmit data further afield. It was surprising that few were engaged in the use of SMART cards despite the fact that more than 400,000 have been issued to NHS staff and students in England.

The number of informants using IM&T for CPD purposes on a regular basis was less than expected (63%). It was outside the remit of this study to determine whether this reflects engagement with CPD, IM&T, or both. This was an unexpected result because the majority of informants were members of the SCoR and therefore had access to **CPD Now**. Lack of confidence is unlikely to be the reason, because more than half (55%) expressed confidence in the use of IM&T for CPD.

Training was identified as the main barrier to the use of IM&T. One of the main themes that emerged from this study was the lack of accessible structured training. Indications were that this mainly related to staff being released from departments, and individuals' own clinical workloads and financing. Despite this, 334 informants did have a formal, nationally-recognised, qualification such as the European Computer Driving Licence (ECDL) and Computer Literacy and Information Technology (CLAiT).

The majority of informants (742) had not received any formal training in general IM&T applications and were primarily self-taught. When general IM&T training did take place, it was mostly at an introductory level and took place in a group which matched with the preferred format for this type of application. The other significant point to note is that when training did take place for clinical applications, it was mainly informal/ad hoc, except for HIS and RIS where informants had participated in small group or one-to-one training.

It appears from the findings that this kind of ad hoc training is appropriate for applications that are used on a daily basis as long as ongoing support and advice are available. However, for applications that are not used frequently, it seems that ad hoc training was not sufficient. Some informants did express a need for more high level training so that they could understand the systems more fully and would be able to troubleshoot problems arising.

The preferred method of training for most applications was one-to-one or group training. Specialist training was only requested by a small number of informants. In addition, remote learning was not rated as a popular method to learn, and the main barrier to training in IM&T was identified as time.

Conclusion and recommendations

IM&T is an evolving discipline in radiography, with the scope of practice ranging from general IM&T skills to in-depth knowledge of specialist clinical applications. Therefore, the workforce needs to be adaptable to change and IM&T skills need to be acquired and updated. In order to enhance the skills of the workforce and improve patient care, there needs to be more IM&T training. The recommendations from this study are that:

- IM&T skills for new graduates need to be identified, and these should be explicit within undergraduate curricula, at least to ECDL level.
- Educational placements offering IM&T experiences need to be identified for higher education students, with in-service education required for HIS, RIS and PACS.
- Further research is required to evaluate the efficacy of different types of training.
- More work and investment is needed to support a clinical and cultural change – it is acknowledged that radiographers require basic IM&T skills (at least the ECDL) but need to be encouraged to achieve at least a basic level of competence.
- The benefits to an organisation of staff training, education and qualifications in IM&T should be acknowledged and addressed, with adequate resources to ensure that radiographers are equipped with the necessary IM&T skills to ensure optimum service delivery and patient care.
- Further work is required to map IM&T competencies across bands and specialties and, where necessary, accredited courses developed.
- Key staff must understand how IM&T can benefit patient care in terms of efficiency, effectiveness and safety, and how to apply knowledge and skills within their area of expertise.
- In the future, advanced IM&T skills may need to be recognised as an area of role development/advanced practice.
- Clinical systems must be integrated more efficiently to enhance the flow of work, particularly as IM&T crosses different boundaries and there is a greater sharing of patient data.
- Extra training should be given to issues surrounding data protection.

About the Authors

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References for this article can be found under 'Synergy resources' at *http://www.sor.org/members/pubarchive/synergy.htm*

In next month's *Synergy*: the final article in the series, on achieving a virtually paperless department

Cutting the paper

The fourth and final article from the Society's IM&T committee demonstrates the key steps taken by one hospital in order to achieve a virtually paperless department, focusing particularly on the requesting (referrer) process. By Anant Patel and Peter Hogg.

Context and background

Many hospitals in the UK are virtually filmless, with most having a Picture Archiving Communication System (PACS). In spite of this, many hospitals continue to use paper-based request forms, so this article discusses how Homerton University Hospital approached the redesign of its processes to achieve an electronic approach to work flow.

