DEVELOPING PRACTICE IN RADIOGRAPHY AND DIAGNOSTIC IMAGING

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Contents

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ABSTRACT

An increase in the range and capability of imaging modalities has resulted in greater demands for radiology services. This research investigates how these changes have affected role requirements and role extensions of radiographers and the consequent implications for the educational needs of radiographers.

Semi-structured interviews and three successive surveys of NHS radiography managers showed that the adoption and diffusion of extended roles in radiography had increased significantly over a ten year period. Role changes included additions both to the procedures carried out by radiographers, and to the reporting of procedures, e.g. film reporting, once the domain of radiologists, is now undertaken by radiographers in many trusts.

Imaging managers' views on the factors that encouraged or deterred the introduction of extended roles were explored. While many radiographers were keen to adopt new roles, implementation was unlikely without radiological support. Respondents believed the proposed 'four-tier structure' would help overcome staffing difficulties, while providing an improved career framework to advance the professional status of radiographers. A key theme was the need for greater clinical knowledge to facilitate transition to advanced practice.

Three studies investigated radiography education. The first used a survey to investigate the preparedness for practice of three cohorts of newly qualified radiographers. Graduates recognised the importance of continuing professional development with extended role skills identified as a priority. The second study examined the relationship between contemporary practice and UK undergraduate radiography curricula. Most programmes had responded positively to developing technology. The third study used a survey to investigate the training for extended roles provided by employers. While most provided some training, much was unaccredited, and there was considerable variation in the duration of training for similar roles.

The research has documented developments taking place at a time of enormous technological innovation. It provides key data on the changing practice of radiography that will be useful to all stakeholders planning improvements to radiography services. The data lead to a re-definition of practice and recommendations for supporting education and training.

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Thank you to my longsuffering family, and, particularly, Janet my wife, for her 'understanding'. I will be able to spend weekends catching up on those many tasks both inside and outside that have been 'delayed'.

Dr. Leslie Mitchell, you were an inspiration but probably did not realise.

The end is one thing but a quotation from the discoverer of X rays sums up the process of discovery:

> *It is very agreeable to have a broad knowledge, and it is sometimes useful, but after all it is only activity that brings real satisfaction.*
>
> *Wilhelm Conrad Röntgen 1845 - 1923*

Glossary

Amniocentesis - a test that is carried out during pregnancy to check on the baby's progress in the uterus.

Angiogram - also called an arteriogram is an x-ray image examination of the arterial system using a contrast medium.

Barium meal - an x-ray examination of the stomach and small intestine using barium sulphate.

Barium swallow - an x-ray examination of the oesophagus using barium sulphate.

Barium enema - an x-ray examination of the large intestine using barium sulphate.

Colonoscopy - an examination of the colon by means of an endoscope.

Bronchogram – an x-ray examination of the bronchial tree made after the introduction of a contrast agent.

Computed radiography (CR) – a process that uses an electro sensitive imaging plate instead of a photographc film and intensifying screens. The exposed imaging plate is scanned by a laser. Image processing software is used to optimise the image.

Computed tomography (CT) – a process that uses X-rays to generate cross-sectional, two-dimensional images of the body. Images are acquired by a rapid 360° rotation of the x-ray tube around the patient.

Cystogram - is an x-ray examination of the urinary bladder using a contrast agent.

Dacrocystography – an x-ray examination examination of the lacrimal system using contrast medium.

Diploma of the College of Radiographers (DCR) - the radiographic qualification recognised by the regulatory body before the introduction of degrees.

Dual energy x-ray absorpiometry (DEXA) - an x-ray technique to measure the density of bones and mainly used in the diagnosis of osteoporosis.

Endoscopic retrograde cholangiopancreatography (ERCP) - an x-ray examination of the bile ducts. An endoscope is introduced into the duodenum from where contrast media can be injected into the biliary tree and pancreas.

Hysterosalpingogram (HSG) - an x-ray examination of the uterus and fallopian tubes using a contrast medium.

Intravenous pyelography/urography) (IVU/IVP) - an x-ray examination of the kidneys, ureters and bladder using a contrast medium.

Mammography – an x-ray examination of the breast using low energy X-rays.

Micturating cysto-urethrography (MCUG) - an examination of the bladder and urethra using a contrast medium.

Magnetic resonance imaging (MRI) – an imaging process that uses magnetic and radio waves.

Picture archiving and communications systems (PACS) – a system that allows images to be stored electronically and to be transferred for viewing at sites remote from the image archive.

PICC line - peripherally inserted central catheter.

Plain film - a radiograph made without the use of a contrast medium.

Proctogram - an x-ray examination used to view rectal function by means of a contrast agent.

Nuclear medicine (NM) / radionuclide imaging (RNI) - diagnostic examinations of anatomy and function where radiation emission is detected following the administration of a radioactive isotope to the body.

Red dot system – a red dot placed on a radiograph by a radiographer to indicate an abnormality.

Reporting – the interpretation of information contained within an image which is normally presented in a written report.

Urogram - a radiograph of the urinary tract.

Ultrasound imaging – examinations where parts of the body are exposed to high frequency sound. Echoes are detected which are used to build up an image.

Venography - is an x-ray examination of the venous system using a contrast medium.

CHAPTER 1

RATIONALE, PURPOSE AND LITERATURE REVIEW

1.1 Purpose of the research

The overall aim of the research was to investigate the consequences of technology diffusion, intended and unintended, as they impacted upon radiographic practice.

The more specific aims were to:

1. Review and evaluate the impact of new technology on radiography and imaging practice and roles.
2. Propose a framework for education and training to support role requirements at pre- and post-registration levels, based on empirical findings of current practice.

The research involved the mapping, analysis and evaluation of extended role developments and education and training to support role requirements at pre- and post-registration levels. Specifically, the objectives of the research were to:

1. Investigate the drivers for change;
2 Identify technologies which will have a continuing impact on radiographic practice;
3. Consider how the integration of technology into work practices can be facilitated;
4. Identify and evaluate any practice shifts in diagnostic radiography;
5. Analyse practice skills and activities in order to define professional and/or sub professional roles in imaging practice;
6. Investigate education provision and propose educational and training strategies to support developing or new roles.

1.1.2 Statement of the researcher's interest in developing practice in radiography

The researcher has been interested in developing practice and education developments in diagnostic radiography for a period of over 25 years. It was when he was elected to the Council of the Society and College of Radiographers in 1984 that the interest blossomed. Through his work on the Council and its various committees he was able to play a part in policy making and its implementation. Over the period of eight years as a Council member he took a leading role in educational matters and was Chair of the Education Committee from 1986 until 1989, when he became President of the Society and College of Radiographers. During this period he played

a key role in the transition from the Society's qualifying Diploma to degree based education. This period was an exciting one with numerous discussions taking place within the profession as many radiographers were not convinced of the need to move to a degree education. However, once the profession had decided to embrace higher education there followed a period of negotiations with a number of organisations: the Department of Health, regional health authorities, the Council for National Academic Awards and Higher Education Institutions. There was much to consider regarding the arrangements for the transfer of courses from largely hospital-based schools to the higher education sector. The first degree course was approved during the researcher's year of office as President.

Outside of Council activities the researcher was the Director of Radiography at a higher education college in north-west England and responsible for developing the degree in radiography there. The move to a degree based educational route brought a freedom to develop curricula which had not existed with the centrally-controlled syllabus of the College of Radiographers. Following the validation of the degree an opportunity arose to move to become the Head of a larger Department at the Hatfield Polytechnic, which soon became the University of Hertfordshire in 1992. The University had been successful in tendering for a new radiography programme from the then North West Thames Regional Health Authority. In the new post as Head of Department, with a new team of lecturers there was a second opportunity to develop a degree curriculum.

The education developments at the start of the 1990s coincided with a period of rapid change and innovation in imaging with the adoption and diffusion of many new technologies. Radiographers were required to adopt the new technologies and techniques and it was important that the new curricula reflected the changes in technology. However, the research base within the profession of radiography was not well developed and the impact of technology and the requirements for education and training content at pre- and post-registration levels were unclear.

The impact of new technology was also having a major impact on the role of radiologists. The development of interventional radiology was drawing radiologists away from their traditional roles. There was already a shortage of radiologists and the adoption of new technologies further exacerbated the position. There were suggestions that the role of radiographers could be developed to undertake some of the tasks previously undertaken by radiologists. In the preliminary work undertaken to support the thesis research, it was evident that the development of technology was beginning to have a major impact on the capacity and capability of imaging. If there was to be a shift in radiographic practice there were questions as to the adequacy of

education and training to support new roles. In order to investigate these matters, the researcher deliberately chose a research programme that went for breadth rather than depth, using a variety of methods. This decision was guided by the preliminary work on the wide implications of the adoption and diffusion of new technologies. In order to get an understanding of the changes taking place it was necessary to focus the literature review on the radiography and radiology literature. However, this was not entirely to the exclusion of other work, as it was important to get a picture of changes in other health disciplines in the UK and overseas on relevant matters of organisational change. A research programme that covered breadth in term of role development and education at pre-and post- registration levels of developments was considered important in order to capture the extent of the impact of new technologies. In this respect the thesis represents a foundation study from which other work can develop.

Although the researcher no longer serves on the Council of the Society of Radiographers, he has continued to work with the Professional Body. He was a member and past Chair of the Joint Validation Committee of the College of Radiographers and the former Regulatory Body, the Council for Professions Supplementary to Medicine until this was discontinued in 2003 when the Health Professions Council came fully into operation. He now serves on a new body, the Approvals and Accreditation Board of the College of Radiographers.

With regard to the changing role requirements for radiographers the researcher was a founder member and first Chair of the multiprofessional Special Interest Group in Radiographic Reporting which was established in the 1990s to provide a network support of radiographers developing new skills.

Before embarking on the programme of research the researcher had developed a deep insight into professional developments in radiography and was himself involved with decision making Bodies as well as heading a Department in a Higher Education Institution. His background therefore provided a good base from which to pursue his interests in role development and education to support new roles.

1.2. The programme of research

The research focused on two key areas. The first area was the impact of technology on roles and skills and comprised three studies. The first study was a preliminary investigation of the impact of technology on changing work practices and skill requirements of radiographers. This involved data collection and analysis of interviews with radiologists, radiography managers and manufacturers of imaging equipment. This is reported in Chapter 2.

The second study investigated the extent to which new roles were being adopted by radiographers and was comprised of three cross sectional investigations in which UK imaging departments were surveyed over a period of six years. The surveys provided data on the nature and scope of the roles being undertaken with the first survey providing the base line from which to map the rate of adoption and diffusion of extended roles. The third survey additionally sought information on the implementation of the 'four tier structure', a model of practice proposed to organise the workforce to better cope with the demands of the service. Surveys 1 and 2 are reported in Chapter 3 and survey 3 is reported in Chapter 5.

The third study followed up a number of imaging managers who had participated in the Survey 2, and was undertaken before Survey 3. Interviews were used to explore factors that encouraged or resisted the introduction of extended roles. This study is reported in Chapter 4.

The second research area focused on the extent to which education and training was developing practice. The research comprised three studies. Study 1 was a cross sectional study that investigated the preparedness for practice of three successive cohorts of newly qualified radiographers. Study 2 examined the relationship between contemporary practice and undergraduate radiography curricula across the UK, Study 3 considered the type and nature of training provided by employers for radiographers in preparation for new roles. These studies are presented in Chapter 6.

The conclusions of the research and recommendations for education, practice and future research are presented in Chapter 7.

A list of outcomes related to the area of research is appended (Appendix 1).

1.3 The Impact of technology on radiology practice

Diagnostic imaging has been subject to powerful forces for change since the late 1970s when the advent of the computer and image processing enabled the capacity of imaging to increase significantly (Welsh Health Planning Forum 1995). In particular, computed tomography (CT), magnetic resonance imaging (MRI), digital radiography and the growth of ultrasound have been at the forefront of technological innovation.

The overall growth in examinations from 1995 to 2004 can be seen from the Department of Health's (2004 a) own statistics for imaging in England, which are presented in Table 1.1. It can be seen that overall there was a 17% increase in activities from 1995[1] to 2000.

[1] 1995 was the first year in which the Department published information in this format.

Table 1.1 Total number of imaging examinations 1995-2004

(Source Department of Health)

Year	X-Rays	CT	MRI	Ultra-sound	Radio-isotopes	Fluoro-scopy	Total
1995-96	18,503,844	1,709,244	347,817	4,031,292	467,916	1,077,914	26,138,027
1996-97	19,167,629	1,056,365	394,940	4,456,816	506,412	1,232,795	26,814,957
1997-98	19,474,590	1,172,656	473,074	4,790,532	722,096	1,179,979	27,812,927
1998-99	19,876,933	1,254,474	522,138	5,018,434	699,654	1,244,632	28,616,265
1999-00	19,967,296	1,359,852	585,797	5,255,330	727,255	1,256,965	29,152,499
2000-01	19,913,022	1,488,752	632,594	5,382,582	539,141	1,253,847	29,209,938
2001-02	19,806,876	1,625,304	705,706	5,571,979	537,653	1,222,296	29,469,814
2002-03	19,512,924	1,767,791	786,646	5,635,358	551,423	1,295,639	29,549,781
2003-04	20,056,669	1,992,826	857,550	5,937,383	582,742	1,221,102	30,648,272
% change	8	17	147	47	25	13	17

In parallel to the technological revolution there were important changes to the National Health Service (NHS) in the early 1990s, stimulated by the Government's White Paper *'Working for Patients'* (Department of Health 1989). The White Paper proposed a number of initiatives to make the health service more responsive to patient need to devolve responsibility to local level and allow hospitals to apply for self governing or trust status. A key purpose was the reform of NHS management along business lines which would in turn provide better value for money.

As part of the Department of Health's research and development strategy, the publication 'Assessing the Effects of Health Technologies', (1992), was also concerned in achieving better value for money, defined 'health technologies' as:

> ".....all the methods used by health professionals to promote health, to prevent and treat disease to improve rehabilitation and long term care. These methods include 'hardware' such as syringes, medicines and high technology diagnostic imaging equipment; 'software' such as health evaluation, diagnostic and therapeutic policies; as well as the skills and time of people working in the health services."
>
> Department of Health 1992:8

In the USA many of the 'hardware' developments in imaging had been adopted widely and had been discussed by Viamonte (1985) and Seago (1987) before they became prevalent in the UK. Whalen (1992), also from a North American perspective, described dramatic changes in imaging that had occurred in less than ten years which included MRI and MR fast-scanning techniques, spiral CT with three dimensional colour acquisition, Doppler sonography, videoscopic surgical techniques and

interventional techniques such as portacaval shunts. But it was Barneveld Binkhuysen (1992), coming from a Western European perspective, who, unlike the previous authors, predicted the continuing expansion of imaging technology with far reaching effects on role requirements. The 'hardware' expansion and consequential increased capacity of imaging techniques had already resulted in a greater demand for the service and had inevitably put added strain on the 'software' aspects and in particular on the radiological resource, i.e. the number of radiologists available. Brindle as long ago as 1986 noted that the funding for radiologist posts would nearly always fall short and Craig (1989) argued the case for more funding for consultant posts. Rose and Gallivan (1991) claimed that: "it would take an increase of 71% in the radiological staffing level, i.e. about 900 radiologists, to achieve the 3.6 radiologists per 100 000 population recommended by the Royal College of Radiologists."

Although between 1970 and 1990 radiologist numbers doubled, their workload trebled, according to the Royal College of Radiologists (RCR 1993). The rapid increase of time-consuming interventional radiology procedures were estimated to account for between a fifth and a third of radiologist time. Many radiology departments reported a 5% annual increase in their activity (Audit Commission 1995) without the same increase in radiologists. In the same period, however, the workforce situation for diagnostic radiography was quite different, in the early 1990s there had been an oversupply of qualified radiographers (Price 1991) and the projected target for entrants into diagnostic radiography set previously by the Manpower Planning Advisory Group (1988) was exceeded. At that time the number of available radiographers, unlike that of radiologists, was sufficient to supply the required workforce needs.

What is certain however is that there will be continuing pressure to meet the demands on the service which is evident from the continuing increase in the number of imaging examinations undertaken each year. As far as expenditure was concerned in 2001/01 the NHS in England spent £830 million in providing radiology services (Audit Commission, 2002). This would have been greater if the number of CT and MRI scanners in the UK per million of the population had not been less than most European countries and the USA, (Wanless Interim Report, 2001); apart from increased expenditure it would have put additional pressure on the workforce. Compared to the European Union average the UK had just over 5 CT scanners per million population and 4 MRI scanners as opposed to 16 and 6 respectively. This number, however, will increase; the Royal College of Radiologists (2000) identified funding for 50 new MR scanners based on the national cancer plan requirements which were over and above those funded by the National Lottery New Opportunities

Fund. Increasing pressures from technological diffusion coupled with constant Government reforms are drivers for change that cannot be ignored.

It was the combination of developing technologies and NHS reforms that were influencing the division of labour; traditional boundaries between some professional groups within healthcare were beginning to blur (Greenhalgh 1993). As Binkhuysen (1992) had predicted the continuing expansion of imaging technology would not only impact on the roles of radiologists but it could also provide much potential for radiographer role development and extension. Therefore it would not only be the interface between the 'hardware' and the 'software', i.e. the interaction between practitioners and equipment that would be critical but also the interface and the division of labour between radiographers and radiologists. The context and background of the technology developments in imaging provided the impetus for the research.

1.4 The context of diagnostic radiography and imaging

Diagnostic imaging has predominantly been the province of two groups of workers, radiographers and radiologists. Diagnostic radiographers are health professionals who employ a range of sophisticated equipment to produce high quality images to diagnose an injury or disease. Radiographers have to be registered with the regulatory Body, the Health Professions Council (HPC) to practise in the United Kingdom. Radiologists are registered medical practitioners with the General Medical Council and use imaging to diagnose, treat and monitor various disease processes.

Following the discovery of X Rays by Röntgen in 1895 there was much interest in the application of the 'new rays' in diagnosing and treating disease. Non-medical and medical workers were soon to engage with the new technology and initially there were no boundaries or lines of demarcation separating the work of the practitioners (Larkin, 1983). This was soon to change and the role of non-medical radiographers was challenged by the medical-radiographers who were later to become radiologists. The role boundary between the professions was established in 1924 after much discussion and bitter argument (Larkin, ibid; Price 2001). The argument largely centred on the practice and autonomy of radiographers reporting their findings directly to referring medical practitioners. This practice was challenged by radiologists who wished to establish the new discipline of radiology with consultant status within medicine. To do this they went to great lengths to stress their difference from radiographers (Larkin, 1983). In the dispute regarding who had the right to report, radiologists questioned radiographers' ability and competence to perform such tasks, even though some had performed such tasks satisfactorily for a number of years. Following the conclusion of the dispute over the division of labour between

radiologists and radiographers the boundaries between the two professions remained unchanged for approaching seventy years, with radiologists concerned primarily with the interpretation of the image and radiographers with its production. Within that period there are instances of radiologists' position being strengthened, for example, Furby, (1944), a radiographer, stated that the primary function of the radiographer was to be of utmost service to the radiologist and the function of the radiologist was the interpretation of the radiograph.

The exclusion of radiographers from reporting remained unchallenged for nearly fifty years until the debate around the potential for radiographers to develop and extend their role was prompted by Swinburne (1971). He recognised the potential for radiographers and others to comment on images as a means of alleviating radiological work loads and in the face of a chronic shortage of radiologists. Swinburne (ibid) also commented upon the fact that radiographers seemed to function below their full potential and on this point he compared radiographers with laboratory technicians who accepted greater professional responsibilities by reporting the findings of their work. His opinion was that radiography should have graduate status which would improve recruitment and lead to an improved radiographic career structure. Swinburne (ibid) considered it was time that "official" recognition was made of the fact that radiographers all over the world assisted in the interpretation of x-ray films. He recognised the interdependency of radiology and radiography and his view was that under the best conditions there was no need for boundary disputes. Swinburne (ibid) had proposed a training programme and a system of working which were radical and ahead of their time.

1.5 Early evidence of role changes

Following Swinburne's article further concerns began to be expressed about the increasing radiological workload and the shortage of radiologists. The British Journal of Radiology (1975) published an editorial 'Must radiologists do all the reporting?' and in the same edition a letter was published from a leading general practitioner (Emrys-Roberts, 1975) who thought that it was a waste of time for radiologists to attempt to report every image. The editorial and the letter prompted a number of responses including those from two radiologists, Aberdour (1975) and McLachlan (1975) who suggested that there was a role for radiographers in this field.

It was not until the 1980s that the work of the radiographer began to diversify when ultrasound imaging signalled a new role for radiographers. This included providing results to patients and reports to medical practitioners of both numerical and interpretational data (Witcombe and Radford, 1986). There remained no sign of any return to plain film reporting by radiographers but the work of Berman, DeLacy,

Twomey, Welch and Eban (1985) and Cheyne, Field-Boden, Wilson and Hall (1987) on the detection of abnormalities in x-ray films by radiographers was launched in 1984 at accident and emergency (A&E) departments at two hospitals in the London area. This became known as the 'red dot' system which involved a radiographer placing a coloured paper dot onto a film which was determined to be abnormal in an attempt to alert medical staff to the presence of trauma and/or pathology. Interest in the feasibility of radiographers playing a role in abnormality detection grew and in the early 1990s Renwick, Butt, and Steele (1991) conducted a study to investigate how well radiographers could triage films in an accident and emergency department, in effect, this appeared to be a variation of the 'red dot' system. Radiographers were asked to place films in one of four categories; 'normal', 'abnormal', 'insignificantly abnormal' and 'further advice required'. The radiographers' selections were compared independently to an assessment made by radiologists. The study concluded that while radiographers could offer useful advice on radiographs to casualty officers, because of a high false positive rate they could not perform to the required level of accuracy to extend their role.

The results were perhaps not surprising given that the radiographers had not undergone any training, and the study was criticised for this fact by Nawrocki and Nawrocki (1991), who suggested that radiographers had considerable potential in abnormality detection and should undergo a short period of training for the task. In response, Renwick (1991) agreed that radiographers were an under utilised resource and believed that they should be given the opportunity of extra training and that his Department was seeking funding for such an initiative. The 'red dot' system gained momentum and by 1991 a study reported 25% of major casualty departments had adopted some form of 'flagging' system (James, Bracegirdle and Yates, 1991).

By the early 1990's reporting was a live issue. Among the radiological fraternity the debate hinged primarily around the numbers and availability of radiologists to meet the increasing demands of the service. Rose and Gallivan (1991) reported on their national survey of consultant radiologists undertaken to investigate the extent of non-reporting and delayed reporting in UK hospitals. Questionnaires were sent to all consultant radiologists in the UK and 565 (45%) replied. The survey revealed some important findings; among these were that only 16.1% of the sample stated that all films were reported; 33.6% stated that 10% of films or more were never reported and one respondent revealed that 90% of plain films were never reported. The two main reasons for the failure to report all films were that patient management would not be affected by a lack of a report and a shortage of radiologists. Of the sample, a majority of 58% considered that all films should be reported by a radiologist, of the 42% who thought not 17%

specified dental and fracture clinic follow-up films as the only categories not requiring a report, no information was given as to what the remaining 25% thought.