This started in 2004 and it was anticipated that it would reach a level 4-6 electronic patient record (EPR) solution[1] by 2008 (figure 1). The radiology department is medium-sized, undertakes more than 100,000 examinations per annum, with modalities common to an average district general hospital: plain x-ray, CT, MR, US, fluoroscopy and mammography.

The procurement process started in January 2002, as a joint programme with Newham University Hospital Trust, to identify a common EPR solution which would allow both Trusts to achieve local and national targets. The programme's business case followed the Department of Health's Five Case Model[2], and the evaluation of suppliers was completed by December 2002.

The preferred supplier provided the majority of the required technical features, including: a patient administration system (PAS) used by administration and clerical (A&C) staff; a clinicians' module (Powerchart) for doctors/nurses/AHPs; an A&E module (Firstnet); a scheduling module used mostly by A&C and clinical staff; case note tracking for A&C staff; and RIS used by radiology staff. Most of these components 'talk' to each other, but there is not 100% seamless integration.

Some other systems (provided by different companies) had to be 'bolted on' to make the total system fit for purpose (eg, EPR with interfaces), including laboratory, PACS and GP messaging.

EPR Level	Name	Description
6	Advanced multi-media and telematics	Level 5 plus telemedicine, other multi-media applications (eg, PACS)
5	Specialty specific support	Level 4 plus special clinical modules, document imaging
4	Clinical knowledge and decision support	Level 3 plus electronic access to knowledge bases, embedded guidelines, rules, electronic alerts, expert system support
3	Clinical activity support	Level 2 plus **electronic clinical orders**, results reporting, prescribing, multi-professional care pathways
2	Integrated clinical diagnosis and treatment support	Level 1 plus integrated master patient index, departmental systems
1	Clinical administrative data	Patient administration and independent departmental systems

Figure 1: EPR Levels envisaged by Department of Health[1] in 1998.

Unfortunately, no relevant professional articles were found before the implementation work began and Anant's (lead radiographer) experience was limited to the hospital information system (HIS) that the Homerton was using. Whilst preparing this article, several presentations[3,4] on radiology ordercomms via the UK PACS & teleradiology group were noted (*www.pacsgroup.org.uk*). This group offers support through general discussion forums where members can post questions, and with more than 2800 members, someone may be able to offer advice.

Anant joined another support group via *www.cerner.com* (a user forum for the preferred provider) and he has been able to submit and answer questions through the online forums. Some years on, Anant still believes that there is not much literature available.

The building of the RIS for ordercomms involved a number of stages before going live with the system, details of which are given below.

1. Preparation

◆ **Engagement (communication):** support was provided by the preferred provider's solutions architect, as well as anyone from the two Trusts who was willing to assist. The staff who helped with the design/redesign and change management were identified whilst mapping the flows, and included: referring clinicians (medical and non-medical); radiologists; radiographers; helpers (particularly in ultrasound departments); A&C staff (receptionists, secretaries, and filing room staff); project managers; departmental managers; and the EPR programme team.

Design decisions were made with these professionals, so when questions arose with the system testers and during staff training, there were documented explanations as to why and how decisions had been made in

chain

relation to system functionality.

◆ **Mapping processes:** initially, the current flows of the department were mapped (figure 2), during which process it became apparent that users of the system felt engaged – in change management terms, such engagement can help with acceptance of change; in systems design and redesign, it can help with the system specification being more acceptable to users' needs.

This user engagement did not just involve managers and section leads, it also took into account staff at all levels. Junior staff opinion was considered important, not least because managerial staff did not know important informal variations that were commonplace in routine practice. This process highlighted interesting practice variations – for instance, some processes were not being followed in all sections of the departments. Hence the electronic vetting that was built as a result had flexibility built into it.

◆ **Organising order entry formats (OEF):** it became apparent that having different OEFs for each modality was important, because some may not need as many inputs as others (figure 3 overleaf shows examples of the areas that could be covered). The OEFs could be customised not only to the modality and type of examination but also to who was going to be entering the data, ie, a non clinical or clinical member of staff. Defining the OEFs

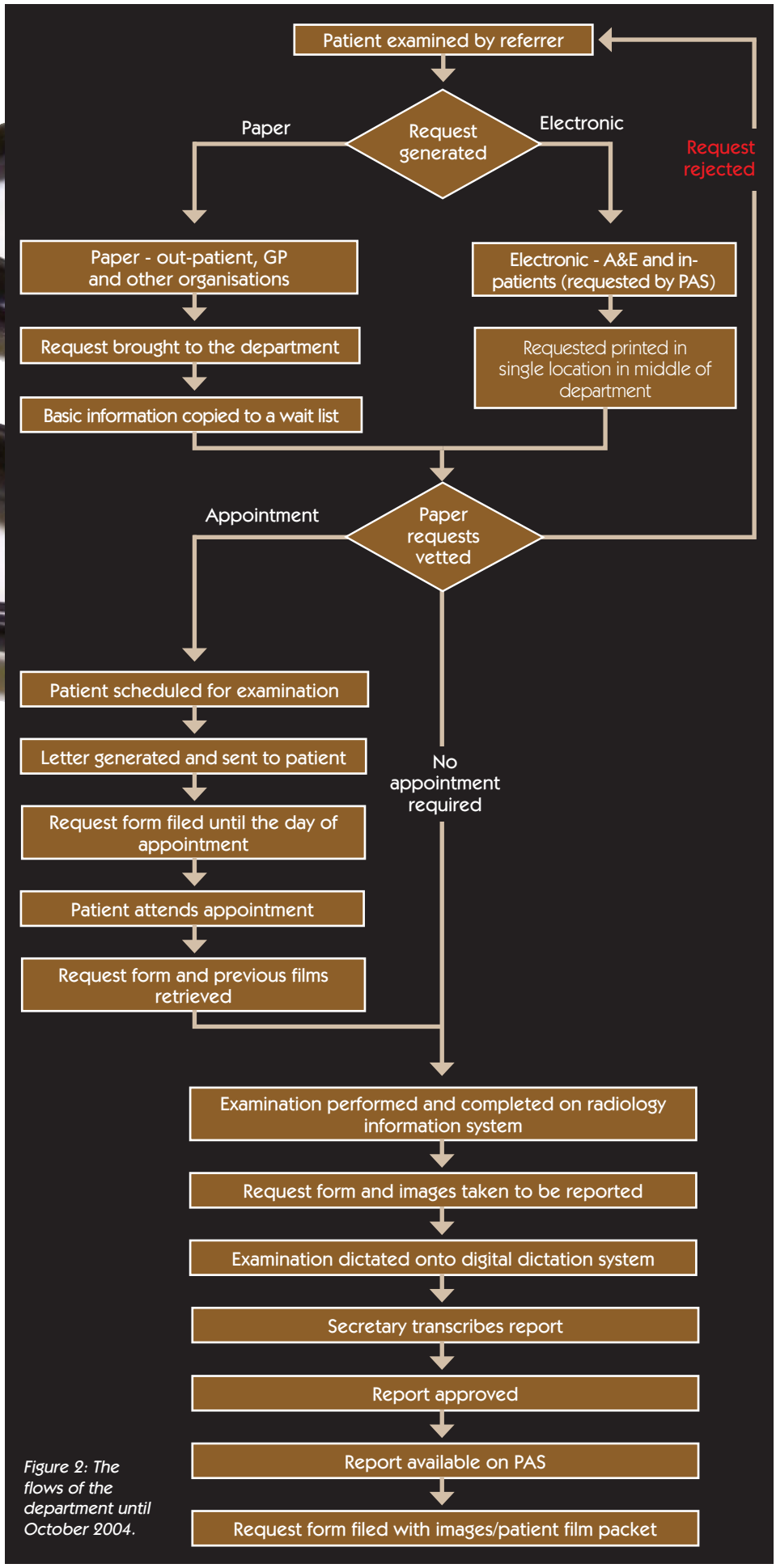


Figure 2: The flows of the department until October 2004.