Saxton (1992) writing an editorial in Clinical Radiology *'Should radiologists report on every film?'* repeated some of the arguments put forward by Swinburne (1971) and expressed concerns over the fact that some radiographs were forwarded to clinicians without the benefit of a radiological opinion. He raised a number of subsidiary questions and highlighted some key issues:

- Were all films being reported?
- Do reports get read?
- Reporting was too late to influence clinical management
- Radiologists were becoming overloaded.

Saxton suggested that this part of the traditional radiologist's role could be undertaken in future by specially trained radiographers and in proposing a solution he stated that:

> "There is little doubt that with careful training suitable radiographers could undertake reporting in such areas as mammography and screening of fracture reporting on accident and emergency films."
>
> Saxton, H.M. Clinical Radiology, 1992, 45, 1-3

At the time Saxton was suggesting an extended role for radiographers, scientific officers within the Department of Health and regional health authorities were pursuing another approach. This centred on de-skilling of radiographers with the introduction of a non-state registered practitioner referred to as an imaging technician (Price, 1991). This was opposed strongly by the College of Radiographers who were pushing to introduce degree level education for entry into the profession. The emergence of the debate on levels of workers was consistent with the scenarios described by Francis (1986) on the impact of new technology. The first argument is that the dominant effect of new technology is de-skilling the work force, destroying occupations and fragmenting skills into meaningless elements which can be performed by unskilled operators controlled by large scale bureaucracies. The counter claim was that routine tasks can be taken over by machinery but a more highly educated workforce will be required to perform complex tasks that require a high level of human decision making skill. The early 1990s was to become a defining period for radiography, and the options were as stark as Francis set out, 'de-skilling or up-skilling', which in essence meant imaging technicians or graduates. As it turned out, the move to degree level education for radiographers advanced rapidly and attempts to introduce a technician to undertake radiography instead of a radiographer

did not materialise.

The debate on role continued and in a study commissioned by the Department of Health and the College of Radiographers and conducted by the North East Thames Regional Health Authority (1993). A 'snap shot' analysis was undertaken to identify any new skills and competencies required to practise radiography. One significant recommendation was that the role of the radiographer in evaluating the image be extended.

The debate, started by Swinburne and taken forward by Saxton, was gaining momentum. The possibility of certain tasks that were traditionally the sole remit of the medical profession being undertaken by radiographers was being explored. Loughran, (1994) and workers in Leeds (Wilson, 1995) were probably the first to put Saxton's ideas into practice and to implement Swinburne's proposals more than twenty years after his original paper. The extended role of the radiographer project based in Leeds provided training for four radiographers in image reporting. The project had financial support from the Department of Health and involved the College of Radiographers and the Royal College of Radiologists on the steering group. The involvement of the Royal College of Radiologists was a significant step considering their opposition to other groups of workers being involved in reporting. The situation that instigated the Leeds project was identified deficiencies in the existing system of plain film reporting, where 25% or so of films were never reported, including a subset of some significant missed diagnoses; reports not being issued sufficiently quickly and the fact that it was too costly to dedicate radiologists for 'hot reporting'[2] , especially out of hours.

At about the same time as the Leeds project was getting underway; Loughran (1994) was running an in-house training scheme in fracture reporting for radiographers. He demonstrated that, with structured training, radiographers could report with consistently high levels of diagnostic accuracy comparable with scores recorded for consultant radiologists. The work at Leeds, however, went further than that of Loughran in that it included radiology of the chest and abdomen.

Questions were also being asked on why the interpretation of breast screening mammograms was the exclusive role of radiologists. Robertson (1995) cited the role of technicians in cervical cytology screening and thought that technicians would free radiologists from the 'presumably tedious tasks of examining hundreds of similar films.' Robertson made no reference to radiographers undertaking this task but Loughran (1995) also cited the successful utilisation of cytology screeners and

[2] A system where films are reported prior to them being returned to the A&E referrer.

making the connection with the successful training of radiographers to report fracture radiographs in his Department.

The identification and range of skills necessary for an imaging department to perform effectively were coming under increasing scrutiny. The Audit Commission (1995) published a report, based on nine hospitals, on the effectiveness of radiology services and recommended that there be a softening of traditional demarcation lines between the work carried out by radiologists and radiographers. The report considered that radiographers could be trained to interpret certain images because of the difficulty experienced by some departments in providing a full reporting service. The Audit Commission report recommended that the Department of Health and professional bodies commission more evaluation on technological and clinical innovations.

One such piece of work was commissioned under the auspices of The College of Radiographers and entitled 'Role Development – Towards 2000' (Paterson, 1995). Part of the study was a postal survey distributed to 470 diagnostic imaging departments of which 333 (70%) responded. The developments reported by Paterson are summarised in the Table 1.2.

Table 1.2 The Extent of Role Development (adapted from Paterson 1995)

	Role Development			
Intravenous injections	Urography	Radionuclide imaging	MRI	CT
Number of Hospitals	82	78	22	82
Fluoroscopic examinations	Lower limb Venography	Barium meal	Barium Swallow	Barium enema
Number of Hospitals	5	14	15	48
Reporting Field	Plain film reports	Red dot system	General medical US	Obstetric US
Number of Hospitals	4	152	110	205

Key: MRI –magnetic resonance imaging; CT - computed tomography; US – ultrasound.

Despite the energetic debate on reporting only four departments had adopted this role change. It was perhaps a reflection of its controversial nature, especially among the radiological fraternity, compared to the other areas of development. On the other hand, ultrasound reporting did not attract the same degree of attention or resistance from the medical fraternity. In fact, the argument put forward by Bates Conlon and Irving, (1994), suggested that trained sonographers were capable of performing and reporting non-obstetric ultrasound and their roles should be extended further to envelope these. While the reporting debate remained controversial, it had opened up

the possibility of certain other tasks that were previously the remit of the medical profession, being introduced into the scope of radiographic practice.

1.6 Skill mix - an added driver for change

The changes occurring within radiology were part of a much wider drive for more efficient working under the banner of skill mix. In organisational terms, skill mix was clearly taking a priority on the agenda and was beginning to attract attention to the fact that the division of labour within the health arena was becoming blurred at the boundaries between different professional groups (Greenhalgh, 1993; Bhopal, 1994).

Buchan, Ball and O'May (2000) noted that skill mix is a term that appears to be used exclusively within a health service context, although other organisations are as likely to want to achieve the most cost effective combination of roles and staff to meet their needs. Buchan also pointed out that the term *'skill mix'*, was subject to different interpretations: the mix of posts in an establishment; the mix of employees in a post; the combination of skills available at a specific time; or alternatively, the combinations of activities that comprised each role, rather than the combination of different job titles. In the report, *'The Developing Role of the Radiographer'* by Price, High and Miller (1997), the term skill mix was interpreted in two ways by radiologists and radiography managers who were interviewed as part of the study. It was used to describe the mix of skills within an individual (and in particular when the range of skills overlapped with those traditionally associated with someone from another profession) and in its second interpretation was used to describe the combination of different professional groups within a unit or department with their differing skills. The latter would be more correctly described as *'skills mix'* as used by the Royal College of Radiologists in their document entitled *'Skills Mix in Clinical Radiology'* (1999).

Price, High and Miller (1997) reported concerns around skill mix at both ends of the radiographic spectrum i.e. both skill mix with regard to doing what was previously a radiologist's job, and also skill mix where the role of the radiographer may have to be blurred with (that of) less qualified technicians. Another manager in the same study reported an anxiety that highlighted the hard choices that would have to be made. The concern was that a time could be foreseen where a choice would have to be made between managing rooms with radiographers or reducing the number of radiographers who would be supported with sub-professional helpers.

The study by Buchan et al (2000) was commissioned by the World Health Organisation and looked at skill mix issues in health services delivery; one aspect of the report examined how health care managers decide on the mix of personnel to employ in a particular setting and what data they used to inform those decisions. Two main questions were asked, the first being: what are the presenting problems for

employing organisations (that is, why do health care providers embark on a skill mix exercise – what are the drivers)? The second was concerned with how do they (employing organisations) decide what to do (that is, what are the contextual factors that influence and constrain the choice of approach)?

Buchan et al went on to identify the drivers for skill mix which are presented in Table 1.3 below.

Table 1.3 Drivers for skill-mix (from Buchan et al 2000)

Drivers for skill mix
1. Skills shortages in particular professions or occupations.
2. Improving the management of individuals and organizations.
3. Sustaining quality improvements (or maintenance).
4. Technological innovation.
5. Sector reform or changes in professional regulations/legislation.
6. Securing improvements in unit labour costs (i.e. reducing costs per unit of "output", or improving "productivity").
7. Assisting in the development of explicit care standards or skills/competency-based training of staff.

While Buchan et al did not focus on imaging there are parallels that can be drawn. In particular, two of the drivers, one and four have clearly impacted on imaging; i.e. radiologist shortages and technological innovation. Kletzenbauer (1996) commented upon both the advances in technology and noted that because of the shortage of radiologists, radiographers were being given the opportunity to develop both personally and professionally and saw this as the opportunity for radiographers to enhance their role by partaking in tasks which were previously performed only by radiologists. Williams (1996) acknowledged the advantage of this in that radiologists could focus on interventional work. Also in Williams (ibid) commentary on skill mix for radiologists and radiographers an important point was made that with radiographers carrying out barium studies, A&E film and ultrasound reporting, patients are able to obtain their results quickly and therefore be able to go onto further treatments if necessary in order to manage their condition. This could also bring about a quality improvement in terms of providing a cost effective, accessible and available service with staff remaining motivated as their job remains challenging.

Skill mix, Buchan et al claimed, was also driven by Government reforms and these were evident throughout the 1990s and 2000s. During the same period there has

been a rise in the expectations of patients as a result of initiatives such as the Patient Charter and shifting the service to a consumer orientation (Maynard 1993). The Department of Health (1998) has also linked quality improvement to new roles. The Department stated that that NHS organisations are accountable for continuously improving the quality of the service and that new roles are encouraged to demonstrate innovations and improve quality.

A decade on from the Government White Paper *'Working for Patients'* (Department of Health, 1989), *'The NHS Plan: a Plan for Investment, a Plan for Reform'* (Department of Health, 2000) set out further reforms to address its outmoded operations; the NHS was described as a 1940's system in the 21st century world. Among the Government's concerns was a lack of funding, too few doctors and nurses and other key staff to meet the demand, a lack of national standards and old-fashioned demarcations between staff and barriers between services. This pressure for change did not relent and there was a direct intervention by Prime Minister Tony Blair following the 2000 budget when he challenged the professions in the NHS to get rid of unnecessary demarcations and introduce more flexible training and working practices (Beecham, 2000). This was a theme that recurred in the Department of Health's (2000) publication '*A Health Service for All Talents – Developing the NHS Workforce*' where it was claimed that traditional demarcations between staff have held services back and the provision of health services should depend on the ability of the staff, not their job title.

The NHS Plan, in particular, clearly had implications for imaging, especially with the announcement that there would be new grade of consultant therapist and a new grade of assistant practitioner working in the breast screening service who would be appropriately trained and qualified to take mammograms under the supervision of a radiographer. The implication of this was explicit in that it would release radiographers to extend their role into some of the tasks traditionally undertaken by radiologists, thereby increasing the capacity of the service. Publication of the NHS Plan was followed up by *'Meeting the Challenge: A Strategy for the Allied Health Professions'* (2000) which examined the Government's commitment to expanding the roles of the allied health professions with the purpose of ensuring that professionals use their skills flexibly and creatively to the benefit of patients. As regards imaging there was a particular reference to the creation of an advanced practitioner in breast screening; the role would include the reading of mammograms which would increase their potential. In this role radiographers would be supported by assistant practitioners.

The Royal College of Radiologists (2002) looked at the impact of an increased workload on radiology and highlighted the threat that the shortage of radiologists would have on the delivery of The NHS Plan and other Government initiatives. Their position seemed not to have the Government's message of removing demarcations high on the agenda as the document ignored the contribution that radiographers were having on workloads. It dismissed any future role or contribution by radiographers stating that there is a shortage of radiographers who might contribute to skill mix and there was no reference to the consultant therapist role identified in the NHS Plan. At about the same time the College of Radiographers (2003) was providing evidence of role development activities and promoting role development in response to technology development.

Buchan et al's (2000) report was instrumental in bringing together, and focusing upon, key drivers for change, and has helped to explain and rationalize the changes taking place within imaging. Buchan's conclusion, however, was that studies on skill mix had tended to be focused largely on developments in the USA and primarily on substitution from and into nursing. He therefore noted that there was a need for broader research in this field. However, Friedenberg (2000) discussed 'skill mix' from a North American perspective and acknowledged that skill mix in health care originated in the UK. Friedenberg (ibid) was also of the opinion that skill mix applied to medicine implied the utilization of all the types of expertise available to patients. Interestingly, Friedenberg's view was that in a nationally funded health care system where radiologists did not depend upon a fee for service basis, cost savings could be achieved. However, where there was fee for service as in the USA (and indeed in the private sector in the UK) the concept of skill mix would not readily be accepted.

Earlier, The Royal College of Radiologists (1999) had held the view that changes in skill mix will often not result in financial savings and gave three examples; the substitution of highly experienced nurses for junior doctors may prove more expensive; more personnel may be required; and training time and facilities for trainees and trainers is often expensive. Their position was that improved patient care rather than reduced costs must be the main aim of skills mix. This did not agree with the sixth driver for skill mix put forward by Buchan et al but, nevertheless, securing improvements in labour costs has to be appealing to an organization especially if productivity is improved as a result. Prior to Buchan et al's stated position, Kletzenbauer (1996) had stated that one imperative of skill mix was to keep overall costs to a minimum and it is this that makes role extension viable. Presumably he meant that radiographer costs are less than radiologists as staffing costs account for over two-thirds of overall costs. Seifert

(1992) had also made the point previously that radiographers provided cheaper labour than radiologists. Perhaps the radiological perspective had more to do with protecting professional boundaries than an integrated approach to skill mix.

1.7 Role development and role extension in practice

Role development by radiographers has been an accepted process which has followed technology innovations. Particular examples have been the developments in nuclear medicine and ultrasound in the 1960s, CT in the1970s and MRI in the 1990s (Welsh Health Planning Forum, 1995). In this sense role development in radiography can be described as a process of adoption, diffusion and assimilation of techniques to support the effective operation of a new imaging modality. Within *'role development,'* however, there is an important sub-section – *'role extension'* which the study by Price, High and Miller in 1997 used to distinguish those tasks undertaken by radiographers that had been traditionally carried out by other professional staff, usually medical practitioners.

The nursing profession also arrived at a similar understanding of an extended role, with Wright (1995) stating that at its most simple role extension refers to nurses carrying out tasks (usually carried out by doctors) not included in their normal training for registration. Paterson (1995) and the College of Radiographers (1996), however, made no distinction between *'development'* and *'extension'* but what they appeared to discuss were extended roles. This is a significant oversight as undertaking an extended role raises particular questions around governance i.e. accountability, competency and risk assessment (Dowling at al 1996; Radiographers Board 2001). If the extended role is one that has been considered to have been delegated by a medical practitioner then the practitioner is required to ensure that the delegate is competent to carry out the task and that he/she is accountable to a regulatory body (General Medical Council, 1995). The subject of delegation of medical care has also been highlighted by the Royal College of Radiologists (1996) and its impact on the radiological workforce (Brindle, 1996, Chapman 1997). In 1977 the then Department of Health and Social Security recognised the importance of extended roles and set out conditions that would have to be met by a nurse delivering an extended role:

- The nurse has been specifically and adequately trained for the performance of the new task and agrees to undertake it;
- this training has been recognised as satisfactory by the employing authority;
- this new task has been recognised by the professions and by the employing authority as a task which may be properly delegated to a nurse;

- the delegating doctor has been assured of the competencies of the individual nurse concerned.

Department of Health and Social Security Health Circular (1977)22

Although this was written in a nursing context there is no reason to suggest that the framework did not apply to other health professionals. However, it was not until Paterson (1995) undertook her benchmark study was there any information on the extent of role development activities nationally, although around the time of Paterson's work other authors were revealing a number of specific examples of radiographers adopting new tasks at their hospitals; the scope of ultrasound practice (Bates et al, 1994); intravenous injections, 'red dot', barium enemas and ultrasound (Nuttall, 1995); image interpretation of mammograms (Pauli, Hammond, Cooke and Ansell, 1996) and plain film reporting (Robinson, 1996).

The other exception alongside Paterson's work was a study by McKenzie, Mathers, Graham and Chesson (1998) who surveyed 100 radiology departments across the UK and reported that radiographer-performed barium enemas took place in 49 hospitals. However, if, as suggested by Paterson in the mid nineties, that roles were developing rapidly, there was no clear picture as to whether the trend was continuing, or indeed what the complete range of activities being undertaken were. However it was clear that the combination of developing technologies and the NHS reforms had set an agenda that was determining the pattern of healthcare delivery in imaging.

In a study on the developing role of the radiographer, commissioned by the College of Radiographers and the Radiographers Board at the Council for Professions Supplementary to Medicine, Price, High and Miller (1997) conducted a survey of radiographers and other related professional staff that explored whether there was a consensus on what constituted the current core activities for radiographers. The survey revealed that role extension had occurred in a significant proportion of NHS trusts and seemed set to continue. Changes were largely welcomed and practitioners commented that, in many cases, changes had been brought about by increased workloads, staff shortages and increased expectations of staff and patients. The situation was reported to be similar in nursing where many nurses were happy to broaden their role but some were concerned that nurses may be used as cheap labour and that roles were becoming increasingly fragmented (Edwards, 1995).

The literature provides numerous examples of radiographers undertaking specific extended roles notably IV injections, barium enemas and image interpretation. A review of the literature relating to individual role extensions is provided as Appendix 2.

In summary, however, most NHS trusts, by 2000 had radiographers administering IV injections (Price et al, 2002; Audit Commission, 2002) and Keenan (2001) stated that those radiographers' giving intravenous injections have *"become fundamental to the operational management of diagnostic imaging departments."*

Radiographer-led barium enemas were initially described in North America with Somers et al (1981). In the UK there was some initial controversy over radiographer performed barium enemas, with change not readily being accepted by everyone, (Simpkins 1992). However, there was radiological support (Chapman, 1993) and evidence was provided to show that not only was their no difference in the quality of examinations between radiographers and radiologists but that there was a higher detection rate for polyps and carcinomas by the former. McKenzie et al (1998) provided evidence to show that barium enemas were undertaken in 49 out of 100 trusts surveyed. In a survey by Price at al (2002) 69% of trusts had adopted radiographer performed barium enemas. Work by Hogg and Nightingale (2003) reported that radiographer performed barium meals are an efficient, cost effective and safe role for delegation.

By the turn of the century ultrasound reporting was undertaken to a high standard (Leslie et al, 2000) and was the most widely diffused (Price et al 2002) but image interpretation (with the exception of ultrasound) has been the most controversial of the radiographer role extensions (Price, 2001). However, by the beginning of the 21st century, in addition to ultrasound, radiographers were providing reports in a number of fields, the most prevalent being skeletal radiography and was becoming well documented (Piper et al, 1999; Brayley, 2000; Brealey and Scally, 2001; Price et al, 2002). There is also evidence of the scope of reporting widening to include mammograms, although there are reports going back to the 1970s on this activity (Dowdy et al 1970) and on barium enemas (Price et al 2002). Reporting in nuclear medicine by radiographers appeared to be limited (Thomas et al, (2000) as it is in chest imaging (Sonnex, 2001), CT (Craven and Blanshard, 1997) and MRI (Gilmore 2001).

1.8 Education and training

1.8.1 Background

The development of radiography education has gone through the stages of development described by Eraut (1994). In his work on developing professional knowledge and competence in which he recognised five stages of development:

1. Period of pupillage or internship, during which students spend a significant amount of time learning their craft from an expert.
2. Enrolment in a 'professional college' outside the higher-education system.
3. A qualifying examination normally set by a qualifying association for the occupation.
4. Period of relevant study at a college, polytechnic or university leading to a recognised academic qualification.
5. Collection of evidence of practical competence in the form of a logbook or portfolio.

Eraut, 1994:6

By the1980s radiography education development had been through stages 1 to 3. Stages 4 and 5 followed after the switch to higher education in the 1990s. Although a log book was in use with the qualifying examination it was rudimentary and it was not until the transfer to higher education that portfolios were adopted.

Moses and Mosteller (1985) identified the impact of new technologies which included the discarding of old procedures and the introduction of new; a shift in the definition of accepted practice; old equipment replaced by new, the review of text books and changes in curricula. The last factor being an issue which the College of Radiographers wished to address; prior to higher education entry to the radiographic profession was by possession of the Diploma of the College of Radiographers (DCR) which provided eligibility for state registration. During the 70s and 80s moves were afoot to seek degree education for radiographers; the first degree was validated in 1990. The transition to higher education resulted in the Diploma being succeeded by a Bachelors' degree and by 1993 all new entrants into radiography education were admitted only to degree programmes.

As part of the strategy to achieve higher education status The College of Radiographers had set out its vision for change in the 'Degree Rationale' (1987) which stressed the need for education to keep pace with technological change. This they felt could only be achieved by a move to higher education. The rationale stated:

> "For more than a decade medical technology has changed at a rapid pace and continues to do so. If the radiographer of the next decade is to contribute fully to the health care team then the syllabus must promote a response and reaction consistent with the demands of a rapidly changing health care service."
>
> The College of Radiographers, 1987:2

The move to Higher Education would, in theory at least, result in greater flexibility in curricula but Price, High and Miller (1997) discovered that the first round of degree courses remained grounded in the DCR. However, all programmes identified the need for the curriculum to reflect changes in technologies; a recognition of the College's stated position. However, when Price, High and Miller (ibid) questioned radiographers about the curriculum, practitioners were concerned more about the time students spent in practice rather than whether the curriculum responded rapidly to the demands of changing health care; the implication being that (in their experience) insufficient time was allocated for practice education. This was despite the fact that the crucial element of clinical education was emphasised by Bowman (1993) who reported that within the patient/radiographer or student relationship the delivery of care is considered made-up of two aspects: the technical element and the patient centred element. Broome and Tillema (1995) also recognised this facet and deemed that professional knowledge is achieved not just through the accumulation of theoretical knowledge but from integration, tuning and restructuring of theoretical knowledge to the rigors of practical situations. Castle (2000) found that radiographic knowledge shares the characteristics most closely associated with mechanical engineering (hard applied) and sociology (soft pure) and radiography is therefore a profession that combines the application of science and technology with contact with patients. The implication being that to highlight the importance of clinical education

Price, High and Miller (1997) also identified clinicians' uncertainty of when new topics should be introduced into the curriculum. In a similar vein there was uncertainty as to when it would be appropriate to train to perform an extended role other than at post registration when training should be targeted on individuals who have the ability and the willingness to accept the extra responsibility that such activities inevitably bring. There was, however, a suggestion that graduate radiographers could take on new roles more quickly than those holding the DCR. It was suggested that the concepts of extended roles and the associated professional, legal and ethical issues should be introduced as part of the undergraduate curriculum as this would prepare undergraduates and make them more open to the concept of the extended role. A further significant concern from the research was expressed by clinicians about students spending too much time studying specialised modalities which was a

different perspective from that set out by the Professional Body in the publication, 'Role Development in Radiography' (College of Radiographers 1996a).