involved close liaison with modality and radiology leads in order to minimise omissions. The radiology departments would have preferred all OEF fields to be mandatory, but a compromise had to be made, so as not to slow down the referrers. Certain questions are more relevant to the inpatient setting, ie, did the patient have IV access; were they on oxygen; did they need isolation precautions to be followed? Hence, these questions could be mandatory for the in-patient category of patients and optional for GP/outpatients.

The priority field again was a compromise because requesting clinicians prefer to put a status as 'urgent' rather than 'routine'. Those vetting the requests were reliant on the reason for exam/clinical information as being the main criteria when deciding what priority was given, so the priority field was ignored. Referrers were allowed to suggest their own status fields which were urgent, routine and so on, because practice to date has indicated that radiology staff vetting requests would assign priority. A field that would have been useful, in retrospect, would be 'cancer referral', which has not been added to the system yet.

A predefined list of reasons for examinations was created as a drop down list, with some having up to 60 options. This was considered to be too many, so a top 10 was selected. Interestingly, four years after the 'go live', this option is ignored by all referrers, ie, they enter the information as free text. The inclusion of this feature is therefore questionable.

Two issues have occurred with OEF:

❖ Free text answers, where it is possible to put a few characters which may not mean anything to radiology. We suggest rejecting these requests and asking the referrer to re-request.

❖ Referrers putting the wrong information into the system. The only solution here is to report the matter as a clinical incident, if necessary, and to inform users/referrers of the consequences when they undertook their training. This included explanation that radiology requests are basically prescriptions of a dose of ionising radiation to a patient and that the information needs to be accurate or medico-legal action could be taken against the referrer.

The radiology OEF was different to the pathology OEF in that the latter had all the mandatory questions positioned at the top, in bold, to speed up data entry. Radiology had the mandatory questions (again in bold) dispersed between the optional questions (regular text) because it was felt that if the clinicians only had to enter data into the fields at the top (similar to pathology) in order to save time, they might ignore the optional fields that were below that could help radiology. In general, this method of not having the mandatory fields at the top was considered to be effective.

Rules for examination duplicate checking were included. If a CT brain examination had been requested within three months of another CT brain, the requestor would be alerted. However, if a CT brain <+contrast> was requested, the alert would not flag a recent CT brain (without contrast being requested) as an exact match (CT brain=CT brain). We suggested that the checks were set up from groups of similar exams (all types of CT heads) so the alerts would be more effective.

Field	Input
Requested date/time	Required
Order for future visit	Do not display
Reason for exam	Required
Additional clinical information (justification)	Required
Mode of transport	Required
Priority	Required
Pregnant y/n (12-55yr)	Optional
LMP	Optional
Isolation precautions	Optional
Patient has IV	Optional
Patient on oxygen	Optional
Patient fasting	Optional
Patient has diabetes?	Required
Weight	Required
Height	Optional
Sedation required	Required
Consulting physician	Optional
Bleep/ext number	Optional
Cardiac pacemaker?	Required
Aneurysm clips?	Required
Electronic, mechanical or magnetic implants?	Required
Metal fragment(s) in the eyes?	Required
Artificial heart valves?	Required
Metal implants, plates or clips?	Required
Shrapnel injury?	Required
Recent surgery in the past two months?	Required
In the first trimester of pregnancy?	Required
Breast feeding (discuss with radiologist)	Required
Kidney failure (discuss with radiologist)	Required
Unable to lie flat and/or still for 30 minutes	Required (discuss with radiologist)

Figure 3: Examples of questions that could be asked and the response (input) options.