Williams and Berry's (1997) work stated that roles were set to expand but in the development of competences there was a difficulty in trying to achieve a balance between current and anticipated practice. They also made the point that practice changes have to be accommodated to allow for the fact that competence continues to develop on the job. They found a general lack of understanding about what to expect from a newly qualified radiographer and recommended a study to consult with employers and new radiographers to compare how new qualifiers are prepared for their first post. In their report Price, Miller and High (1997) acknowledged that nearly half of the diagnostic personnel consulted thought that current education and training programmes did not prepare radiographers adequately for their first post. Factors identified as the main concerns were weaknesses in the students' clinical education and practical experience. This did raise doubts of the expectation that students will be safe and competent practitioners in an increasing range of activities immediately on graduation.

In 1999 Williams and Berry undertook work to establish a model of competence for newly qualified diagnostic radiographers that would be acceptable to a number of key stakeholders. This work categorised the associated roles and responsibilities of a radiographer. Many of the categories were generic to health professionals although category seven related to the technical role and responsibilities, i.e. the technical aspects of radiography, making these skills profession specific. Within this category the expected competencies of an individual are to be able to:

- safely use and care for equipment;
- demonstrate the prompt identification and reporting of faults/hazards;
- participate in quality assurance programmes;
- demonstrate knowledge and application of exposure variables;
- undertake image processing;
- use appropriate criteria for assessing image quality in order to recognise an acceptable standard;
- sustain and develop a high level of technical skills.

(Williams and Berry, 1999: 228)

Their research focused on the technical elements as students perceived the learning of these physical science topics as more difficult than other aspects of the curriculum. There were identified strengths of degree education and one of these was providing a good basis for encouraging lifelong learning, and evidence indicated that most newly

qualified radiographers make good progress within six months of commencing work (Price, Miller and High, 1997; Williams and Berry, 1997).

1.8.2 Education and training for new roles

The literature on post-registration postgraduate training is more extensive than that on undergraduate education, but still rather limited on initiatives taken to train radiographers for extended roles.

Price, High and Miller (1997) found that role extensions were adopted on a seemingly ad hoc basis which was influenced strongly by department work load as a primary factor and staff enthusiasm as a secondary factor. Furthermore the study found that the adoption of extended roles was not consistent across the hospitals involved in the study. Moses and Mosteller (1985) identified a shift in practice as one of the changes forced on health care systems as a consequence of new technology but also identified the changing of curricula as a late consequence of technology innovation. If curricula changes were a late consequence then there are important questions on how prepared were radiographers to adopt new roles and to what extent was education and training supporting any shift in practice.

Image interpretation

There is a limited literature on training for image interpretation but by 1999 six UK universities were offering a postgraduate course in radiographic reporting. Several of these universities required radiographers to report with a minimum standard of 95% accuracy (Prime, Paterson and. Henderson 1999). Prime et al also claimed that training helped to change radiologists' opinions and push radiographic reporting forward. These findings were supported by earlier research (Boynes, 1997) that suggested that increases in sensitivity of 2% and specificity of 19% after training and research by Eyres et al (1997) obtained similar results. A leading radiologist, Robinson, was of the view that postgraduate education and training proved beneficial in the field of image interpretation of plain films by radiographers (Robinson et al 1999). While Carter and Manning (1999) reported a considerable increase in diagnostic accuracy to 100% after training they recommended continual monitoring of performance in order to accelerate competence. Chapman (1997), however, noted that radiographer training was much shorter than that for radiologists and because of this radiographers can respond quicker to workload changes. Chapman went on to claim the downside of this was that radiographers have a more limited knowledge base and therefore the acquired skills can only be limited to specific areas. In a different approach, McConnell and Webster (2000) documented the benefit of a short

training course to improve reporting performance and to confirm the competence of individuals prior to undertaking a longer more costly post-graduate training programme. Hargreaves and Mackay (2003) conducted a study on the accuracy of the red dot system and not surprisingly found it improved with training. For a period of 8 weeks seven radiographers were monitored with respect to their sensitivity, specificity and accuracy of use of the red dot. These radiographers were then given a 10-week training programme in the basic principles of trauma radiology. The accuracy of the radiographers as a group increased from 89.9% before the training to 93% at its conclusion. Sensitivity for fracture detection increased from 76.2% to 81.3% but specificity for fracture exclusion decreased slightly from 96.4% to 96.1%. The false positive rate remained at 3% whereas the false negative rate fell from 7% to 4%.

As referred to previously the reporting of chest radiographs is a role that appears not to be commonly adopted by radiographers but was nevertheless the subject of work by Hughes (1996) and Sonnex et al (2001). Hughes introduced training for radiographers in pattern recognition of chest radiographs and discovered that radiographers could identify both significant and insignificant abnormalities. Radiographs were categorised into normal and significantly abnormal and the sensitivity and specificity was 86% and 54% respectively; this improved to 92% and 83% post tutorial training. Sonnex (ibid) claimed that because the opinion of an experienced and trained radiographer is immediate it could be invaluable to the diagnostic management of the patient. This research used the radiologist as the “gold standard”; sensitivity and specificity of the radiographers was 90% and 94% respectively. The results were high but could be due to the fact that the research was carried out in a specialized heart and lung hospital where radiographers were highly experienced in their field.

Intravenous Injections

In the field of IV injections Bewell and Chapman (1996) claimed that there is less risk of serious difficulties with formal training and Nuttall (1995) reported that audits of radiographers who had completed training had revealed that no difficulties had arisen.

Barium enemas

Mannion (1995) undertook a study to follow the progress of radiographers undergoing training to undertake barium enemas. The objective of the study was to assess the standard of their work in comparison with radiologists – no significant difference was reported. This was a small study but was replicated by Bewell and Chapman (1995) with a larger sample (n=96) where it was found that the examination complication rate was comparable to that experienced by radiologists. They concluded that formal

training is critical to introducing an extended role task without serous difficulty and can result in an improved service. Nuttall (1995) undertook an audit of newly trained radiographers and unsurprisingly found that initially screening times were longer than radiologists but these soon became comparable with experience.

Nature of training

Regarding the different types of training currently in use there is a lack of information that identified the most frequent employed in imaging. In other fields there is emerging information, for example, a study of technological change and human resources development practices in Singapore reported that on the job training was the most frequently used method to address organizational change needs (AAhad, Osman-Gani and Jacobs, 2005). Wright (1995) reported findings of chaos in extended role training identified by a Royal College of Nursing survey. Wright commented upon the uncertainty of training, its lack of formalization and transferability, with the adoption process of training for extended roles being turned into a bureaucratic machine. As far as could be ascertained in the literature review for the work reported here, no similar exploration had been conducted to date within imaging services.

What would seem important for new ways of working in radiography was summed up by Fraser and Greenhalgh (2001). They recognized the complexity of the education process in the UK and concluded that education should not be focused merely on enhancing competence (knowledge, skills and attitudes) but on also on capability. This they defined as 'the ability to adapt to change, generate new ideas and continuously improve performance' (p 799).

1.9 Organisational Issues

The NHS is a large complex organisation employing nearly one million people and inevitably there are different socialisation processes for the professions, different needs and expectations of client groups and local priorities encompassing resource allocation and performance management (Iles and Sutherland, 2001). Iles and Sutherland cite Pollitt (1993) and Dawson (1999) who suggest that the NHS is characterised by three defining features: range and diversity of stakeholders; complex ownership and resourcing arrangements and professional autonomy of many of its staff. Against the background of technological innovation managing the NHS is a major challenge. It is not surprising therefore that successive Governments have had programmes of reform for the NHS although prior to 1997 there was the promotion of the internal market, which was finance driven, but with no great pressure to change career structures and progression. Boonstra and Vink (1996) in considering organisational change from a western European perspective provided an interesting

insight to forces of resistance to change when introducing new technology. They stated:

> "There seems to be a process of organisational conservatism that is shaped and bounded by forces of a social and political nature in the sense that those involved have a concern to preserve organisational arrangements with which they are comfortable."
>
> Boonstra and Vink (1996: 354)

They further claimed that once traditions become institutionalised into bureaucratic structures, strong cultures are a means of ensuring predictability and supporting the prevailing systems of the division of labour. Within imaging, despite the re-assignment of certain tasks there were strong parallels to what Boonstra and Vink (ibid) found where practice culture has been embedded within strict divisions of labour. Their conclusion was that organisational and technological change has to take place within a theoretical framework in order to understand the relationship between strategy, technology and organisation to overcome conservatism to guide the process of change.

After ten years experience of applying new technology within organisations in the UK, Eason, Harker and Olphert (1996), they discussed scenarios around the introduction telemedicine linking general practitioner surgeries with hospitals. Overall, they drew some interesting conclusions. Of particular significance was the fact that no attention is usually paid to organisational issues because, where technical innovations are introduced, it is often with the assumption that there will be no attendant organisational change. Their observation that introducing a technology can produce knock-on effects with unintended and negative outcomes bears out the findings of some workers in imaging. For example, not everyone was in favour of skill mix and Simpkins (1993), a radiologist, considered *'that skill mix in radiology is just a con'* and felt that 'skill- takeover' was closer to the truth and that there were no radiologists clamouring to take over radiographic activities but Simpkins' view within the literature was isolated. Williams (1996) reported negative views on skill mix by trainee radiologists who felt that their exposure to certain procedures were becoming limited because of the expansion of the role of radiographers and the decreasing availability of consultants who were training them. Kletzenbauer's study (1996) reported an overall negative attitude to skill mix by clinical radiographers who feared loss of 'job territory' to imaging technicians. By 1997, however, there was some support for the introduction of an imaging technician even if this was a minority view. Price, High and Miller (1997) asked a selection of radiologists, managers and radiographers if they believed there was a role for an imaging technician. Half of the radiologist sample

were in favour and envisaged a role for a worker who could undertake specific designated asks under supervision. Managers also were divided but those against, in common with the radiologists, were not in favour because of perceived lack of flexibility in what a technician could offer. The managers' understanding was that a technician would need to be supervised at all times, restricted to the examinations they could perform and be unable to undertake "on-call" duties. Of the radiographers' sample only a minority were in favour but in common with managers who were in favour they could see the need for adequately trained technicians to fill a gap which the extension of the radiographer's role would create.

In a study on implementation of business process engineering in a large NHS teaching hospital, organisational issues were at the centre of the project (McNulty and Ferlie, 2004). The project, in a large city teaching hospital set out to transform the hospital from one configuration to another over a short period in order to improve performance. One of the case studies on reengineering the process of care for patients admitted with a fractured neck of femur involved radiographers. In the vision for this new service A&E doctors would be replaced by A&E nurses trained to order X-rays; radiographers would assess the radiographs and orthopaedic doctors would admit patients to the wards. Two years into the process 60% of patients admitted had their radiographs requested by nursing staff but assessment of the films by radiographers was not implemented. Agreement was reached eventually (subject to the development of medical protocols) but nine months later radiographers were not assessing the films due to opposition from A&E doctors. An orthopaedic surgeon recognised resistance from some A&E staff and attributed this partly to the fear of work being taken away. McNulty and Ferlie (ibid) concluded that there were obstacles to radical forms of change within contemporary public service organisations. They claimed that outside of the initial champions, reengineering failed to generate a critical mass of support throughout the hospital. The process was not seen as helpful to the operational problems and agendas of managers and clinicians at key levels in the organisation. As a consequence they were inclined to preserve the status quo. McNulty and Ferlie (ibid) in reporting the findings of case studies pointed to the *'continuing power of doctors in healthcare.'* Their comment was that while senior managers could influence clinicians they could not control them. The conservatism found by Boonstra and Vink (1996) was plainly in evidence in the reengineering project despite the fact it was well resourced and had the support of the hospital's top level managers. Bach (2000) also reported a similar state of affairs in nursing where historical traditions of demarcation between occupational boundaries made redeployment difficult. On the other hand Desombre, Kelliher, Macfarlane and Ozbilgin (2005) argued that functional flexibility of employees is a mechanism for

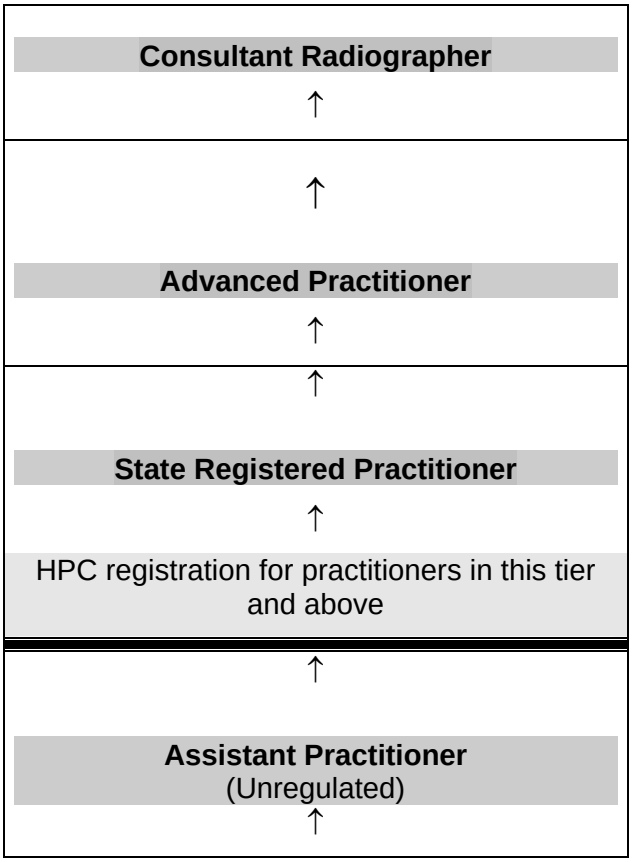
improving efficiency and service quality and is especially appropriate in a service environment. They cited Cridland (1997) whose view was that functional flexibility can lead to improvements in productivity as traditional approaches are replaced by multi-skilled employees undertaking more varied forms of work. However they acknowledged the importance of training, recognising that employees who are multi-tasked but not multi-skilled may not be able to perform in a manner likely to make redeployment effective. They also make the point that it is important to specify the role responsibilities of such workers which make clear what the worker is not responsible for as well as those for which they are responsible. In the three case studies in non-medical areas reported by Desombre et al (2005), they found little resistance to role changes but agreed that their study did not address the concerns faced by doctors in reengineered organisations.

The Labour Government's reform programme from 1997 has been concerned with modernising the NHS. Funding has been increased with the proviso that the investment is linked to modernisation, with more effective management and organisation. Their case was presented in the White Paper 'The New NHS - Modern·Dependable (1997). More investment and better technology was promised along with the establishment of consortia to assess workforce issues of local health care services. The NHS Plan (Department of Health, 2000) was the prime driver in increasing the number of health professionals, introducing new roles, new ways of working and role redesign. The NHS Plan stressed that it was a plan for investment and a plan for reform which would have far reaching consequences. For the allied health professions, this was the announcement of the consultant therapist and assistant practitioners in mammography who would work under the supervision of a radiographer. The intention of the latter was to release radiographers to extend their role into some of the tasks traditionally undertaken by radiologists. The theme of role design was continued in the Wanless Interim Report *'Securing Our Future Health'* where it was argued that there was scope for much of the work historically done by doctors, to be undertaken by suitably trained nurses (Wanless 2001). This in part was intended to overcome the demarcation between professions and there was no reason why this concept could not be applied across imaging. In 2001 the NHS introduced the Changing Workforce Programme, a national workforce modernisation programme to test, evaluate, implement and spread workforce design. Within this framework was the National Practitioner Programme to oversee the piloting of a number of new roles which included anaesthesia practitioner, critical care practitioners, emergency care practitioner, medical care practitioner and surgical care practitioner. These were not directly associated with imaging but showed the determination of the Government in securing the change that it had called for.

1.10 A new model for practice for radiography: the four-tier structure

Despite the evidence of radiographer role extension, there appeared to be little attempt to introduce a new framework to support and recognise the developments in imaging practice in the 1990s until Evans (1999) described a framework for the breast screening service which became known as the '*four-tier structure'.* This had tiers for assistant practitioners, state registered practitioners, advanced practitioners and consultant practitioners. The assistant tier would be a sub-professional level; therefore, this level of worker is not regulated and would work under the supervision of a registered practitioner. For the practitioner tier and above, radiographers are required to be registered and are therefore regulated by the HPC. The four-tier concept was subsequently expanded, primarily by the Department of Health (Department of Health Learning and Personnel Development Division, 2003).to embrace diagnostic imaging and therapeutic radiography. The model is illustrated in Figure 1.1.

Figure 1.1. The four-tier structure



A series of scoping projects was instigated into the three areas. These culminated in publication of a report entitled *Radiography Skills Mix* (Department of Health Learning and Personnel Development Division, 2003). The report's conclusions were that the four-tier model could be implemented successfully in diagnostic and therapeutic

radiography as well as the breast screening service. Examples were provided of where assistants and advanced practitioners were being employed; however, there was only one reference to one consultant post being developed in clinical imaging, despite the fact that the consultant tier was being strongly promoted by the Department of Health (Department of Health, 2001 a; Price, 2002). There is later evidence that the model is being implemented at a number of trusts (reported in Chapter 5) but only in three trusts was there radiographers employed in each of the four tiers.

1.11 Further matters of modernisation

Radiographers, along with other allied health professionals, have had their pay and conditions determined through negotiations between management and trade union representatives through the Whitley Council framework. The framework was cumbersome (White and Hutchinson, 1996) and did not reward staff wishing to develop a clinical career rather than following a management pathway. The road to modernising pay and conditions in NHS trusts began when they were allowed to establish their own pay arrangements in the 1990s, but less than twenty five NHS trusts did this (Corby, 2003).

The vision set out in *The NHS Plan* (Department of Health, 2000) was of a modernised service with staff working differently and with the creation of new roles. The strategy to deliver a changing workforce was referred to as '*the skills escalator'* approach was promoted strongly in '*Working together – learning together': A framework for lifelong learning for the NHS* which was linked to the framework for lifelong learning (Department of Health, 2001 b). Further developments at the end of the period in which the research leading to this thesis was undertaken were the *Agenda for Change* (AFC) (2004 b), *The NHS Knowledge and Skills Framework* (NHS KSF) and the *Development Review Process* (2004 c). The approach set out in these documents was designed to encourage staff, through a strategy of lifelong learning, to constantly renew and extend their skills and knowledge, enabling them to move up the 'skills escalator'. This publication stressed the need to develop concepts of flexible access to education, life long learning, multi-disciplinary learning and working, and maintaining and extending skills development through continuing professional development (CPD). The new modernised pay system set out in *Agenda for Change* will apply to over one million NHS staff and is designed to ensure fair pay and a clearer system for career progression. *Agenda for Change* proposed a common pay spine with bandings from 1 to 9. Job evaluation in conjunction with the NHS Knowledge and Skills Framework (KSF) determines the banding to which a member of staff is allocated. Staff should be paid on the basis of the work they undertake and

for the skills and knowledge they apply in their post (NHS KSF, 2004 c). With regard to the four-tier model, this is likely to be subsumed within *Agenda for Change*, with the assistant practitioner being equivalent to Band 4, qualified practitioners at Bands 5/6; advanced practitioners at Band 7 and consultant practitioners at Band 8. Further work would be necessary to identify the adoption and diffusion of the new bandings along with the four-tier model.

1.12 Summary

The increase in workload as a consequence of increased capability and capacity due to technological innovation continues to be a major issue for the imaging workforce. There has been continuing pressure on the service which is evident from increase in the number of imaging examinations undertaken each year (Table 1.1). It is probable that the number of annual examinations will further increase as investment provides more imaging hardware.

Throughout the last 15 years the combined impact of technologies and the increasing service demand was continuing to influence skill mix and shape practice requirements. While skill mix and role extension were becoming an integral part of routine working practice in some centres, in others they appeared not be happening.

The diffusion of technologies in imaging is a complex process influenced by the technologies themselves and by the social and cultural environment in which they have been adopted. Increasing pressures from technological diffusion coupled with constant Government reforms are key drivers for change. To meet the continuing demands and new ways of working there is the need to ensure a more highly educated workforce, given that radiographers are performing more complex tasks that require a high level of human decision making skill. There is, however, a suggestion that the profile of the workforce needs to change in order to provide a better skills mix that is appropriate to deal with the wide range of tasks being undertaken in an imaging department. The concept of the four-tier model, originally introduced for breast screening, was extended to cover therapeutic radiography and diagnostic imaging with the intent of embracing multidisciplinary teams defined by the skills and competencies required for the service and not by profession.

The changing nature of clinical practice and the delivery of healthcare needs were at least sufficient to compel professional bodies to respond by attempting to re-define inter-professional roles and responsibilities. The acknowledgement and recognition by The Royal College of Radiologists, in particular, was an important step in 'legitimising' new work practices by radiographers, especially in the eyes of some of its members who hold key and strategic management positions in imaging departments. Robinson (1998), a radiologist, in perhaps recognising the reality of the

changing situation, stated that cultural attitudes cannot be changed quickly; slow steady steps are much more likely to succeed than attempts at overnight revolution.

All of these changes have led to a compelling need for the research objectives that this thesis addresses. The thesis will consider the specific context of radiography in the healthcare environment; examine the issues raised by technology innovation; and, the reforms being undertaken in the NHS. The research will document and map the changes taking place at a time of great technological innovation. It will provide data on the changing nature of the role of radiographers and their ability to cope with technological innovation. The redefinition of roles, the emergence of a practice model and supporting education and training framework with a strategy for implementation provide significant outcomes of the research which will have important implications for the delivery and effectiveness of radiographic practice.

CHAPTER 2

DEVELOPING TECHNOLOGY: THE IMPACT ON IMAGING AND POSSIBLE CONSEQUENCES FOR THE SKILL REQUIREMENTS OF DIAGNOSTIC RADIOGRAPHERS.

2.1 Background

Technological diffusion has been described by Rogers and Shoemaker (1971) as the progress of a technological innovation in a given social system over a particular period of time. The development of skills as a consequence of the introduction of new technologies is therefore part of the diffusion process. There are two major processes that underpin skill evolution and development. The first is the expansion of job roles (and descriptions) to accommodate and include new activities and, hence, requirements for new skills. The second is the development of both initial education and training and the expansion of continuing professional development (CPD) to meet the development needs of both new and longer-serving practitioners. The initial study reported in this chapter investigated the impact of changes to technology on skill-mix requirements of radiography departments, followed by an exploration of the implications of such changes for pre-registration education and training and for CPD.