2. Future flow

The data collection exercise related to the old/current processes (figure 2) had to be completed in order to make decisions as to how we could redesign for the 'future flows' (figure 4). These were built to incorporate

vetting for all exams, so before the system went live these new flows had to be explained during training. This was the first time that the majority of staff were exposed to the new system, because the proof of concept demonstrations were usually only attended by managers.

◆ **Proof of concept design for all flows and design decisions:** 10% of the examinations (spread over all modalities) were built at the beginning of the system construction following the future flow (figure 4) to enable the users/stakeholders to comment. These were documented and necessary changes were made as required. Comments that arose included points like '*how are we were going to replace consent and LMP forms or anything else that required a patient's signature*'. There was no solution to this at the time, because the Trust did not want to scan anything into the system, so we continue to use paper for these activities.

Having the future flows signed off after the proof of concept demonstration acts as a contract between the designer and the staff that will be using or be responsible for the system.

3. Replacing paper

The Trust agreed to put a PC in every radiology area where a member of staff may need to input or read information. This was performed before the 'go live', so all the examination rooms and viewing areas had to have network points with PCs. Laptops on a trolley, with wireless networking, could also be used. Invariably, we have found that there are times when there are not enough PCs, but if there seems to be frequent queuing, it is sensible to add another close by.

Referrers who have received EPR training were able to use the system without issues, but locums who were not trained would not have a username and password. Minor logistical matters for this category of staff were addressed by clinical site managers issuing a temporary username/password. It was found that referring clinicians did not need to rely on sending requests via an internal postal system, their secretary or with the patient – as soon as the request is electronically signed it is accessible to radiology. The referring clinicians can also track the progress of the request, from whether it has been scheduled to whether the images and report are available on PACS.

It might be worth noting that if there is ever an incident, a full audit trail from