Stocking (1992), acknowledging the role of government in the process of technological diffusion, also identified a range of factors and people that influence the introduction and use of medical technology. Central to the diffusion process are the health care professions, especially doctors, while other important influences include patients, pressure groups, the media and industry, with the latter having a particular interest in promoting the sale of certain products. In the context of role change within the health service, it is particularly those activities at the boundary between medical doctors and other groups of health workers that have been at the centre of changing skill responsibilities. In other words, it is not that changes to skill requirements arise from technological change *per se*, but rather, that increasing technological diffusion changes the total array of tasks to be undertaken (both in quantity and in nature); this in turn leads the (resource-limited) health service to re-assign activities to different groups of workers. Very often it is activities at the boundary of medical practitioners and other groups that form the focus for changes in skill-mix distribution. Once such changes occur, they become incorporated into job descriptions and expectations of the professional group under consideration; and thereafter such skill development issues should inform decisions regarding the purchase of education and training.

Medical imaging has evolved rapidly over the past twenty five years, with the introduction of techniques such as computed tomography (CT), digital radiography, magnetic resonance imaging (MRI) and ultrasonography. The increase in range of

imaging services has not been matched by any similar increase in the numbers of medical practitioners to operate these services. The increased level of demand on medical practitioner services in developing specialisms has led to imaging being one area in which the interface between the medical practitioner and another professional group - in this case, radiographers - has evolved rapidly in an attempt to manage immediate skill shortages

Barneveld Binkhuysen (1992) suggested that continuing expansion in technology would have far reaching effects on role, and hence skill, requirements. To some extent changes in post-graduate education and training have reflected these developments, with the establishment of post-graduate courses in radiographic reporting, ultrasound, magnetic MRI and nuclear medicine have been developed to address the specialist activities which radiographers frequently have to undertake. If limited resources are to be distributed equitably and in order to attain the best training outcomes it will be necessary to identify the extent to which such changes have already taken place and are likely to take place in the future; to identify the likely impact in terms of changed skill and, hence, training needs; and make recommendations for change to future pre- and post-registration education and training provision.

Work carried out under the auspices of the former North East Thames Regional Health Authority (1993) used activity sampling to provide a 'snap-shot' of staff roles. The subsequent report recommended that the role of the radiographer in image evaluation be expanded, although little evidence was found at that time of task overlap between radiologists and radiographers. Two years later, evidence presented by Paterson (1995) suggested that this situation was changing rapidly, and many examples of situations in which radiographers' roles were encroaching on that of radiologists were reported. In the same year a study by the National Audit Commission (1995) looked at the management of radiology services and recognised that changes in technology and clinical practice call for radical rethinking of staff competencies, and called for more evaluation of technological and clinical innovation.

While it was clear from such studies that diagnostic imaging was in a state of flux and transition, it was unclear how changes would best be managed or how the service would develop. However, what was clear was that in order for imaging 'hardware' to be used effectively it was essential that changes in the skill and knowledge base or 'software' necessary to support use of the new technologies, were identified, and, as far as is possible, quantified.

The research questions that arise from this situation are as follows. The first question is the extent to which changes in technology lead to changes - either an increase or a

decrease - in skill requirements. The second is the question of the extent to which preparation for the group which has taken over these activities (radiographers) is equivalent to or has parity with the training for the original group (radiologists).

It needs to be noted that the introduction of some types of technology, such as ultrasound, have not immediately become the remit of just one professional group, but rather, has been adopted by several groups simultaneously. Such cases can illustrate the way in which different professional groups have risen to the new development challenge and facilitate comparison of the effectiveness of the different developmental approaches.

In many respects these questions reflect the two positions outlined by Francis (1986) discussed in Chapter 1. Firstly, there is the claim that the dominant effect of new technology is to de-skill the work force, destroying occupations and fragmenting skills into meaningless elements which can be performed by unskilled operators. Conversely, the claim that while routine tasks can be taken over by machinery, complex tasks can be performed by a highly educated workforce with higher levels of decision making skill. While it can be argued that a need for higher levels of education and training will arise from the adoption of new responsibilities by radiographers, the other argument is that that technology allows individuals to take on such tasks by virtue of the fact that it simplifies the task, making it amenable to performance by workers with lower skill levels than previously. Therefore the first issue is to identify the extent to which changes to technology have led to increased or decreased skill requirements.

This chapter firstly identifies changes at the interface between equipment ‘hardware’ and skills ‘software’, followed by the views of different professional groups on the implications of these changes for future skill and development requirements. Radiologists, radiography managers and imaging equipment company personnel were consulted in individual and group interviews. Interviewees were asked to identify factors that had resulted in changes to work practices within imaging departments. Secondly, they were questioned on their views concerning likely future developments to technology and, hence, for skill-mix within imaging departments. Finally, the implications for future training and education were discussed along with likely developments in service delivery arrangements and work practices.

2.2 Purpose

This study sought to explore the impact of changes to technology on the skill requirements of radiography departments, followed by an exploration of the implications of such changes for pre-registration education and training and for CPD.

2.4 Methodology

2.3.1 Research Tools

The primary research tool was a semi-structured interview. The semi-structured approach provided a framework in which to conduct the interviews but gave sufficient scope for interviewees to develop and explore themes that arose from each primary question.

The opening question asked interviewees for their views regarding *"what individual factor has had the greatest impact on imaging over the past decade*?" This was followed by the question *"what factor(s) do you think are most likely to continue to impact in the foreseeable future?"*

Subsequent questions were determined partly by interviewees' responses to these opening questions and partly by a predetermined set of further questions that focused on the future of a range of imaging modalities and were used as prompts if this topic was not raised spontaneously by respondents. Invariably responses related to the role of the hardware or 'hard' technologies and to elucidate opinion on the interface with the 'software' or 'soft' technologies prompts included the following:

- Are there any changes in skill requirements needed currently from what were required 5 and 10 years ago?
- What do you understand by the term *'the radiographer's extended or expanded role?*'
- Do you consider current education for radiologists and radiographers is appropriate for the demands of the work undertaken?

Interviewees were also asked to identify factors that had resulted in changes to work practices within imaging departments and were questioned on their views concerning likely future developments to technology and, hence for skill-mix within imaging departments.

Interviews were subsequently transcribed and subjected to a content analysis which focused on comments regarding 'hard' and 'soft' technologies.

Responses were categorised under the headings of 'hardware' or 'software' i.e. responses concerned with equipment or responses concerned with people or policies, mainly skills, role development, resourcing and education. This assisted in

clarification and presentation of the issues raised but the interdependency of these two categories was clearly evident.

2.3.2 Participants

Seventeen interviews were conducted with a total of 20 individuals: seven with individual radiologists, seven with individual radiography managers and six representatives from film and equipment manufacturers. The clinical sample, i.e. radiography managers and radiologists were selected on the basis of their position within an organisational hierarchy. Respondents were employed at consultant radiologist or radiography manager level within their organisation; this was to ensure they were able to give an authoritative overview of developments within their department i.e. seniority. The sample was based within a 30 mile radius of the University of Hertfordshire.

To represent equipment and imaging manufacturers, applications specialists from three major multi-national companies were approached. One of the companies allowed a group interview with four representatives. The other two companies provided one representative each.

2.3.3 Procedure

All interviews with the clinical staff were conducted at the respondents' place of work. The individual interviews with the two applications specialists were conducted on University premises; the group interview took place at the company's UK headquarters.

At the start of the interview the interviewer explained the purpose of the research and gave an assurance of confidentiality and asked for permission to record the interview. In all cases permission was granted. The interview then commenced and was recorded on audio tape. Interviews generally lasted approximately 1.5 hours. The basis for the interview questions are presented in Appendix 3.

2.3.4 Analysis

Interviews were subsequently transcribed and analysed independently by the researcher and a research assistant. Text was subjected to a content analysis which focused on comments regarding 'hard' and 'soft' technologies. The two sets of categorisations produced by the coders were compared and where there was disagreement between the two coders further discussion took place until either agreement was reached or the categories were discarded. A summary is presented as Appendix 4.

2.4 Findings

2.4.1 Overview

Responses are presented under the two main headings of ‘hardware’ and ‘software’ i.e. responses concerned with the equipment itself (the hardware) and responses concerned with people or policy - mainly skills, role development, resourcing and education (the software). This was to assist in clarification and presentation of the issues raised. However, in practice the interdependency of the two categories became evident. The extent to which they overlapped, impacted upon each other and subsequently upon quality, was clearly recognised by the interviewees.

2.4.2 ‘HARDWARE’ - The Imaging Equipment

In response to the question of what has had the greatest impact on imaging in the past ten years, the radiologists and managers cited either MRI or ultrasound. Two typical examples of statements in this category of response from the medical and manager groups of respondents included the following:

> “The biggest recent impact has been MRI and in fact I would have to say that cross-sectional imaging has revolutionised radiology in the last ten years. I see MRI as taking a bigger and bigger slice of the cake particularly as the biological risks are thought to be very low and that is something uppermost in our minds at the moment.”
>
> Radiologist.

> “I think it would have to be ultrasound, because especially the fact that it is not using radiation is quite important.”
>
> Radiography Manager.

Manufacturers’ views differed from those of clinicians and took a different perspective with the computer being cited as having the greatest impact. Taken together, such changes might have been expected to bring about either a reduction in time to undertake certain tasks (because the computerisation of tasks would lead to speedier image acquisition) or reduction in some workloads because the introduction of one type of imaging technology could reduce demand for another. While image acquisition times have been shortened, any hopes of the new technology reducing or easing workloads apparently have not been realised. Increasing demand for services had negated any benefits these shortened acquisition times might otherwise have brought:

> “The greatest impact has been digitisation brought about by the application of computers in radiography. Imaging is faster; the image can be viewed

immediately after acquisition and can be windowed to provide different contrast levels. ”

Company representative.

“Examinations are requested because the technology is available, (although) whether it’s actually what is required is another matter. When we got our CT scanner we thought nuclear medicine would go down but it’s gone up 50%”

Radiography manager.

Comment on likely future developments in imaging tended to focus on the continuing development of existing and new speciality imaging modalities. The possible future impact of computed tomography (CT), magnetic resonance imaging (MRI), nuclear medicine, plain film and digital radiography, picture archiving and communication systems (PACS) and ultrasound were each raised as areas in which developments may be expected to continue.

The modality whose future prompted the least agreement was CT. Some respondents believed that it would cease to be used because other modalities will be able to supply similar information with less radiation risk. Others believed that the availability of spiral CT, with faster volume acquisition times, would prove a prompt to further development. This is an area that will need particular attention in future surveys in order for skill needs to be determined more accurately.

The consensual view of clinicians that MRI would continue to expand was based on several factors. The development of compact services and the development of units specific to small anatomical areas such as knees and ankles were viewed as making this technology cheaper to install, house and run and therefore likely to become more readily available. Absence of ionising radiation and continued reduction in scanning times might expand the range of use of this imaging modality in the future. Therefore this was seen as being one area of probable continued growth with attendant development needs to address demand for service in this area.

Only a few of the clinicians spontaneously mentioned nuclear medicine, probably because none were working directly in this area although their departments housed such facilities. The consensus view was that its use would continue but would not increase at the same rate as in previous years. One suggestion was that future growth of this specialism would depend upon how it fared against MRI.

There was agreement that plain film radiography would continue as a viable modality for the foreseeable future, however, recognition was given to the growth in digital radiography systems. Digital radiography was predicted to be an area of slow but

steady growth because of the large amount of diagnostic information that can be captured by one exposure. One notion was that digital acquisition will result in fewer exposures, fewer operator errors and lower doses of radiation to the patient, all of which would result in lower unit costs (and hence more effective utilisation of limited resources). While this would imply a more economic service to be gained from newer digital equipment, a complete move to digital acquisition was thought unlikely to happen in the near future. Instead, it is likely that there was likely to be a slow but steady transfer to digital units as older equipment is replaced.

With reference to picture archiving and communications system (PACS) some believed that such technology was already sufficiently developed to permit practical installations and would rapidly become essential. However, others were equally firm in the belief that major technical difficulties need to be resolved before large-scale installations become commonplace and funding for such major projects was unlikely.

An area of agreement between all interviewees was that ultrasound would continue to be a major growth area for a variety of reasons, the absence of a radiation risk, low capital investment and the expansion of the role of sonographers might help keep operating costs down. Interviewees referred to developments such as colour Doppler and applications such as bowel imaging, vascular imaging, intra-operative ultrasound and breast imaging increasing the repertoire of ultrasound. Many commented that the portability of ultrasound units, together with the fact that other professional groups are undergoing training in its use, will increase the possibilities for its use outside the hospital.

2.4.3 Summary of views on future diffusion of 'hard' technologies

Respondents believed that most of the modalities would continue to grow with the exception of CT for which real doubts were expressed. Expansion of the range of modalities was unlikely simply to lead to maintenance of current levels of demand but with more appropriate types of imaging being substituted across modalities early indications were that medical practitioners request multiple investigations using two or more modalities, leading to an increased demand.

The implications of such reports regarding current practice appear to be that more radiographers will need to acquire skills across multiple areas. The replacement of older equipment with new digital technology, and the increasing use of specialist modalities, indicates that in order to meet increasing demand it will not be sufficient simply to train new practitioners in these skills; there is likely to be a need rapidly to update existing radiographers to work safely and effectively with the changing technology.

2.4.4 'SOFTWARE' - The skills to utilise the new technologies

Emergent themes were very much related to the changing culture within the NHS and the adjustment to that change. Particularly important was the role that education and training would need to play in supporting the changing culture and enabling employees to work effectively with new technology. Themes concerned the nature of changing practice and skill mix and, in particular, management of the interface between radiology and radiography. Whilst wherever possible responses were grouped separately and discretely, most of the issues here were both interrelated and related to the 'hardware' issues reported above. Some could not easily be classified into discrete elements, and it is acknowledged that, in seeking to categorise responses for the purpose of clarity of reporting, it might suggest that issues were viewed as separate by respondents. This was not the case. The importance of the 'hardware and software interface' was highlighted by the overlap in comments made by respondents when responding to questions concerning both 'hardware' and 'software'. With this proviso, the major themes identified and classified as aspects of 'software' are presented in Table 2.1.

Table 2.1: Classification of respondent comments into sub-categories of 'software'

'SOFTWARE' ISSUES
1. Education and training:
1.1 training/re-training for new technologies/ new skills
1.2 initial training for single or multi-competency
1.3 computing skills
2. Role overlap, flexibility and changing job demands
3. Imaging in the community

2.4.5. Education and training

Training/re-training for new technologies/ new skills

The need for change in the education and training provided for both radiographers and radiologists was widely recognised by all respondents. These requirements were seen as being dictated by changing skill needs arising from role evolution, which in turn were viewed as arising from changes to technology.

Both radiography managers and radiologists believed that changes were needed to both initial training and workplace development to support the greater involvement of

radiographers in image interpretation and reporting. In general, there was support for radiographers having a greater depth of knowledge of anatomy and pathology, which would be essential to support an extended clinical role. Unsurprisingly, the two groups of respondents had somewhat differing views on where the emphasis for such changes should lie. Radiologists believed the bulk of such training should lie in the further development of medical knowledge to support analysis and interpretation, whereas radiographers focused more on the development of pattern recognition skills *per se*. Some radiographers also indicated in their comments beliefs concerning the appropriate place for this type of further development, with some preferring such information to be delivered within post-registration lecture programmes while others envisaged a more practical on-the-job approach to development.

> "The biggest section of education has got to be anatomy, physiology and pathology."
>
> Radiologist.

> "A lot can be done on the job but core lectures are important, bringing in more pattern recognition."
>
> Radiography Manager.

> "This needs to be formalised, (but) only a certain amount needs to be done in the theoretical situation. Cross sectional anatomy is important but sitting on the job looking at the subtleties of the pathological condition ... you (learn to) know when the scan is not right."
>
> Radiography Manager.

Developments were seen as having urgency in certain areas, where image interpretation was becoming an accepted part of the radiographer role. In accident and emergency the importance of anatomical knowledge to support the developing role of the radiographer was particularly recognised:

> "More pathology needs to be taught, more pattern recognition will be necessary to support the role of the radiographer in A&E in particular."
>
> Radiography Manager.

For modalities such as ultrasound and MRI, inclusion of such specialisms within initial training programmes for radiologists was seen as necessary. Here, the current approach to training typically undertaken by radiographers was considered to provide an example of good practice that should perhaps be adopted by other professional groups:

> "Training in ultrasound [for radiologists] is an act of diffusion, an unspecified period observing and getting hands on the probes. There are no start and end points. This ought to change in radiology, a period to become proficient in ultrasound is important. It could take radiographers up to four years [to become fully competent in ultrasound] if it were not for specified training."
>
> Radiologist.

It was also apparent that there were concerns regarding the spread of unqualified use of ultrasound. Moves to increase the availability of ultrasound examinations in general practice and community settings could lead either to increased demand for radiographers or for training for general practitioners (GPs) themselves. All of the radiologists interviewed were concerned for future practice if GPs conducted their own ultrasound examinations without appropriate training. This has resource and training implications, and while it may make the service more accessible to clients, would almost certainly serve to further stretch resources. These points are brought out in the following statement from an interview with a consultant radiologist:

> "The idea of GPs doing ultrasound is complete anathema to me because I know how difficult it is. They don't know how difficult it is so they don't know they're making mistakes. ..... the way to get round that is to get expert sonologists and sonographers working outside the hospital environment but the only advantage there is to save the patient travelling, there's no other advantage, it's not cheaper."
>
> Radiologist.

Initial education to develop single competency or multi competency

Prior to degree level education and training, it had been customary for student diagnostic radiographers to undergo pre-registration training in plain film radiography only. With the introduction of new modalities there was a case for some introductory level input covering the specialist modalities. It was not always the case, however, that a student would obtain clinical placement experience within the specialisms and where placements were available the level of activity was restricted to observation. The nature and scope of training fed into the typical career pattern, that is, entry to a basic-grade radiographer post, followed by later specialisation within a specialist modality. More recently, exceptions have been seen to this rule, with some radiographers moving straight from graduation to working in posts in specialist units. With the specialist modalities now constituting a larger proportion of the imaging services offered, and with the particular growth area of ultrasound in mind,

respondents were asked whether students should have the option of receiving initial pre-registration training focused on a single specialism alone.

There was little support amongst managers and radiologists for a more limited pre-registration programme focused on one specialist modality. In discussing the education and training necessary to support radiographers working in specialist modalities, interviewees argued that, even when working exclusively within a single modality, staff perform more effectively when they have a background knowledge of other modalities. The view that emerged was that the appropriate time for specialisation was after basic training. The majority of radiographers believed that general radiography and imaging still provided the most appropriate form of preliminary training for workers in this field, despite the growing proliferation of specialist jobs in areas such as ultrasound. Radiographer managers felt that current radiography education and training gave a broad-based preparation that equipped students to move into other specialist areas. Specialist training alone was seen as restricting students' future possible choices for career development. It was believed that eighteen year olds might not be in a position to realise the implications of such a choice at that age, and therefore practitioners believed the best course of action was to continue with broad based education, that is, the radiography and imaging degree. This was supported by a radiologist who stated the following.

> "There is an argument as with echocardiographers that with training, people could go straight into ultrasound. I hope it won't happen and I feel it is a great strength that sonographers in a previous life were fully qualified radiographers ... basically I think that's what radiography training and being a basic grade teaches them, it's knowing quite a lot about patients and things like that which otherwise they would not get. I'm not immensely keen on having a sonographer training programme and certainly not starting them off at eighteen. I think it would be an expensive way of doing things and in the long run ineffective."
>
> Radiologist.

Overall, the view was that radiographers will, or at least should, continue to follow a career path that commences with a basic grade radiographer post and then allows either upward progress in the radiographer strand or allows subsequent specialisation into a modality such as nuclear medicine or sonography. Some radiography managers have already noted that career patterns were changing, with some opportunities for basic grade workers becoming available within specialist units. However, from both a managerial and individual point of view there are other arguments against such possible changes:

> "If staff are modality-specific then there is no cross-over between them, it could lead to difficult situations departmentally. I think staff will get bored doing the one thing."
>
> Radiography Manager.

There was general agreement that staff with limited skills would be inflexible and, ultimately, less cost-effective than staff trained in a wider variety of procedures. They believed that effective use of the newer technologies required highly skilled operators, even if the human-machine interface is designed to be as user-friendly as possible.

2.4.6 Computing skills

The increasing use of computer-controlled equipment has naturally led managers to see this as a live issue. In addition to control of the equipment itself, there are additional specialist activities such as image manipulation that are computer-controlled. Computer literacy therefore was a subject that produced a range of opinions, but the prevalent view was that both radiologists and radiographers will need to become more computer literate. Both radiologists and radiographers expressed the view that members of their professions will need to be both increasingly technically competent and increasingly computer literate:

> "We need to press a lot more buttons. I think the old fashioned concept of a chap sitting in an office in a darkened room and looking at chest x-rays is dead. Medical training before radiology will get tougher. A new type of person must want to do radiology now that therapeutic radiology is growing. "
>
> Radiologist.

> "Radiographers will have to be computer literate. They have always been good at the technical skills and should continue to be good at (this) and not compete medically with radiologists and not become pseudo doctors."
>
> Radiography Manager.

However, some interviewees pointed to the fact that most software these days is increasingly user-friendly:

> "People say you've got to have more computer skills these days but in fact if you look at the software you don't need to have computer skills."
>
> Radiologist.

Despite this, references to 'computer skills' 'computer-literacy' and the like were repeatedly made by respondents.

2.4.7 Role overlap, flexibility and changing job demands

As discussed in Chapter 1 the term 'skill mix' has been used to describe either the particular mixture of skills within an individual or within a team of mixed professionals. In the interviews reported here, respondent concerns lay mainly with the mixture of skills required in teams, and in particular the implications of this for training of radiographers to meet increased skill demands. As already noted, increasing work demands placed upon radiologists have led to a situation in which radiographers are increasingly required to take over many of the tasks which traditionally were performed by radiologists. Movement of responsibility for certain tasks at the interface between radiologist and radiographer has led to what is now referred to as 'the extended role' of the radiographer. This term is used to indicate a situation in which radiographers undertake activities that previously would have been the sole responsibility of a medical practitioner, such as image reporting and intravenous injections. These situations frequently arise as a consequence of radiology departments seeking a more flexible combination of skills across the different professional groups to meet the shortfall caused by limited resources. The extent to which changes have taken place varies from hospital to hospital. There was no consistent pattern to developments; local situations typically dictate the development of protocols. Radiographers generally have seen such changes in a positive light, and have welcomed the opportunity to take on more demanding, and, hence, professionally and personally more rewarding, activities.

Areas identified in which demand already had led to radiographers becoming involved were barium studies and contrast injections. In these areas it was suggested that change had been so endemic that within five years barium studies and intra venous (IV) injections would form part of the standard job description for radiographers:

> We used to have medical staff injecting contrast but now we have radiographers"
>
> Radiography Manager.

> "It may well be that five years down the road it's standard that radiographers do barium enema examinations. You would ensure when you employed people that it was in their contract of employment that they did barium enemas and IV injections."
>
> Radiography Manager.

In general, most managers welcomed the increase in scope of practice. Ultrasound was cited by several respondents as an area which exemplified the way in which responsibilities would change in future:

> “Skill mix will be upwards. A radiologist should be available in general ultrasound but if the radiologist is late then the radiographer does it.”
>
> Radiography Manager.

> “At one time a radiographer assisted a radiologist in ultrasound....now a helper assists the radiographer. “
>
> Radiography Manager.

The shift in radiologist/radiographer boundary has had further ‘knock-on’ effects. Some radiography tasks have had to be transferred to other groups of staff in order to prevent radiographers suffering from role overload. Clearly in such situations there is a need to achieve a balance between what is expected of different groups of staff, the skills available within that group of staff, the development and career opportunities provided by such role changes, and the sheer volume and level of work demanded of the different groups. In the following interview excerpt there is a concern voiced for adequate training to perform the extended role, an acknowledgement that there is a limit to the extent to which tasks can be pushed down the line, and recognition of limits to the extent to which one can continue to expect individuals to take on tasks that were once outside their remit as a means to avoid resourcing shortfalls.

> “A lot is learnt by sitting next to Nelly but there is a gap in the formal side of things. There has to be a concentration on the [already] qualified person, that is where the current skills gap is. In about five years time ... it will be time to consider (changing the curriculum) for new students.”
>
> Radiography Manager.

Two main points emerge here. Firstly, the recognition by practitioners that there are quality assurance issues concerning training and development to equip radiographers to take on new roles that are not adequately addressed within the current local ad hoc responses to changing demands. Secondly, the comments such as the one above indicates that there is a need to prioritise development for existing staff to meet skill shortfalls rather than changing arrangements for pre-registration training in the short-term. Together, these two issues indicate that there is a need for formal continuing professional development provision to address issues around the changing radiographer role. However, while such development opportunities may be welcomed by many, if such expectations for radiographers to take on additional job activities were to reach unreasonable levels, then potentially radiographers may see future job demands less as opportunities for personal development and more as unreasonable expectations by employers:

> "If you are short of staff, people will start to say that is not my job. You can only reduce the staff so much. People will begin to make excuses - 'I have not got time to do it'."
>
> Radiography Manager.

Therefore there are several issues linked to the central issue of the extended role and skill-mix. Both training and resourcing levels need to be adequate. Skill-mix cannot be used as a means to overcome fundamental skill shortages. Where people take on additional roles they must have both adequate training and adequate time to undertake the tasks. It is not possible to make extensive changes to role responsibilities without first considering training and resourcing issues.

2.4.8 Imaging in the Community

Any moves to locate imaging services within the community were seen as likely to influence future developments. The type of technology available within such arrangements and the level of independence required of the radiographer would influence any future consideration of changing skill needs. Respondents could see few benefits apart from reduced travelling times for patients, but could foresee difficulties arising from such arrangements. The general view was that providing services 'in the community' potentially risks quality and could result in misdiagnosis and duplication.

2.5 Implications and Limitations of the Study

This study was conducted with a sample of managers, radiologists and imaging company representatives based within a 30 mile radius of the University of Hertfordshire. The overall study, in effect, was comprised of a series of individual case studies. The challenge of this type of study was recognised by Robson (1993) as one of creating an accurate and coherent picture of the topic. In order to try and create a coherent picture of the impact of technology on imaging, managers and radiologists were selected for interview as the leaders of their particular communities within the local area. A limitation of this approach was that the findings could not be generalised as being representative of the national picture of imaging developments. In contrast to the local perspective, the picture provided by the company personnel provided a wider picture of the hardware developments internationally as the interviewees represented companies that were world leaders in the imaging field. Their contribution provided a valid input and gave a wider picture on hardware developments that could impact on local imaging communities.

The semi-structured approach enabled the interviewer to explore issues in depth. However, it was important to allow the respondents to develop their answers without giving any prompts that could be interpreted as an 'expected in answer' which would

have limited the value of the study. A further limitation of the approach was the time involved both with interviews and analysis but it was a good investment as the study provided the basis for the remainder of the research to progress.

Overall and despite potential limitations, the study provided a useful baseline from which the other aspects of the research were developed.

2.6 Summary

The purpose of the research was firstly to investigate the impact of developing technology on diagnostic imaging in terms of both the attendant changes to imaging practice and skill-mix requirements; and secondly to identify perceptions of education and training requirements needed to respond to such changes.

In identifying factors that had resulted in changes to work practices most interviewees mentioned particular imaging modalities rather than general structural, political or resource-related issues. In general, respondents believed that the use of most modalities would continue to expand.

When asked about the likely implications of new technology for skill requirements most clinicians predicted that there would be increasing demand for skills in what are viewed as the specialist modalities. Multiple investigations using more than one modality were frequently requested, and therefore increased demand was being seen across all imaging services. The implications appear to be that many more radiographers will need either to acquire new skills in modalities other than X-rays or in areas of activity currently the province of radiologists, or, most likely, both. It is likely that demand will dictate that the skills of existing workers are updated and programmes will need to cater for the needs of this group.

In terms of acquisition of new skills recognised as being the province of radiologists, areas identified by radiographers and radiologists were: barium studies, the giving of contrast media and isotope injections, image interpretation and reporting, and these areas were likely soon to be viewed as part of the standard job requirements for radiographers. Additional areas mentioned were responsibility for deciding on the termination of examinations and for identifying pathology. In terms of the best focus for future development of courses in image interpretation, some suggested a need to focus on anatomy and pathology, while others suggested an emphasis on pattern recognition skills. Most likely a balance of input across these areas are necessary.

Some radiography managers commented on the fact that career patterns are changing, with some opportunities for newly-qualified workers becoming available within specialist units. If those departments operating these more unconventional career paths discover that their needs are not being met adequately by current pre-

registration training, then it is likely that more pressure will be seen in the near future to reform the structure of present training programmes in order to offer early specialisation. Therefore if a basic radiography degree continues to provide adequately prepared persons for specialist posts then we may continue to see support from practitioners for this pattern of development; on the other hand if those departments operating career paths that depart from the norm start to discover that their needs are not being met adequately by the status quo, then there may be more pressure to reform the structure of present training programmes to offer more chances to specialise early on. However, clearly more research is required to determine the extent to which career paths are changing and to the extent to which specialist modalities are offered within radiology departments or as independent units or even as services within the community, rather than in acute hospitals. In addition the extent to which post-registration training is able to provide adequate quantity and depth of development of specialist skills needs to be understood before it is possible to make further recommendations for future developments in regard to this aspect of education and pre-registration training. Clearly each of these issues could have an impact on decisions regarding whether to allow increasing levels of specialisation within pre-registration courses in the future.

A general issue arising within the broad arena of new skill needs was ‘computer skills’ and ‘computer-literacy’. With hindsight it was clearly remiss not to request respondents to explain their use of such phrases; however it appears that they indicate that at the very least some familiarity with computer-controlled equipment is viewed as essential. While it is unlikely that any recent students would graduate without such skills, for older radiographers there may be specific development needs in this area, particularly with the increasing introduction of digital radiography equipment. However, before any decisions can be made concerning what is really required in terms of these skills, more information would be needed in order to discover exactly what service managers mean when they use terms such as ‘computer literate’. If, as seems likely, it means only the ability to work with computer-controlled equipment, then short introductory courses, possibly organised by the equipment manufacturers themselves, may be all that is needed. Liaison with designers and manufacturers of imaging hardware will be necessary to indicate the extent of change to human-computer interfaces for this technology that are planned for the future.

There were concerns regarding potential role overload. While there are career development opportunities presented by role extension, there were also concerns regarding the extent to which tasks can continue to be transferred to other (usually lower-paid) groups of workers or assistants as a means of dealing with staff shortages

and overwork amongst medical personnel. Interviewees felt there was a limit to the extent to which individuals could be expected to continue to take on additional tasks outside their original job description as a means of avoiding resourcing shortfalls. Skill-mix should not be used as a means to overcome more fundamental skill shortages. Resourcing was essentially linked to many of the issues mentioned. In particular interviewees were clear that where people take on additional roles they must have both adequate training and adequate time to undertake the tasks.

The extent of role development and /or extension has been dictated by local rather than national initiatives and therefore has been relatively ad hoc in nature. In effect, developments have been passive in that practitioners have taken on new roles in response to changes which may not have been supported by corresponding national developments in education and training. Resourcing is essentially linked to many of the issues mentioned. Where people take on additional roles they need both adequate training and adequate time to assimilate the tasks.

Rapid technological change combined with increasing workloads make it likely that many radiographers will need skills over and above those developed either as part of the older diploma or current degree programmes. However, none of the interviewees commented on the need to ensure professional updating.

Whether or not such role developments have been effective is as yet unclear. Pressure from conflicting demands must result in practitioners evaluating their roles in a manner which has not previously been undertaken. In principle, it should be possible to compare the relative clinical and cost-efficiency of the different professional groups. These larger questions of effectiveness do need to be investigated.

The need for change in the education and training provided for both radiographers and radiologists was widely recognised by all respondents. Requirements were seen as being dictated by changing skill needs arising from role evolution, which in turn were viewed as arising from changes to technology. Interviewees believed that changes were needed to both initial training and workplace development to support the greater involvement of radiographers in image interpretation and reporting. The need for development was urgent in certain areas especially where image interpretation was becoming an accepted part of the radiographers' role. In accident and emergency imaging the importance of anatomy and pathology to support the developing role of the radiographer in interpretation was especially recognised.

There was virtually no support for pre-registration training in a single specialist modality. There could well be a wider consensus on this important issue as the same views were expressed by a majority of radiologists and radiographers in a study

conducted by Price, High and Miller (1997). Interviewees argued that the appropriate time for specialisation was after basic radiography training, and that this still provided the most appropriate form of preliminary training, despite a growing proliferation of specialist jobs. However, level of demand indicates that it will not be sufficient to change only pre-registration programmes. It is likely that demand will dictate that the skills of existing workers are updated and programmes will need to cater for the needs of this group. In discussing the education and training necessary to support radiographers working in specialist modalities, interviewees argued that even when working exclusively within a single modality, staff perform more effectively when they have a background knowledge of other modalities. The appropriate time for specialisation was after basic training with the view that radiographers will, or at least should, continue to follow a career path that commences with a basic grade radiographer post and then allows subsequent specialisation into a modality such as nuclear medicine or ultrasound.

Increasing work demands placed upon radiologists were giving rise to situations in which radiographers were required to extend their role to take over some tasks which traditionally were performed by radiologists such as barium enemas, image reporting, responsibility for deciding on the termination of examinations and intravenous (IV) injections. These situations frequently arose as a consequence of departments seeking a more flexible combination of skills across the different professional groups to meet the shortfall caused by limited resources. The extent to which changes have taken place varied from hospital to hospital. There was no consistent pattern to developments and local situations typically dictated the development of protocols. It was suggested, however, that change had been so endemic that by the 2005 barium studies and IV injections would form part of the standard job description for radiographers.

Overall, while development opportunities were, on the whole, welcomed, there was a need to achieve a balance between what is expected of different groups of staff, their development and career opportunities and the sheer volume and level of work demanded of the different groups.

The re-distribution of workloads alone will not reduce the total amount of work and there will be a limit to the extent to which tasks can be pushed ‘down the line’ without re-structuring of the workforce. The shift in the radiologist / radiographer boundary will have major implications for imaging services, three key areas are:

- the extent that individuals can continue to take on tasks that were once outside their remit as a means to avoid resourcing shortfalls

- resourcing and availability and adequacy of CPD for existing and new roles
- the need for adequate time to assimilate the tasks and gain experience where staff take on additional roles.

As diagnostic imaging technology continues to evolve, there will be a significant impact on practice, skill-mix requirements and management policies for the foreseeable future. The combination of developing technologies and continuing NHS reforms are setting an agenda that will determine the requirements of role development in radiography for some time to come.

To investigate the extent to which roles of radiographers were evolving nationally, cross sectional surveys were conducted and are reported in the next chapter.

CHAPTER 3

CROSS-SECTIONAL STUDY OF EXTENDED ROLES IN DIAGNOSTIC IMAGING

3.1 Background

This chapter reports the outcomes of surveys of extended roles of radiographers at acute NHS trusts in the UK and reviews the changes that took place between 1998 and 2000.

Opportunities for radiographers to develop and extend their role have been discussed by a number of authors including Craven and Barber (1995), Williams (1996) and Chapman (1997). The literature also reveals a number of specific examples of radiographers adopting new tasks: Loughran (1994), Bates, Conlon and Irving (1994), Nuttall (1995), Pauli et al 1996), and Robinson (1996). Work carried out between 1995 and 1997 on behalf of the College of Radiographers and the Council for Professions Supplementary to Medicine (Price, High and Miller 1997), indicated that there were heightened expectations of radiographers to extend their roles. These examples however were reported at individual locations rather than across the United Kingdom as a whole. The research reported in Chapter 2 exploring the potential impact of changes to technology on skill requirements in radiography departments also was conducted within a limited geographical area.

There have been two notable exceptions that sought evidence of the adoption of extended roles on a wider front. One is the survey conducted by Paterson (1995) who reported that radiographers' roles were changing and were encroaching on work traditionally undertaken by radiologists. The second is work by McKenzie et al (1998) who surveyed 100 radiology departments across the UK and reported that radiographer-performed barium enemas took place in 49 trusts. If, as Paterson suggested, roles were developing rapidly then there needed to be a clear picture of the extent and the range of activities being undertaken by radiographers so that the consequences for education and for service delivery could be assessed. Additionally, neither was there any clear evidence as to why the scope the roles of radiographers were extending, although, there is some literature that provides clues as to the nature of the factors that encourage adoption and diffusion of extended role activities. One factor may be that the number of radiologists in the UK has failed to keep pace with demands arising from the development of new imaging methods and 'time-consuming' interventional procedures. Indeed, this point was commented upon by Chapman (1997) who noted the fact that radiographers were undertaking many of the tasks traditionally undertaken by radiologists. Williams (1996) suggested the increase in

radiographer activity has been detrimental to radiologist training as there is less consultant time available because of their input into training radiographers.

In order to investigate the adoption and diffusion and hence the extent and scope of changes to radiographic practice, two cross sectional studies were undertaken over a two year period.

3.2 Purpose

The purpose of the two surveys was to:

- map the adoption and diffusion of extended role activities across the United Kingdom from 1998 to 2000;
- identify any regional patterns of development;
- inform curriculum development needs.

3.3 Methodology

3.3.1 Participants

The study sample consisted of managers of UK imaging departments at NHS acute trusts. Imaging managers were selected such that their position within the organisation would enable them to provide accurate and authoritative responses to the questions asked.

NHS trusts were identified from the Institute of Health Services Management Year Book; the editions used were current for the years of the surveys. Only the acute NHS trusts were included as by far the majority of diagnostic radiographers practise in that sector. All these trusts were included in the surveys. As the surveys were targeted at the total population this would ensure that the responses were as representative as possible.

In the intervening period between surveys there was a reorganisation of NHS boundaries in England. A number of trusts merged and regional configuration changed in four areas. Therefore the first survey included 278 acute trusts but for the second survey this number was reduced to 253. Four of the NHS regions changed. Health authorities that were formerly the two Thames regions (but geographically within London) formed the new London Region. The new Eastern Region was formed by health authorities in East Anglia and those from the North Thames Region geographically outside London. The South East Region was formed by those health authorities formerly within South Thames and the Oxford part of the Anglia and Oxford Region and Hampshire and the Isle of Wight. The South West region remained the same but for the exclusion of Hampshire and the Isle of Wight. In the second survey trusts were grouped under the new regional boundaries.

3.3.2 Materials and questionnaire design

A structured questionnaire was utilised for the two cross-sectional studies. The first survey provided a baseline from which to enable comparisons over time.

The questionnaires started by asking for basic demographic information. In formulating questions about extended role activities, these activities were identified as those that had traditionally been undertaken by medical practitioners but were now also practised by radiographers. The activities were identified from those which had been reported in the literature, especially from the work of Paterson (1995) and Price, High and Miller (1997) and, in addition, from those identified in the research reported in Chapter 2. Specifically, these were: the administration of intravenous (IV) injections, barium enemas and image reporting. Information was also sought on the number of trusts and radiographers operating a 'red dot' system. This system, first described by Cheyne, Field-Boden, Wilson and Hall (1987) involves radiographers placing a coloured dot on films, which they believe to reveal abnormalities, to alert medical staff to the presence of pathology. While this is typically not seen as an 'extended role' task, it could be viewed as a precursor to reporting and therefore was included. The last question enquired whether there were any other extended role tasks undertaken and, if so, managers were asked to specify what they were.

Overall the questionnaire used in survey one consisted of seven main questions. The first two asked whether the trust was classified as teaching or non-teaching; the region in which the trust was located, selected from the options provided. These were the English health regions plus Northern Ireland, Scotland and Wales. Questions 3 to 6 each sought information on IV injections, red dot schemes, barium enemas and image reporting. The image reporting category was divided into nine sub-categories; axial skeleton, appendicular skeleton, chest, paediatric, mammography, ultrasound, barium enemas, nuclear medicine and other.

Each question (including the reporting categories) comprised of two parts, firstly, whether the particular role was undertaken by radiographers and if yes, what was the year the task had been adopted. The full questionnaire is shown in Appendix 5.

There were some amendments made to the second questionnaire as a consequence of the analysis of the data produced from the first study. Respondents were asked to give the year of implementation of a task if after the 1st July 1998 which was the time of the first survey. In the second questionnaire an additional question was included which asked for the number of radiographers undertaking each activity and a further question asking for the total full time equivalent radiographers and radiologists working at each trust. Nevertheless each questionnaire was of a comparable format and covered similar ground. The questionnaire for survey two is presented in Appendix 6.

It was apparent that while the questionnaires would map any changes taking place there was little scope for exploring issues in detail such as factors encouraging or preventing the adoption of extended roles. This became clearer after analysis of the first questionnaire. Therefore, in order to explore issues in more detail, the cover letter enclosed with the second questionnaire also asked whether the manager would be willing to be interviewed on issues influencing the adoption and diffusion of extended roles and their consequences. This work is presented in Chapter 4.

The questionnaire for survey 2 consisted of two parts, the first section sought information on extended roles as described above while part 2 sought information on the education and training provided in support of extended roles. The results of the education and training survey are reported in Chapter 6.

3.3.2. Procedure

Both questionnaires received ethical approval from the Joint Ethics Committee of the Departments of Radiography and Physiotherapy.

For each of the two surveys the questionnaire was placed in envelopes addressed to the Imaging Manager at the named NHS acute trusts. A letter was included with each questionnaire explaining the purpose of the survey. The letter included with the second questionnaire invited the manager to participate further as indicated in the previous section. A pre-paid addressed envelope was also included for ease of return.

3.4 Results

The results are reported from the two surveys in turn. This is because a number of trusts had amalgamated and the boundaries of some health regions had changed. This is then followed by a review and comparison of the findings from each of the two investigations.

3.4.1 Survey 1

Questionnaire returns were received from 233 managers, which represented a response rate of 83% (233/276). Seventy five returns (33%) were from teaching trusts and 155 (67%) from non-teaching trusts. Circulation details and response by region are shown in Table 3.1.

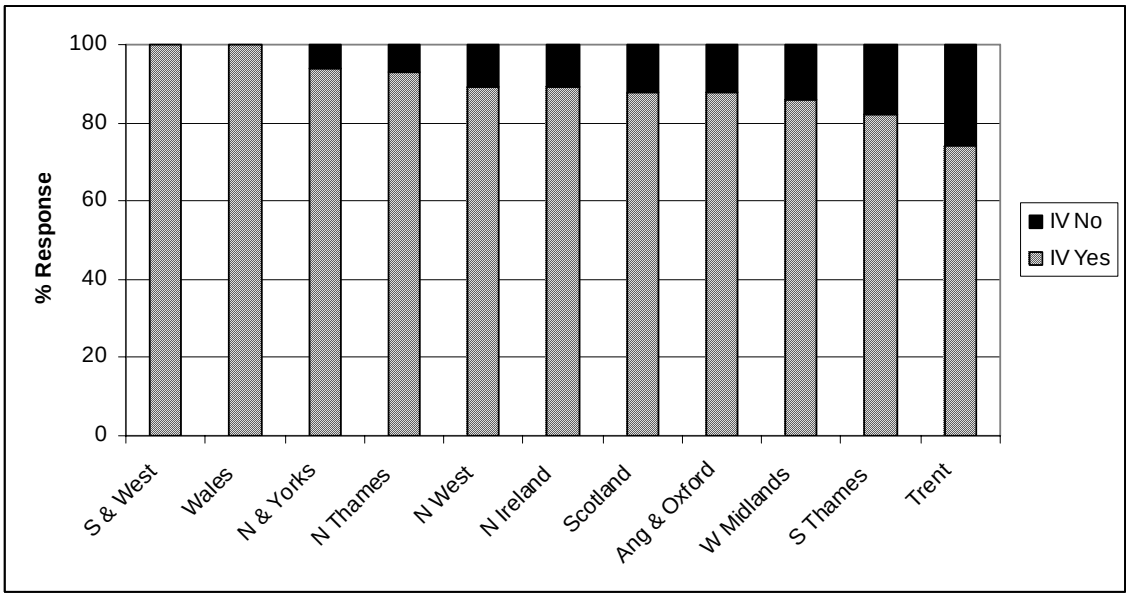
Table 3.1 Response by Region

Health Region	Number sent	Returns	Per cent
South and West	21	21	100
Wales	16	15	94
Scotland	27	25	93
Trent	21	19	90
North West	30	27	90
W. Midlands	24	21	88
North Thames	37	30	81
South Thames	37	28	76
Anglia & Oxford	23	17	74
Northern & Yorks	25	18	72
N. Ireland	15	9	60
Total	**276**	**230**	**83.3**

Intravenous injections

Managers in 205 (89%) reported that radiographers performed intravenous injections. Of the teaching trusts there were 65 trusts (87%) supporting the role and 140 of the non-teaching (90%). Of the returns as a whole the percentage distribution was 28% teaching, 61% non-teaching and 11% not utilising radiographers for this task. The earliest year reported for the implementation was 1980. The year with the highest rate of adoption for this task was 1996 with 49 trusts adopting the procedure. The South & West and Wales were the only regions with 100% diffusion and Trent was the region with the lowest diffusion reported. Figure 3.1 illustrates the percentage of trusts where radiographers undertake IV injections, by region.