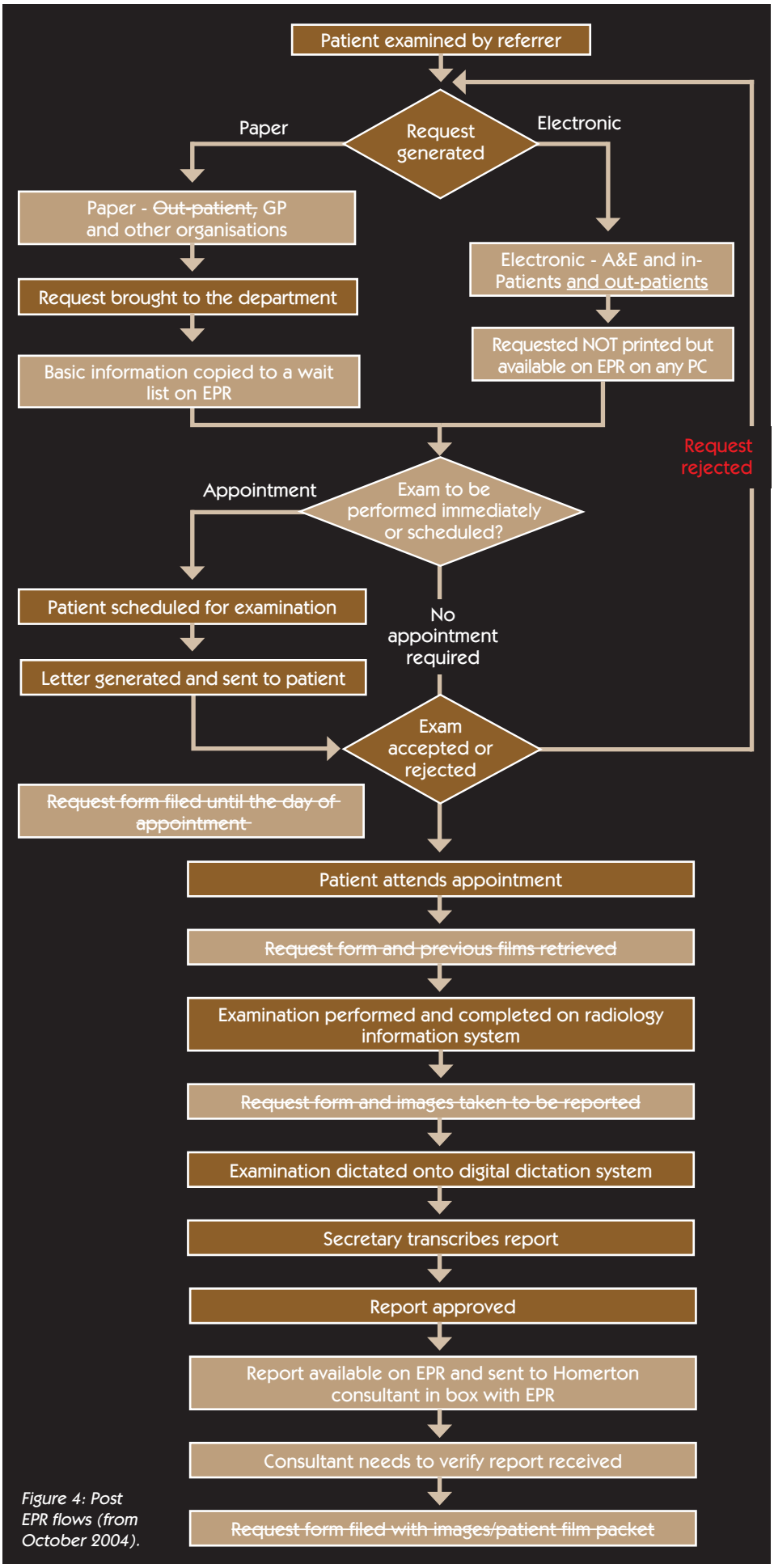
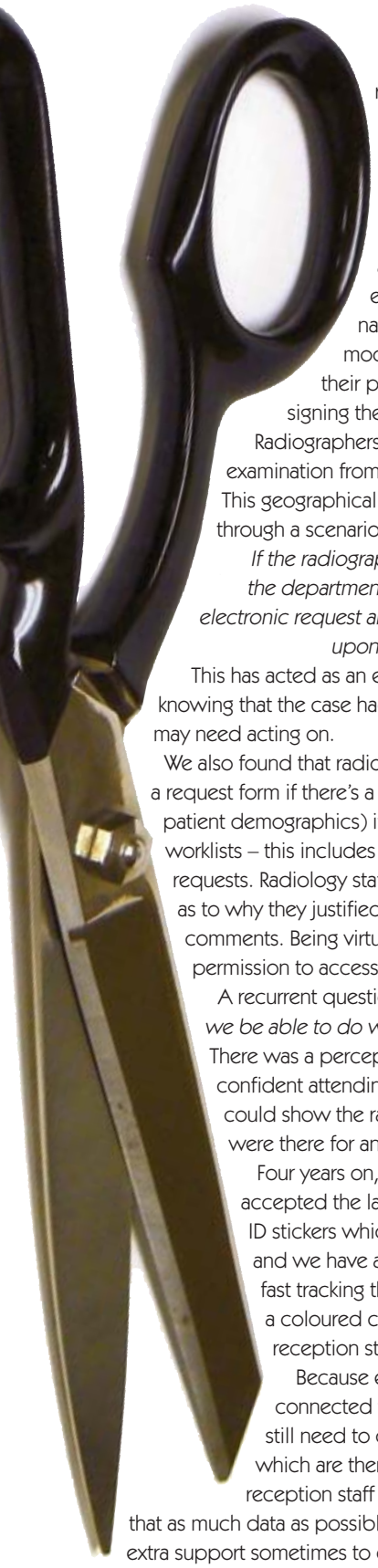


Figure 4: Post EPR flows (from October 2004).



referral to results/report would be available – ie, the staff involved and the actions they performed, along with date time stamps. Initially, in A&E, some doctors would not log off their EPR module (Firstnet) and another person could request examinations under someone else's name, so a rule was built into the module that required a doctor to re-input their password prior to electronically signing their request.