Figure 3.1 IV injections participation by region

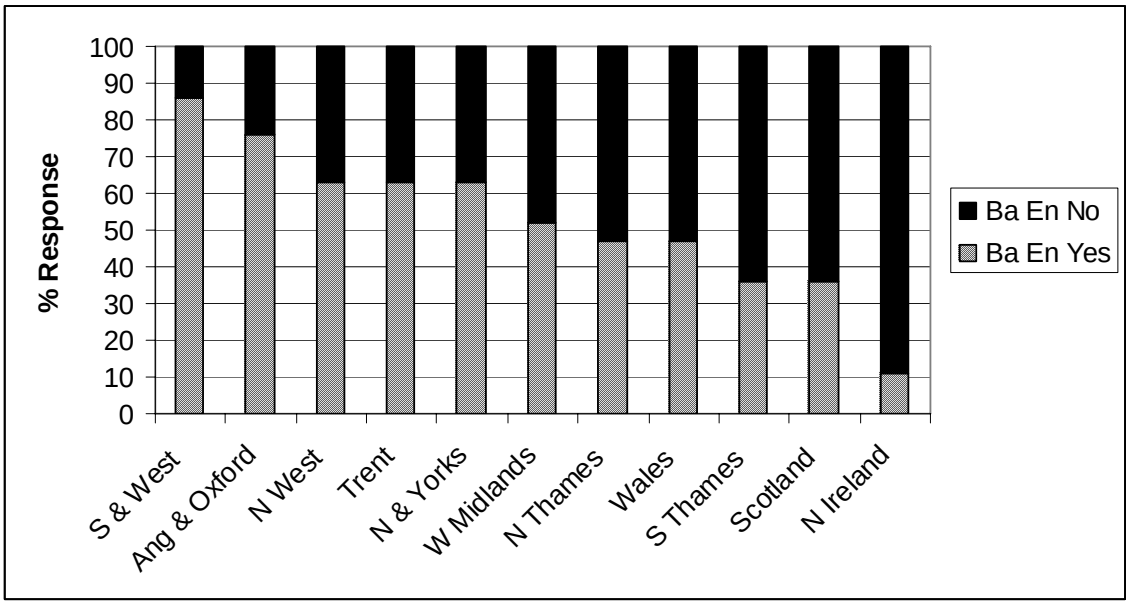


Barium Enemas

Managers in 122 trusts (53%) reported that radiographers undertook barium enemas. Of the teaching trusts there were 34 trusts (45%) supporting this role and 88 of the non-teaching (56%). Of the returns as a whole the percentage distribution for barium enemas was 15% teaching, 38% non-teaching and 47% not utilising radiographers for this task. The earliest reported date for introducing this activity was 1985 and the year with the greatest rate of adoption was 1997 with 38 trusts devolving this task to radiographers.

In no region was the role completely diffused but there was a wide difference between the South & West at 81% and Northern Ireland at 11%. In one South & West Trust the role had been discontinued. Figure 3.2 gives the percentage of trusts where radiographers perform barium enemas by region.

Figure 3.2. Barium Enemas participation by region

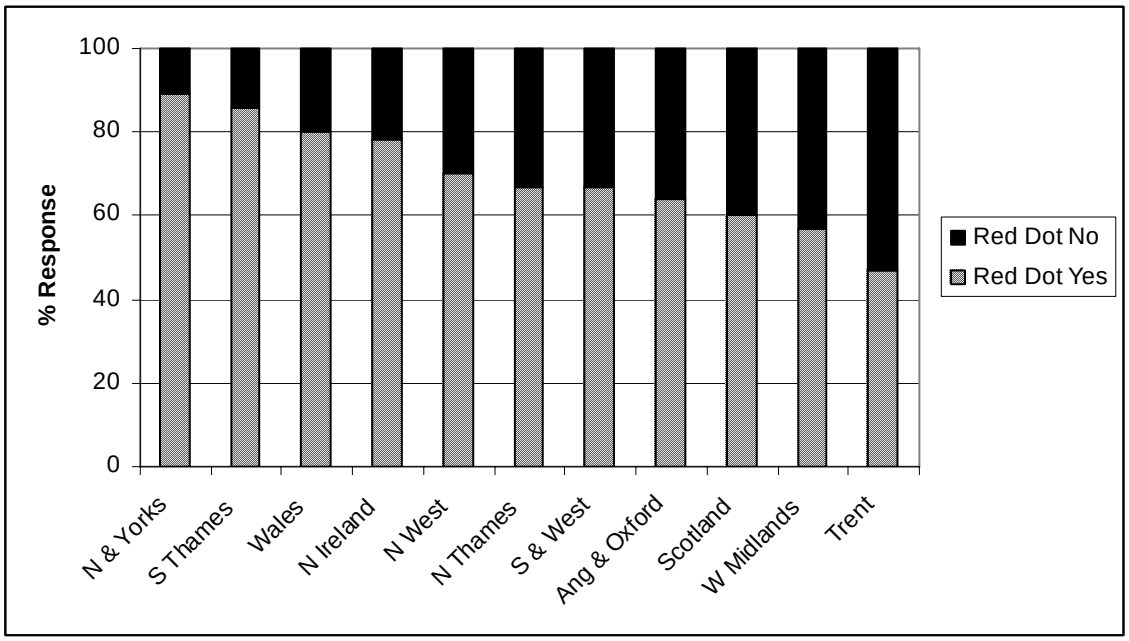


Red-Dot Schemes

Respondents reported that a red dot system was in operation in 162 (70%) of trusts. Of the teaching trusts there were 47 trusts (63%) supporting this role and 115 of the non-teaching (74%). Of the returns as a whole the percentage distribution for red dot was 20% teaching, 50% non-teaching and 30% of trusts were not utilising radiographers for this task. The earliest report of the adoption of a red dot system was 1966. This is interesting because it precedes 1984, the date normally acknowledged for its commencement (Berman et al, 1985). The year in which the largest number of trusts reported adoption of a red-dot system was 1994 with 21.

Again in no region was the role completely diffused. Northern & Yorkshire had the greatest number of trusts ($>$90%) undertaking the role and Trent the least (42%). The distribution by region is illustrated in Figure 3.3

Figure 3.3. Red-dot schemes participation by region.



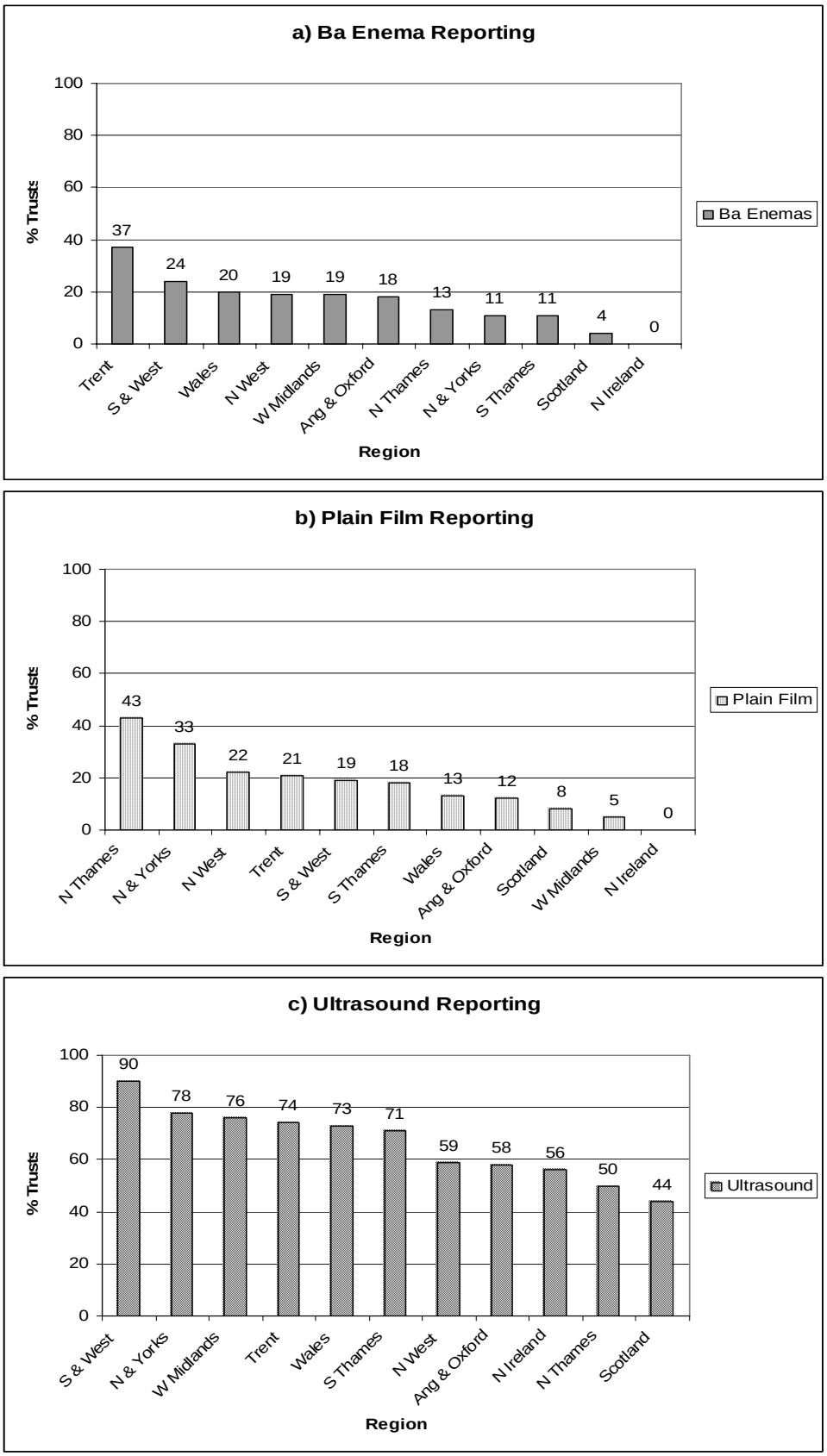
Reporting

Reporting was divided into sub-categories: appendicular skeleton and, axial skeleton; barium enemas; chest; mammography; paediatrics and ultrasound.

With the exception of ultrasound, reporting was the activity that was undertaken the least. Plain film reporting was undertaken by radiographers in 45 trusts (20%), with the earliest date of adoption recorded as 1993 with 1997 being the year of greatest adoption with 15 trusts introducing the activity to radiographers.

In 37 trusts (16%) radiographers reported on barium studies, the earliest year that reporting commenced was 1990 and with 1998 as the greatest year for adoption. Radiographers performed barium enemas in 122 sites but only 37 of these trusts indicated that radiographers reported. For each region, Figure 3.4 shows the extent of reporting in these three categories. The percentage is calculated as a proportion of the total returns for the category from each region.

Figure 3.4 Trusts where radiographers provide reports



In the other reporting categories 10 trusts (4%) stated that radiographers reported on mammograms, in only one trust was there reporting on paediatric films and there were no radiographers reporting chest films. Only 68 (30%) of trusts indicated that no reporting of any kind was undertaken by radiographers.

Other Tasks

Respondents were asked whether radiographers undertook any other tasks that could be classified as an extended role. Thirty-four managers (15%) reported other extended role tasks being undertaken. There was no obvious pattern or trend that could be identified, barium swallows and venography had the greatest frequency. Tasks to emerge are presented in Table 3.2

Table 3.2 Other extended role tasks

Task	Frequency	Task	Frequency
Barium swallows	6	Advice and information	1
Venography	6	Advanced trauma life support	1
Micturating cystograms	4	Cardiac ultrasound	1
Barium meals	2	Bladder measurements	1
Venu puncture/blood tests	2	Endoscopy	1
ERCP	2	Hysterosalpingography	1
Sialograms	2	Lithotripsy	1
Management of patient in MRI	2	Jejunum biopsy	1

3.4.2 Survey 2

Questionnaires were sent to 253 NHS acute trusts. The numbers of trusts circulated were less than in Survey 1 for the reasons stated in 3.3.1.

Returns were received from 172 managers, representing a 68% response rate. Fifty four trusts (32%) were identified as teaching, 115 as non-teaching trusts (68%) and in 3 (1.7%), the status was not provided. There were three returns from the Islands, one return from Jersey, Guernsey and the Isle of Man respectively; these are not included in the presentation of data by region with the exception of Table 3.3.

Table 3.3 Questionnaire response by region

Region	Number sent	Returns	%
South West	18	18	100%
Eastern	19	17	89%
Scotland	28	20	71%
North West	28	19	68%
Trent	21	14	67%
Northern & Yorks	23	15	65%
South Eastern	32	21	66%
West Midlands	24	15	63%
London	28	16	57%
Wales	16	9	56%
N Ireland	12	6	50%
Islands	3	1	33%
Not stated	(1)	1	-
Total	**253**	**172**	

In survey two it was decided to explore whether there was any association between the adoption of extended role tasks at teaching and non-teaching trusts as one possible reason for any difference. This was because it was hypothesised that any difference might be attributable to a limitation of extended roles at teaching trusts because of the need to train junior radiologists. Therefore, for each activity a Chi-square test was performed to explore any association between performing the extended role activity and the type of hospital (teaching or non-teaching). The significance level for rejection of the null hypothesis (no association) was set at the 5% level.

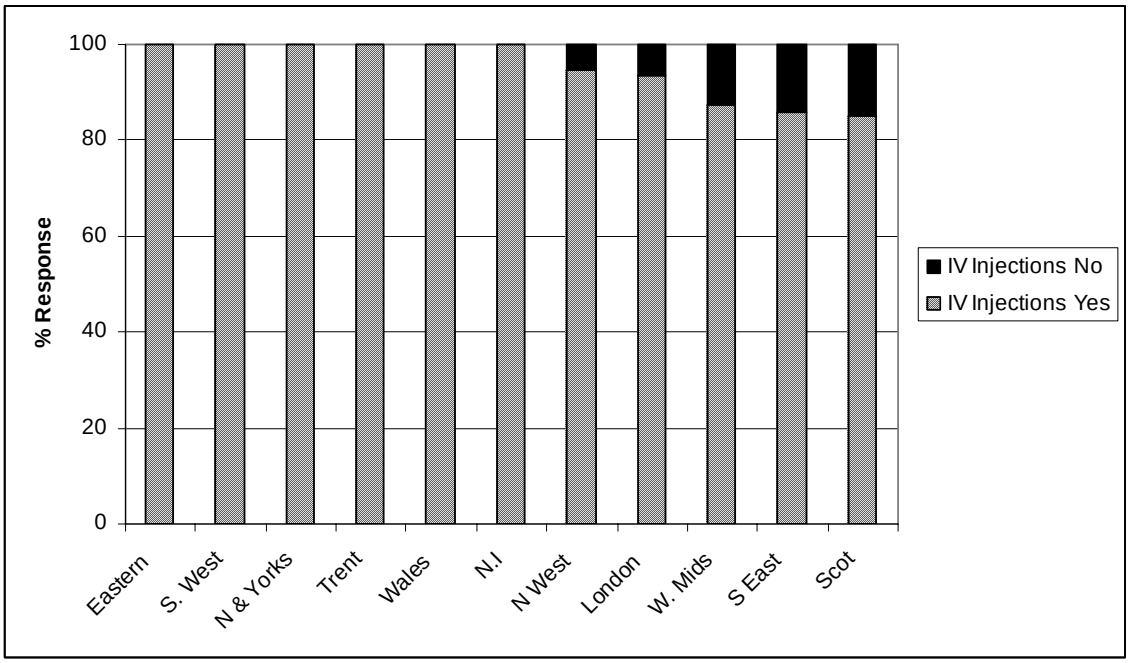
Intravenous injections

One hundred and sixty one managers (93.6%) reported that radiographers in their hospital performed intravenous injections. 109 (95%) of non-teaching trusts and 49 (91%) of teaching trusts reported that radiographers undertook this activity. There was no statistically significant difference between teaching and non-teaching trusts for this activity [$\chi^2 = 0.43$, df = 1, $P = ns$].

The number of radiographers providing IV injections from the sample was 1,544. Regional variation in performance of this activity is shown in Figure 3.5.

It is noteworthy that in just one year the number of regions with 100% giving intravenous injections went up from 2 to 6.

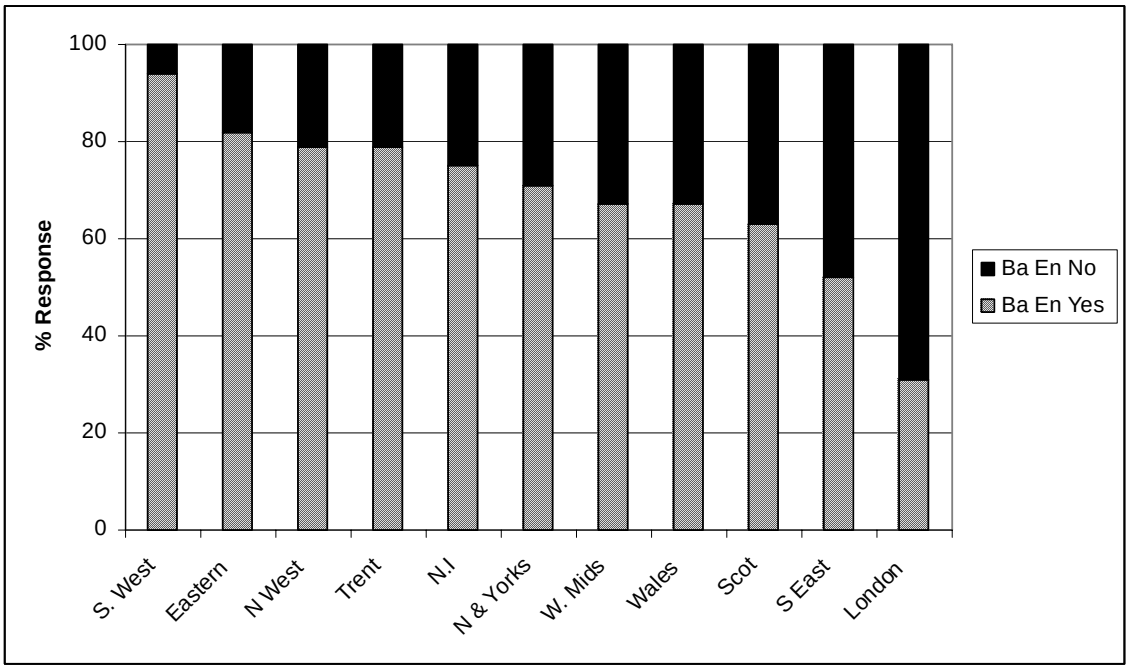
Figure 3.5 IV injections participation by region



Barium Enemas

One hundred and nineteen managers (69%) reported that, in their hospital, radiographers conducted barium enemas. Barium enemas were found to be significantly more likely to be conducted by radiographers working in non-teaching trusts than in teaching trusts, with 86 non-teaching trusts (75%) and 30 teaching trusts (55%) [χ^2 = 6.055, df = 1, *P*= 0.014] reporting radiographer involvement in this activity. A total of 322 radiographers were reported as currently being involved in undertaking barium enemas. Regional variation for this activity is shown in Figure 3.6.

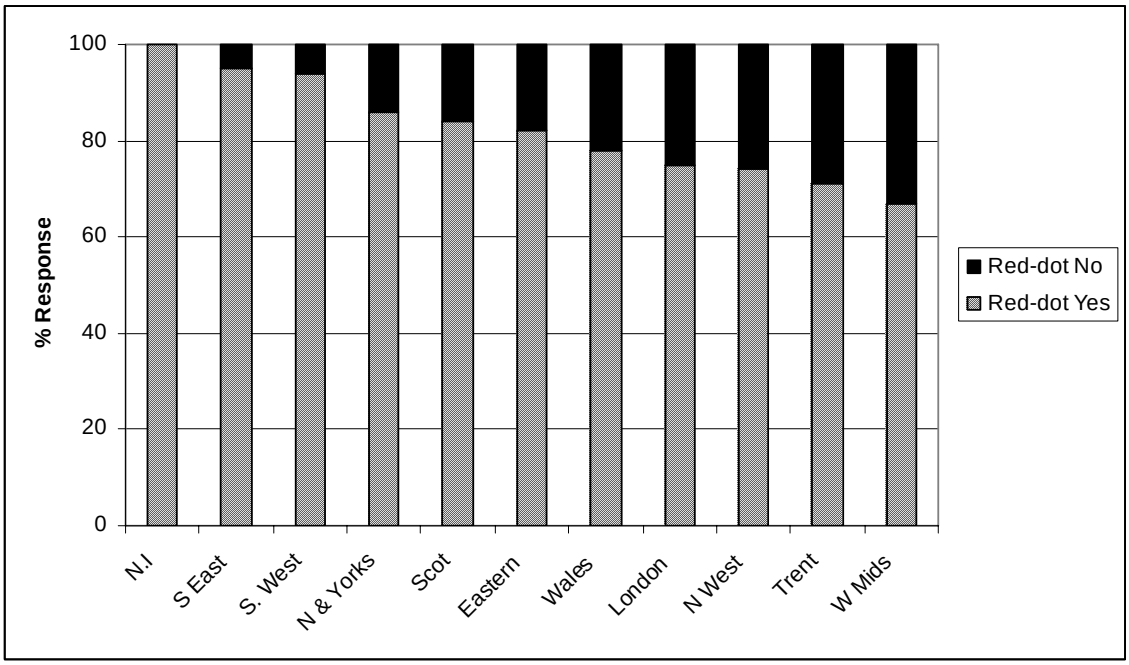
Figure 3.6 Barium enemas participation by region



Red Dot Schemes

One hundred and forty one respondents (82%) reported that a red dot system was in operation. Of these, 99 non-teaching trusts (86%) and 39 teaching trusts (72%) reported radiographers undertook the activity. Again, the rate of radiographer involvement in this activity at non–teaching trusts was significantly greater than at teaching trusts [χ^2 = 3.836, df (1), *P*= 0.05]. The regional variation is shown in Figure 7. The number of radiographers participating in red-dot schemes totalled 3,040. Regional variation for this activity is shown in Figure 3.7.

Figure 3.7 Red dot schemes participation by region



Reporting

Reporting was divided into sub-categories: appendicular skeleton, axial skeleton, barium enemas, chest, mammography, paediatrics and ultrasound. The distribution of reporting sub categories, dates of implementation, and the year with the greatest frequency of adoption and the number of radiographers involved are shown in Table 3.4.

Table 3.4 Reporting by radiographers

Reporting Activity	First introduced	Year with greatest frequency of adoption	Radiographers involved	Trusts under-taking activity	% of Total (N=172)
Ultrasound	1973	1997 - 15	600	124	72.1
Appendicular skeleton	1993	1998 – 15 trusts	91	43	25.0
Barium enemas	1993	1998 -		34	19.8
Axial skeleton	1995		38	20	11.6
Mammography	1989	2000 - 7	31	18	10.5
Nuclear medicine	pre-1997	2000 - 2	14	10	5.8
Paediatrics	1997	-	9	6	3.5
Chest	Pre-1998	-	17	2	1.2
CT (head)	Post 1998	-	1	1	0.6
IVU + urodynamics	Post 1998	-	1	1	0.6
Venography	Post 1998	-	1	1	0.6
Intra-occular foreign body	-	-		1	0.6

With the exception of ultrasound, reporting was again the least-frequently undertaken activity. Reporting of the appendicular skeleton took place in 43 trusts (25%), while in a further two trusts radiographers were undergoing training prior to taking on these reporting duties. Reporting of the axial skeleton was undertaken in 20 trusts (11.6%) and again there were a further two trusts with radiographers in training. There was no significant difference between teaching or non-teaching trusts for extent of radiographer involvement in any reporting category (axial skeleton $\chi^2 = 1.538$, $P = ns$, appendicuar skeleton $\chi^2 = 2.165$, P = ns, barium enema $\chi^2 = 0.01$, $P= ns$, paediatric $\chi^2 = 0$, $P = ns$, mammography $\chi^2 = 0$, $P = ns$, nuclear medicine $\chi^2 = 1.094$, $P = ns$ and ultrasound $\chi^2 = 0.835$, $P = ns$).

Thirty four managers (20%) indicated that radiographers reported on barium studies. Figures 3.8, 3.9 and 3.10 show the variation across each region for the reporting categories of ultrasound, appendicular skeleton, axial skeleton and barium enemas.

Figure 3.8 Ultrasound reporting participation by region

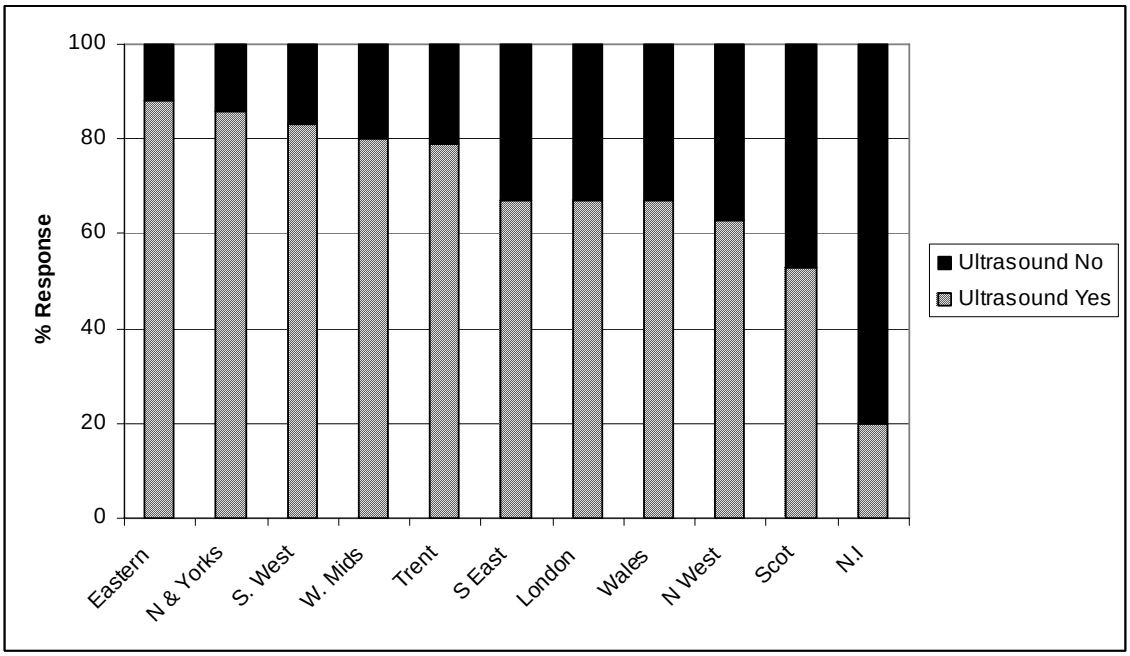


Figure 3.9 Plain film reporting participation by region

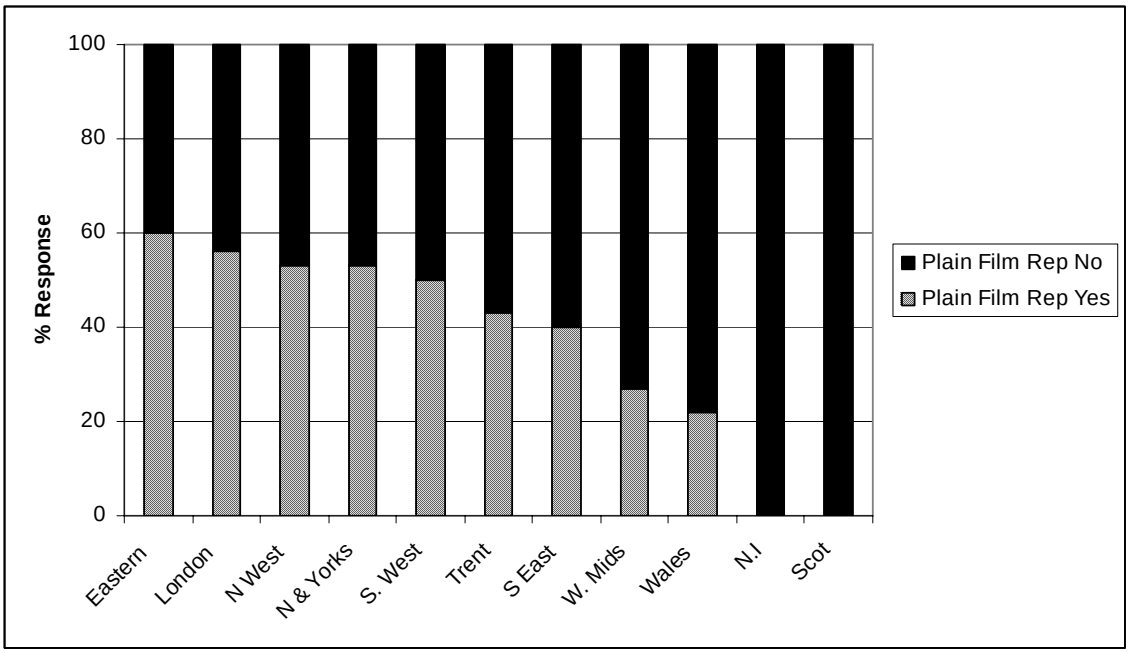
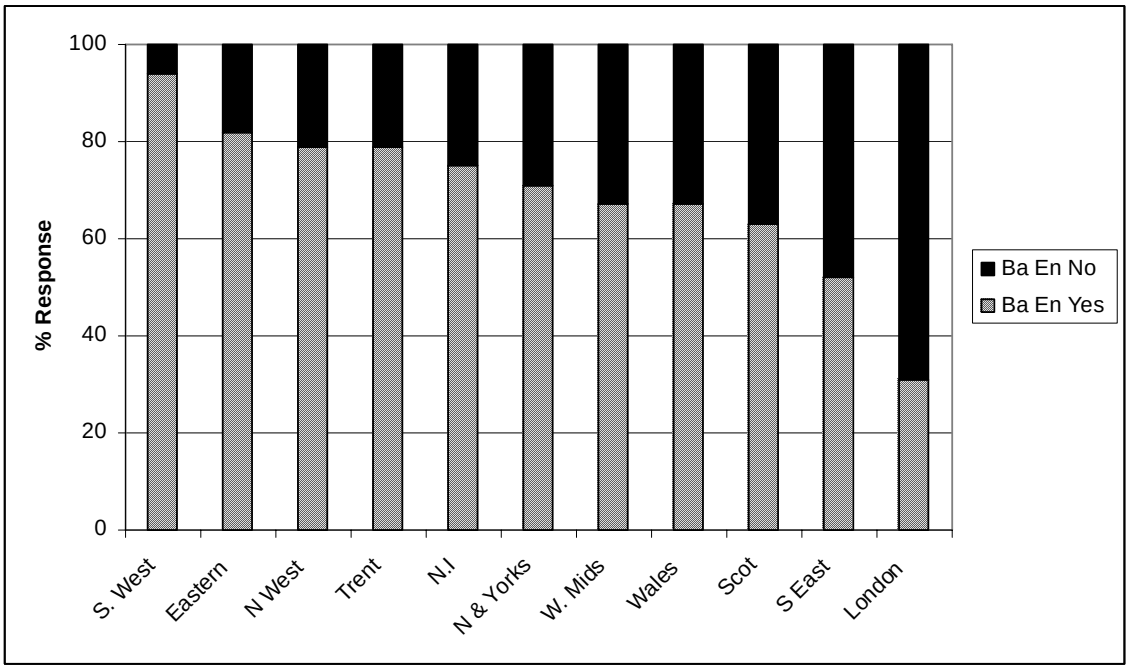


Figure 3.10 Barium enema reporting participation by region



Only 35 trusts (20%) indicated that no reporting of any kind was undertaken by radiographers.

Other Tasks

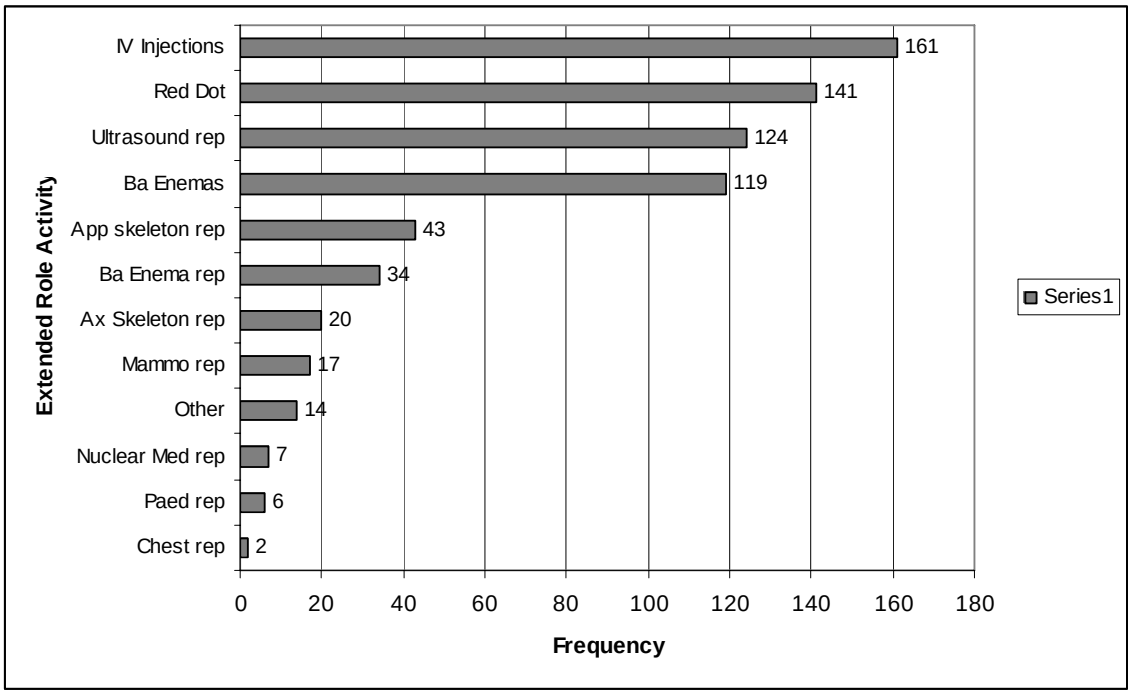
Thirty five respondents (20%) indicated that radiographers had adopted other extended role activities since 1998. No obvious pattern or trend was identified. Additional tasks identified by respondents are presented in Table 3.5.

Table 3.5 Other extended role tasks

Activity	Frequency	Activity	Frequency
Venography	6	Barium meals	1
Ultrasound including: inter-operative, vascular, general abdominal	5	Defaecating proctograms	1
Urodynamics	3	Endoscopy	1
CT without radiologist supervision	2	Hystero-salpingography	1
Radiographer led IVU lists	2	QA management, IT management	1
Video fluoroscopy	2	Screening UPIs	1
Injecting morphine, pethidine, temazepan for interventional studies.	1 1	Selection of appropriate examination referred by nurse practitioner.	1
Injecting Gadolinium in MRI Injecting US contrast	1	Peripherals angiography	1
Authorisation of MRI requests	1	Videofluoroscopy	1

The percentages of all trusts indicating involvement in extended role activities are shown in Figure 3.11.

Figure 3.11 Proportion of activities for sample



Staffing

There was an additional question which arose concerning the nature of the factors that encourage diffusion of extended role activities into radiographic practice. In Chapter 1, a number of sources claimed that the number of radiologists failed to keep pace with demands arising from the development of new imaging modalities and the 'time-consuming' interventional procedures. Chapman (1997) referred to the fact that radiographers undertake many of the tasks traditionally undertaken by radiologists. It was decided to investigate whether there was an association between the number of full time equivalent (FTE) radiologists and radiographers and the likelihood of radiographers adopting extended role activities. Reduced radiologist to radiographer staffing ratios might increase the probability of the latter adopting new tasks. Specifically, if the ratio of radiologists to radiographers was low, a consequence of this could be a higher likelihood of radiographers undertaking extended role tasks. For each activity the median value of the ratio of radiologists to radiographers was compared between trusts where the activity was performed by radiographers and those where the activity was not performed. If there was an association between this ratio and the likelihood of radiographer involvement in extended role activities then the median value would be expected to be lower for those trusts where the activity was undertaken by radiographers. Median value calculations are shown in Table 3.6.

Table 3.6 Median values of radiologist / radiographer ratio

Activity	Median values (ratio radiologists to radiographers)		Difference
	Activity not undertaken (A+)	Activity undertaken (A-)	(A+)-(A-)
IV injections	0.208	0.200	0.008
US reporting	0.208	0.200	0.008
Barium enemas	0.208	0.200	0.008
Red-dot	0.196	0.200	-0.004
Axial skeleton reporting	0.200	0.204	-0.004
Appendicular skeleton reporting	0.200	0.208	-0.008

This comparison of ratios indicated that there was no tendency for the radiologist/ radiographer ratios to be lower at those trusts where the activity was undertaken and those where they were not.

3.4.3 Role Extension: Extent of changes from Survey 1 to Survey 2

The situation at the time of Survey 1 did not remain static and in the intervening two year period between the first and second surveys. For each activity, comparison of the rates of radiographer involvement at the time of the first and second surveys revealed a percentage increase, with the sole exception of IV injections, which was already well diffused at the time of Survey 1. The comparisons for IV injections, barium enemas and red dot are shown in Table 3.7 and for reporting in Table 3.8.

Table 3.7 IV, Red-Dot, Barium Enemas: A comparison

Activity	Survey 1	Survey 2
IV injections	**89.1%** (205/230)	**87.8%** (151/172)
Red Dot	**70.4%** (162/230)	**76.4%** (132/172)
Barium enemas	**53.0%** (122/230)	**64.5%** (111/172)

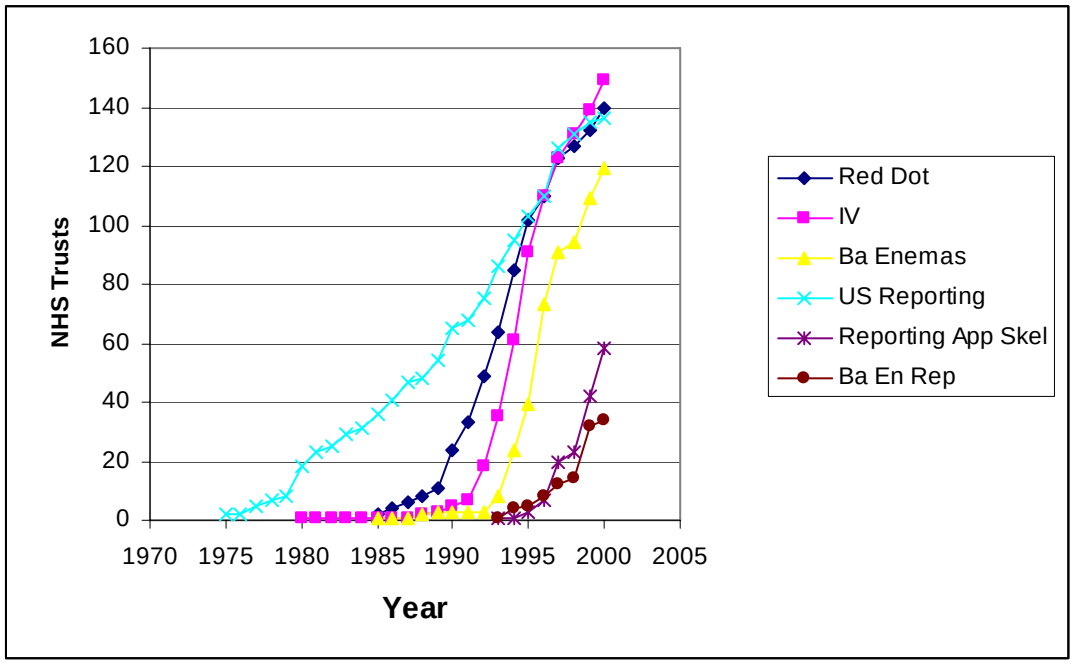
Table 3.8 Reporting: A Comparison

	Survey 1	Survey 2	
Reporting category	**% (of sample)**	**% (of sample)**	**increase since '98 (Trusts)**
Plain film	16.0	36.0	26 (4 in preparation)
Barium enema	16.0	19.7	7
US	65.2	72.2	8
Red dot	70.4	81.5	14
Mammograms	4.3	9.9	7 (5 in preparation)
Nuclear medicine	1.7	6.0	6
Paediatric	0.4	3.4	5

Plain film reporting (appendicular and axial skeleton) was the fastest increasing activity with an increase of 26 sites. For ultrasound reporting, which was already well diffused in 1998, there was also an increase.

Using data from the second survey the adoption and diffusion of IV injections, barium enemas, appendicular skeleton reporting, barium enema reporting, ultrasound reporting, and red-dot systems are shown cumulatively in Figure 3.12.

Figure 3.12 Adoption and diffusion of extended role tasks (cumulative)



Radiographers were active in ultrasound reporting from the mid 1970s. The first two trusts to commence barium enema reporting and appendicular skeleton reporting were in 1993. Radiographer performed barium enemas began at one trust in 1985. This had progressed to 8 trusts by 1993 and there was a rapid increase to 24 in 1994. IV injections were administered by radiographers at one trust in 1980 and progressed

slowly to a total of seven trusts in 1991 but then diffused rapidly throughout the 1990s. Apart from the claim by one manager who reported a red-dot system in 1996 (not shown in Fig. 3.12), two trusts reported commencing the system in 1985, which is consistent with the work of Berman et al (1985) who are acknowledged to have originated the system.

3.5 Implications and Limitations of the Study

The two cross sectional studies produced relatively high returns for postal surveys (83% in Survey 1 and 68% in Survey 2), providing a picture of the rate of adoption and diffusion of extended roles over a two year period. A limitation was that, for reasons of confidentiality, managers were not asked to identify their trusts. Thus it was not possible to produce a longitudinal picture of events by region. Nonetheless, the geographical grouping of trusts, despite some boundary changes, did provide useful data regarding the diffusion of tasks within geographical regions.

A further limitation of the study was the fact that the surveys were designed only to discover whether radiographers reported or not, rather than the circumstances under which radiographers practised and the nature and scope of reports. This limitation arose because a balance had to be achieved between, on the one hand, simplicity of design, to encourage completion and return, and a complex design that would capture more in-depth information but would risk a lower return rate. While the conciseness of the questionnaire led to success in achieving high return rates in both surveys, the response format also meant that it was not possible to gain in-depth responses in order to form a detailed representation of the rationale for developments and any factors that encouraged or discouraged adoption of extended roles. As stated in 3.3.2, to address this limitation, the second survey contained an invitation to managers to take part in an in-depth interview on issues around the implementation and management of extended roles. This work is reported in the next chapter.

3.6 Summary

This study has mapped the adoption and diffusion of extended role activities across the United Kingdom. It has shown that the number of NHS trusts utilising radiographers to undertake tasks which previously had been the role of radiologists has continued to increase. The findings also indicated that the adoption of new tasks by radiographers has been ongoing for some time. While the data now indicates that role extension is widespread across the UK, there is however no evidence to suggest that implementation has been systematic, for example, in response to any centrally organised initiative. Nonetheless there is certainly evidence to suggest that extended roles, if not exactly the norm, are becoming common practice.

There were regional differences across all activities. The largest differences emerged in image reporting, where Northern Ireland and Scotland lagged behind compared to all other regions. The implementation of only two of the tasks considered, barium enemas and red-dot schemes appeared to be associated with teaching or non-teaching status, both tasks were more likely to be introduced at non-teaching trusts. Intravenous injections by radiographers were well diffused across all trusts regardless of status. There would appear to be no conflict with radiologists, it has proved to be advantageous to the patient by improving continuity of care and reducing waiting examination times (Keenan 2001). The frequency of reporting (with the exception of ultrasound) was increasing but had not reached the levels of other fields. This slower rate is likely to reflect its controversial nature and resistance by some radiologists. This latter reason would fit in with Robinson's (1998) view that cultural attitudes cannot be changed quickly. Other extended role tasks were reported by a number of trusts which would appear to be instigated by a particular need at the trust. A further study would be able to identify whether the roles listed were becoming more widespread.

A comparison of the extent to which extended role activities had been adopted by radiographers at teaching and non-teaching trusts revealed that barium enemas and red-dot systems were more likely to be undertaken by radiographers employed at non-teaching trusts. Regarding barium enemas, one possible explanation for this finding could be the need for junior radiologists to be trained in the activity leading both to less need, and fewer opportunities, for radiographers to become involved in this activity. Williams (1996) complained about the lack of consultant time to train junior radiologists at teaching hospitals, and the data reported here do indicate significantly greater radiographer involvement in barium enemas and red-dot systems at non-teaching than at teaching trusts. This is exemplified by the situation pertaining in London where data from the 2000 survey illustrated that five out of 16 trusts declared radiographer involvement in barium enema examinations. Of this group of 16, eight were teaching and eight were non-teaching institutions. In only one of the eight teaching trusts was the task undertaken by radiographers compared to four out of eight of the non-teaching trusts. Regarding red-dot schemes there were more likely to be introduced at non-teaching trusts, a possible reason for this is that at teaching trusts there could be junior or trainee radiologists available to comment immediately on A&E films, thus radiographer input would not be required.

Another issue that was investigated was whether increasing pressure on radiographers arising from reduced radiologist numbers served to increase the likelihood of radiographer uptake of extended role tasks. Contrary to expectations, there was no evidence to suggest that radiographers were more likely to undertake

extended role activities where there were proportionately fewer radiologists in post. Although not assessed in the data reported here, future work should look at the workload indicators. The increase in workload as a consequence of increased capability remains a major issue. The Royal College of Radiologists (2000) claimed that by 2005 the shortage of radiologists will remain approximately 500 short of the number required to carry out the workload being undertaken in 2000. A modest increase in workload of 10%, the number of radiologists required would rise to approximately 750 additional radiologists. Given the likely increase in workload, a key question is whether radiographers can continue to extend their practice and continue to perform the traditional radiographic tasks without a restructuring of the profession. The proposal of the '4-tier model' of practice (Evans, 1999; Department of Health, 2000) could provide the basis for modernisation of the radiographic profession.

Nevertheless, the study has illustrated a shift in practice for radiographers and the indication is that extended roles are becoming embedded in practice. Matching the skills available with the demands of imaging across different staff groups will provide a challenge to manpower planning for delivery of an effective service. It is fairly clear that the adoption and diffusion of extended roles in radiography will continue for some time. The pressure will continue in order to meet the demand for services which is inevitable given the shortage of radiologists claimed by the Royal College of Radiologists (2000) together with a growing demand for radiological services (Department of Health 2000). These are likely to be factors accelerating the introduction of extended role activities rather than reducing them.

The blurring of role boundaries and skill mix within multidisciplinary environments suggests that radiographic education will need to be responsive to the demands of practice in order to meet changing priorities. The reported trends also suggest that radiographers will need to develop skills over and above those developed during pre-registration education and training. The areas of development identified by these surveys help identify where priorities should lie for current continuing professional development initiatives for existing staff as well as for institutions reviewing the undergraduate curricula in radiography. Opportunities also exist for training and education providers to be proactive in supporting and enabling the widening scope of practice. In addition, such developments will necessarily also have implications for modernising and developing the scope of pre-registration education.