Radiographers can vet (and accept/justify) an examination from wherever there is a networked PC. This geographical independence can be demonstrated through a scenario:

If the radiographer was bleeped whilst away from the department, whilst on call, they could view the electronic request and justify it electronically from a ward upon the relevant worklist.

This has acted as an excellent way of anyone in radiology knowing that the case had been discussed and vetted, and may need acting on.

We also found that radiology staff no longer have to find a request form if there's a query, they can look it up (using patient demographics) if it hasn't already populated their worklists – this includes future/cancelled and duplicate requests. Radiology staff can also add their own comments as to why they justified the request and any other comments. Being virtually paperless allows staff with permission to access any of the patient's data.

A recurrent question keeps coming round: *when will we be able to do without the patient's request form?* There was a perception that, initially, patients felt more confident attending radiology with something that they could show the radiology staff, as validation that they were there for an examination.

Four years on, we feel that patients seem to have accepted the lack of paper. A&E and patients have ID stickers which help speed up their checking in, and we have also found that if a patient needs fast tracking then we simply issue them with a coloured card, so as to alert the radiology reception staff.

Because external referrers such as GPs are not connected to the EPR from their surgeries, they still need to complete paper forms, the details of which are then entered into the EPR by radiology reception staff rather than being scanned to ensure that as much data as possible is entered. The A&C staff did need extra support sometimes to decipher a doctor's handwriting or help with clarification of certain terms. GPs have not been affected because they have continued as before.

Consent and LMP forms still need to be signed and retained in records. There have not been any issues with this record keeping process so there are no plans to scan these in. However, these would be the last two steps to be resolved in order to be totally paperless in radiology rather than 'virtually paperless'. We generate paper request forms for external referrals, eg, DEXA and nuclear medicine, because we do not have these modalities at the Homerton. Labels are still generated due to a local issue of lack of desktop integration between the Cerner EPR and Sectra PACS. The lesson learnt from adding systems at a later date is to ensure that the Trust stipulates exactly what is expected of the new system and the timescales by which they need to be achieved.

On reflection, Anant felt this was probably one of the main lessons he learnt from this project, and is purely defensive. From the beginning of the project he:

- Kept all documents and was able to access them quickly;
- Kept all emails (received and sent) and organised these into folders for quick access. Having proof that he did consult the users of the system, via email, was crucial;
- Ensured that any issues were logged, so project managers were aware of any issues, no matter how small. There were more than 600 items recorded on the issues log, with a significant number still open by 'go live', hence the need for documenting them and recording their status, in case questions were asked;
- Would follow up verbal agreements with anyone by email.

Conclusion and summary

An almost paperless radiology flow was achieved. The initial engagement and mapping of the current flows were achieved at the same time and this developed good relationships that would help with the future flows and design decisions. All the design decisions and agreements were documented in case of questions at a later stage.

When developing the future flows, it was important to have it all signed off by the staff who were going to be affected at the proof of concept stage, so acting as a contract between Anant, who was developing the system, and those who would have to test, train and eventually use the system.

The OEF was probably the most crucial part of the inputs required for achieving the paperless state. Because all the details entered by the referrers were done so electronically with mandatory fields, in theory, nothing could be missed, unless it was entered as free text or the referrer put false information onto the system or the question had not been asked initially. Currently, we would recommend the entering of data be specifically mentioned in user training and logged as incidents where necessary.

Hopefully, this article is useful to any radiology departments that are considering replacing their current paper systems.

About the Authors

Anant Patel is a lead radiographer at Homerton Hospital NHS Trust.

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References for this article can be found under 'Synergy resources' at *http://www.sor.org/members/pubarchive/synergy.htm*

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To comment on any of the articles, please write to Rachel Deeson at *racheld@synergymagazine.co.uk*