Overall, the pattern and rate of adoption of extended role activities fits the observations made by Stevens, Robert, Gabbay (1997). They claimed, firstly that there is a tendency for new health care technologies to be introduced somewhat

haphazardly in the first event. While the data also could support Stevens's second suggestion (that technological diffusion is typically unorganised and occurs at different rates) the factors influencing this, and such claims as ease of adoption and clinical enthusiasm, needs further investigation.

CHAPTER 4

ISSUES INFLUENCING ROLE EXTENSION

4.1 Background

The literature has been surprisingly quiet on issues influencing role extension in imaging at a departmental level. Buchan, Ball and O'May (2000) identified the drivers of skill mix in the health sector generally and the Royal College of Radiologists (1999) suggested roles that could be delegated to suitably trained and properly supervised radiographers. These roles included IV injections, barium examinations, identifying fractures on extremity A&E films and interpretation of ultrasound scans. The surveys reported in Chapter 3 provided evidence that such roles are being introduced, but it was clear there was no organised coherent or strategic change underway. Perhaps this was not surprising given the longstanding demarcation between radiology and radiography. Introducing new ways of working and overcoming a long and established culture and systems of work can be difficult.

Barriers separating professional groups were recognised by the Government in their modernisation agenda with the NHS Plan (Department of Health, 2000) proclaiming that "the old hierarchical ways are giving way to more flexible team working between different clinical professionals" (page 82). The Plan went on to further claim and that "the new approach will shatter old demarcations that have held back staff and slowed down care" (page 86). The Strategy for the Allied Health Professions (2000) announced that by 2004 there would be a first generation of therapist consultants who will have started work. In a reference to breast screening, the strategy claimed that the introduction of an advanced practitioner role would better utilise the potential of radiographers. The strategy also went on to state that the proposed introduction of assistant practitioners will free up more of the radiographer's time for development of the higher level role. This was the basis of the so-called 'four tier structure' which was proposed as a model of practice to support new ways of working under the modernisation agenda.

The publication of the two Department of Health documents was timely and provided a basis for encouraging the establishment of a supporting framework for extended roles in radiography. However, the strategy documents did not dictate policy at local level and provided no evidence as to the impact of new ways of working and to any difficulties that trusts may be experiencing.

The cross sectional surveys reported in Chapter 3 indicated that the number of NHS trusts in which radiographers were undertaking extended role tasks was continuing to

increase and had commenced prior to the publication of the two Department of Health documents mentioned above. What the surveys did not do was to provide any explanation or rationale for why roles were being extended. Neither could the surveys account for why certain tasks were being adopted in some trusts but not in others. In order to provide answers to these questions the next phase of the research was to investigate issues that encouraged or prevented the adoption of new roles.

In order to explore issues regarding the adoption and diffusion of extended roles imaging managers were approached and asked whether they would consent to being interviewed. The plan was to conduct interviews with managers in a selection of trusts where the second cross sectional survey reported in Chapter 2 revealed there had been either extensive or limited change in radiographic practice. Follow-up interviews would enable exploration of the implications arising from the emerging practices. Where changes were limited there would be the opportunity to investigate any barriers preventing development of new ways of working.

This chapter, therefore, through thematic analysis of interview transcripts with imaging managers explores issues impacting upon and arising directly from the adoption and diffusion of extended roles within their trusts.

4.2 Purpose

The purpose of the study was to explore key issues influencing the adoption or non-adoption of role extension and its impact on imaging services.

The objectives of the study were to:

- identify and explore the rationale for the introduction of extended roles;
- examine existing and/or emerging practice, including initial training and strategies for maintenance of competence;
- evaluate issues that encouraged or prevented changes in practice;
- evaluate the impact of extended roles on the division of labour;
- identify changes required in radiographic education to support new roles.

4.3 Methodology

4.3.1 Participants

A letter had been included with each questionnaire in the second survey that asked managers to indicate whether they would consider being interviewed as part of the follow-up study.

Sample selection

Over sixty managers indicated they would be willing to the request to participate in the study.

The interview sites were selected against the following criteria:

- *Geographical location*: to include representation of trusts from across the United Kingdom.
- *Representation of non-teaching and teaching trusts:* teaching and non-teaching trusts to be represented in a similar proportion to those in the cross sectional study.
- *Extent of implementation of extended roles*: Inclusion of trusts where the introduction of extended roles was well advanced and those where introduction was limited.
- *Availability:* Availability of managers for interview during the six week period timetabled for this programme of work.

Initially, it had been the intention to include at least three but not more than six departments in the study. Given the large response it was decided to increase the number of interviews to twelve as this was considered to be feasible over a six week period, the time allocated to the study. Availability of the interviewer and potential interviewees to meet within the set timescale militated against conducting interviews in each region. Despite the number of responses indicating a willingness to participate in the study the selection of sites proved to be a more difficult task than anticipated. The actual number of interviews was eleven. Out of the eleven trusts, three were teaching and eight were non teaching; this is a similar proportion to the cross sectional study. Only in Northern Ireland and Eastern was it possible to meet the criterion to include a teaching and a non-teaching trust within the same region.

Geographical location of trusts was within the defined regional boundaries used for the second cross sectional described in Chapter 3. Table 4.1 identifies the location of interviews and the status of the trust i.e. teaching or non-teaching. Two sites within the Eastern region were used to pilot the interview protocol; these are included in the results giving a total of eleven interviews, these two sites are indicted by (p).

Table 4.1 Location and status of trusts

Trust	Location	Status
A	Northern Ireland	Teaching
B	Northern Ireland	Non-teaching
C	Scotland	Non-teaching
D	Northern & Yorks	Non-teaching
E	South East	Non-teaching
F	Eastern	Teaching
G	Eastern (p)	Non-teaching
H	Eastern (p)	Non-teaching
I	Eastern	Non-teaching
J	London	Non-teaching
K	South West	Teaching

4.3.2 Materials

The research tool was a semi-structured interview which provides scope to follow up and explore the response to any primary question that needed additional explanation and/or expansion.

Interview construction

Interview questions were constructed following analysis of the questionnaires from the national surveys and the earlier interviews reported in Chapter 2. Questions were grouped into three main sections and sought information on the following issues.

Section 1

The nature and extent of extended roles.

Barriers to adopting extended roles.

Audit and CPD to support new roles.

Section 2

Accommodating and supporting extended roles and the 4 Tier Structure. [See Chapter 1 for description.

Section 3

Education and training to support new ways of working.

The primary questions used as the basis for each interview are presented in Table 4.2.

Table 4.2 Interview Questions

Interview Questions

Section 1 Extent, Barriers, Audit, CPD

1. What are the extended roles that have been introduced in your department?
2. Why have extended roles been introduced into your department?
3. What have been the motivating factors?
4. Were there were any barriers to radiographers adopting extended roles?
6. How do you select the staff who will undertake the new or extended roles?
7. How do you monitor/audit performance of staff undertaking new roles?
8. Has there been any apprehension from staff in adopting the new roles?
9. How do you ensure competence is maintained by those undertaking extended roles?
10. What is the impact(s) on your department, as a whole, arising out of radiographer role extension?
11. Are there any other extended roles you would ideally like to introduce in your department and if so are there any barriers preventing their introduction?

Section 2 Accommodating and supporting extended roles

14 Are you familiar with the '4 tier' structure being promoted by the Society of Radiographers and if so, what are your views on it?

15. Would you like to see the introduction of *assistant practitioners* into your department and if so what would they do?
16. Do you see any barriers to prevent the introduction of *assistant practitioners*?
17. Do you have any plans to introduce the notion of *advanced practice* into your department?
18. Do you have any plans to introduce *consultant radiographers* in your department?
19. Can you foresee any barriers to the introduction of advanced and/or consultant practice in radiography?

Section 3 Education and training to support new ways of working

20. What is the education/training for these roles?
21. Do you consider that any changes are required in radiographic education in order to meet the demands of the profession?

4.3.3 Procedure

Before proceeding with the interviews, ethical approval for the study was granted by the Joint Ethics Committee of the Departments of Radiography and Physiotherapy.

The initial approach to each manager to confirm willingness to participate in the study, discuss availability and to arrange interview dates was made by telephone.

Interview questions were piloted at two sites which allowed the interview protocol, the questions and the audio equipment to be tested. In the first pilot interview, the questions were not made available prior to the interview but on reflection this was seen to restrict the usefulness of the interview, as it did not allow the interviewee to consider their responses in any depth. As a consequence of this it was decided to make the questions available prior to the second pilot interview to give interviewee the opportunity to consider their response fully. This approach was successful and was adopted for the remainder of the interviews.

Prior to each interview an information sheet setting out the purpose of the study, the interview questions and the consent form were dispatched at least four days prior to the interview.

All interviews were conducted at a manager's place of work. Prior to the commencement of each interview the purpose of the study was reiterated and the opportunity provided for the interviewee to raise any point on which they needed clarification.

It was emphasised that participation in the study was on a voluntary basis and the anonymity of the interviewee and the trust would be assured. However, it was stated that in the resulting thesis and any subsequent publications, the trust would be classified by its teaching or non-teaching status and by geographical region. All of the managers agreed to be interviewed on this basis and signed the consent form.

After completion of the preliminary procedures, interviews commenced and were recorded on audiotape. Each interview was in the order of one hour.

Interviews were subsequently transcribed by a secretary; any technical terms which were misrepresented were corrected by the researcher. Following this process, transcripts were sent to the interviewees and to make amendments or additions as considered appropriate to the accuracy of the interview.

4.4 Possible sources of bias in qualitative research component

4.4.1 Current research on qualitative methods

Qualitative research is a powerful tool for uncovering important organisational and training issues in health research, as in other areas, with interest increasing over the past decade (Bowling, 1997; Shortell, 1999; Greenhalgh, 2001; Cassell and Symon, 2004). Shortell (1999) intimated that one of the advantages of the utilisation of qualitative research is its value in helping in the understanding of context and the complexity of change and where there is the need for a more in-depth understanding of naturalistic settings.

According to the constructivist qualitative paradigm, interviews involve the sharing of information in order to construct meaning through interpretation. When used with an appropriate methodology, interviews can be powerful tools (Miller and Crabtree, 1999). The semi-structured approach provides the flexibility to probe primary questions, to allow in-depth exploration and to collect more meaningful data than could be obtained from a self-administered questionnaire (Robson, 1993). Moser and Kalton (1971) emphasised that interviews comprise a social process between two individuals and that outcomes have to be seen this light. They also acknowledged that individual response biases can occur due to the interviewer possessing a strong opinion that influences the way in which questions are asked and interpreted. Berg (2001) highlighted the potential for bias arising from the effects of the interviewer's own attributes, such as demeanour, mood and appearance. Such attributes can serve to confirm or deny any expectations that the interviewee may hold regarding the interviewer. King (2004, p11) stated that "a key feature of the qualitative research interview method is the nature and relationship between interviewer and interviewee," and that "the qualitative researcher believes there can be no such thing as a 'relationship-free' interview."

However, strategies can be adopted to reduce biasing effects. Important among these is careful planning, with consideration given to what should be the style of the interview and the questions to ask (Wilig, 2001). Berg (2001) stressed careful wording to avoid asking biased questions, and an ability to remain neutral in order to avoid perceived 'correct' or socially acceptable responses. The use of more structured interviews in realistic (work) settings can enable the systematic comparison of data from different interviewees (King, 2004). Berg (2001) put forward the 'ten commandments' required for successful interviewing, which included an appropriate introduction and ending known as naturalising (Miller and Crabtree, 1999).

4.4.2 Potential biases in this research

There were three possible sources of bias. Firstly, the interviewees could be influenced by the role and status of the interviewer. As a past President of the Society and College of Radiographers, the researcher might be perceived as having strong opinions which might influence the manner in which questions are asked, and hence answered. A respondent may have wanted to give the 'right answer,' believing that the interviewer was being told what he wanted to hear. Alternatively, a respondent could give an answer that is 'anti-establishment', if feelings about the Professional Body were negative. Secondly, interviewees could use the interview to portray their department in a manner that best suited their local agenda, for example, as a means of making a case for funding to support extended training. Thirdly, the interpretation placed on qualitative data might be slanted to match the beliefs of the researcher.

4.4.3 Reducing the potential for bias due to interviewer role and status

In order to minimise bias and obtain a full picture of each situation, the approach adopted involved the use of a pre-prepared discussion guide, to enable the interviewer to progress through a set of questions presented in a logical format, with all participants being asked the same primary questions. Questions were reviewed and agreed with the Principal Supervisor to ensure that potential leads or cues to the expectations of the researcher were minimized. This was especially important as it had become clear to the researcher that the education and training for extended roles demanded urgent attention.

Following the pilot studies it was decided to send the questions to the interviewees several days prior to the interview. This process was important for effective communication (Berg, 2001).

The time from arrival at the hospital and immediately prior to the commencement of the interviews was critical to establishing a rapport between interviewer and interviewee. On arrival the researcher showed a general interest in the manager's department, for example, asking about type of equipment in use, any developments across the trust as a whole, while being careful not to impinge on any aspect to be covered in the interview.

The interviewer could not pre-determine the exact environment for the interview other than it being at the managers' places of the work. Fortunately, all interviews took place in office environments with which managers were familiar and comfortable. This had the advantages of (a) giving managers a feeling of control and hence making them more relaxed and (b) providing a naturalistic setting which served as a cue for

the issues discussed. Prior to each interview it was explained that the research was part of a PhD programme and independent of the Society and College of Radiographers or any other organisation. There were no reasons to suggest that this position was not accepted.

The interviewer believes that he presented himself appropriately for each interview. Questions were asked in a manner that gave no cues as to the researcher's beliefs. Active listening techniques were employed and responses respectfully received. The overall strategy adopted was to foster interviewees' trust so that they were willing to share key information.

Transcripts were then prepared by a secretary and sent to the interviewees, who were given the opportunity to review their responses outside of the interview situation. The only modifications received from the interviewees were of a minor typographical nature. Key phrases were then highlighted and collated into the different categories of response so that responses could be systematically compared and themes identified. The categories used in this analysis (for example, 'reasons for the adoption of extended roles') were checked by the Principal Supervisor who acted as a second coder for a random sub-sample of interview transcripts.

4.4.4 Summary

Qualitative research has generated important findings for health and organisational research for some time. The interpretative component means that findings and conclusions are inevitably open to potential biases. In order to minimise such bias in this research, careful planning was employed throughout. Precautions were taken to minimize interviewee expectations about desired responses and the potential for the research to further their own agendas. Further precautions were taken to ensure that the interpretations of the researcher did not conflict with the views of the interviewees. The researcher believes that these precautions led to the most comprehensive information possible about changes in imaging departments.

4.5 Results

4.5.1 Section 1 Extended Roles

Each of the managers interviewed indicated that their departments had introduced extended roles. The roles and their distribution across the interview locations are shown in Table 4.3.

Table 4.3 Extended Role Distributions

Trust & Type	Ba enema	Ba enema rep	Ba meals	IV Inject-ions	Plain film rep	US	US rep	Red dot	Cysto-graphy	Arterio graphy	Video fluro-scopy	ERCP	Parotid sialo-graphy
A t	✓	✓	x	✓	✓	✓	✓	✓	✓	✓	✓	x	x
B nt	✓	prelim	x	✓	train	✓	prelim	✓	✓	x	x	✓	x
C nt	✓	x	x	✓	x	✓	x	✓	x	x	x	x	x
D nt	✓	x	x	✓	x	✓	✓	✓	x	x	x	x	x
E nt	✓	prelim	x	✓	x	✓	✓	✓	x	x	x	x	x
F t	✓	prelim	x	✓	x	✓	✓	✓	✓	x	x	x	x
G nt	✓	x	x	x	train	✓	prelim	✓	x	x	x	x	x
H nt	✓	prelim	✓	✓	✓	✓	✓	✓	x	x	x	x	x
I nt	✓	x	x	✓	x	✓	✓	✓	x	x	✓	x	x
J nt	✓	x	x	✓	✓	✓	✓	✓	x	x	x	x	✓
K t	✓	✓	x	✓	x	✓	✓	✓	x	x	x	x	x

Key: t = teaching trust; nt = non-teaching trust; ✓ = activity undertaken; x = not performed or activity not claimed to be an extended role; prelim = preliminary report for radiologist: train – radiographers undergoing training; Ba = barium; rep = reporting; IV = intravenous injections; ERCP - endoscopic retrograde cholangiopancreatography

In all trusts in which radiographers were interviewed radiographers performed intravenous injections and barium enemas. However, at two sites the recognition of IV injections as an extended role task was questioned. One manager pointed out that an IV injection had become an expectation of the radiographer's role and was no longer viewed as an extended role task. This position was supported by the manager of the second trust who stated that many people were coming through their radiography training having been prepared to undertake *venepuncture* and they no longer thought of the administration of an injection as an extended role task.

Radiographers were performing barium enemas at all of the trusts but the extent to which radiographers were involved in image interpretation on the examinations varied. At four trusts radiographers were making preliminary observations on the images before presenting to a radiologist to compile the formal report and in only two departments were radiographers producing the final report in their own right. Barium

meals were performed by a radiographer at one trust only. This was identified as a new role but had not been reported in the cross sectional study.

Only in three trusts were radiographers reporting on plain films but at further trusts radiographers were being trained to undertake this activity. Ultrasound was considered to be an extended role activity at each of the locations. However, while reporting in ultrasound was undertaken in 10 of the trusts, in two of these the report was preliminary and was passed to a radiologist to approve and confirm the definitive version.

Two managers believed that the developing role within CT and MRI was not recognised to the extent it should be. For example, radiographers in MRI were able to make their own decisions whether to inject contrast and by definition this became an extended role although it was not recognised as such. Comparing these comments with the findings of the second national survey, there was no evidence to suggest that such tasks were being adopted or recognised as extended roles to any great extent. In that study, of the trusts that listed new roles which could be interpreted as falling within this category, four respondents (6%) stated that radiographers performed the following tasks:

- checking and authorising MRI requests;
- injection us contrast;
- unsupervised CT scanning (2 responses).

In these four instances the respondents clearly classified these as extended role tasks. However, the questionnaire would not have revealed those trusts where similar tasks were being routinely undertaken but not recognised as extended roles.

A number of new roles had been introduced since the national survey questionnaires had been returned. These were: paediatric cystograms, video fluoroscopy and at one site radiographer-led femoral arteriograms were about to commence at another. At one trust, the manager argued that undertaking mentoring of students and new staff constituted an extension of their roles.

Rationale for the introduction of extended roles.

Reasons for introducing extended roles fell into four main categories:

1. shortage of radiologists (n=11)
2. increasing workload (n=11)
3. pressure and enthusiasm from radiographers to take on new tasks N=4)
4. enthusiasm of radiologists (n=4)

The reasons given at each location are presented in Table 4.4.

Table 4.4 Reasons for adopting extended roles

Trust	Location	Status	Reasons
A	Northern Ireland	T	Lack of radiologists To decrease waiting time for patients Enthusiastic radiographic staff seized the opportunity
B	Northern Ireland	NT	Radiologist enthusiasm Radiological interest Workload pressure, insufficient radiologists.
C	Scotland	NT	Frees up radiologists time Greater interest for radiographers
D	N & Yorks	NT	Shortage of radiologists Speed up patient throughput. Radiographer enthusiasm
E	South East	NT	Need to be seen as a forward thinking department Recognition of radiographers' increased capability Radiologist enthusiasm Increased volume of work in ultrasound, radiologists could not cope. Recruitment and retention of radiographers
F	Eastern	T	Free up radiologists time To reduce waiting lists Radiologist enthusiasm
G	Eastern	NT	Pressure from radiographers Radiologists who could not cope with increasing workload
H	Eastern	NT	Lack of radiologists Radiographer enthusiasm
I	Eastern	NT	Need, right climate, radiologists & junior doctor shortage
J	London	NT	Waiting lists, trying to improve the patient experience Personal interest of radiographers
K	South West	T	Free up radiologists' time Radiologist enthusiasm Reduce waiting lists

Shortage of radiologists

Shortage of radiologists was reported as the major factor influencing role extension by all of the managers. More often than not new roles were adopted following problems in meeting increasing workload demands.

> "We have had problems with a lack of radiologists. We did have ten and then we had eight left, and we struggled to replace them, so clearly it helps out if we can cover sessions. Radiologists' sessions get cancelled all the time for one reason or another, radiographer sessions do not. You can always rely on radiographer sessions getting done."
>
> Manager, teaching trust.

A manager at another trust reported that introduction of new roles had been promoted by radiologists.

> "New roles have mainly been driven by the radiologists, they have been quite keen. They see a deficit in the training programmes for radiologists, a shortage of consultants to do the barium techniques and it was obviously foreseen three or four years ago that we needed radiographers to fill this gap. So it is very much radiology supported and radiology led."
>
> Manager, non-teaching trust.

In almost all cases where extended role tasks had been introduced this followed some form of needs analysis. In the following example, this had been prompted by the radiographers wanting to fill the gap.

> "Usually they (extended role tasks) were identified as a need in the work flow, i.e. things were getting held up because there wasn't a radiologist around and the radiographers felt that they could do it, which was what then prompted them to say 'I would like to take on certain roles'. It was a joint decision between the radiographers and the director of management who would then see the clinical director and say: 'this is what we need in the department."
>
> Manager, non-teaching trust.

The difficulty in finding a radiologist to inject patients for intravenous urograms was the key factor at another trust.

> "We looked at IV injections a number of years ago and did a survey to see the length of time we were waiting for radiologists. Not a criticism of the radiologists, but there was nobody nominated to inject, you had to grab the nearest passing radiologist and they were expected to stop

> what they were doing immediately and do an IVP injection. On average there was a 10 or 15 minute delay on everything we did and also the length of the procedure was greatly extended. So we thought it would make good use of the skills that the radiographers could develop.
>
> Manager, teaching trust.

Radiologist enthusiasm

It became clear from a number of interviews that there was often one radiologist who was interested in pioneering a particular extended role and without this input it seemed less likely the role would be adopted. The following exemplified this:

> "In general medical ultrasound we have quite a progressive consultant radiologist. When we introduced radiographers into the general department he felt that it was part of their role to report their own films, bearing in mind that it is a very operator-dependent activity and it was not sensible to expect somebody to report on somebody else's work. Therefore, ultrasonographers immediately started reporting their examinations much the same as they do and have done in obstetrics for a number of years."
>
> Manager, teaching trust.

At another trust the response of the manager clearly recognised the role of the clinical director in introducing new roles.

> "Probably the clinical director initiated the first steps with the red dot system, the barium enema training and reporting."
>
> Manager, non teaching trust.

Radiographer pressure

Radiographer enthusiasm was a factor in some instances and often influenced by roles being undertaken by radiographers elsewhere:

> "The radiographers were never pushed into it, it was the radiographers that wanted to do it, they saw it a natural progression really. I think because it has been seen elsewhere, other places have done it, there was no reason we couldn't do it. We have always stuck with that and nobody is forced to do it."
>
> Manager, non-teaching trust.

An interesting variant on this was reported by one manager. Rather than these changes being prompted by enthusiasm for radiographers undertaking a particular task, there was a lack of enthusiasm by radiologists for undertaking particular tasks.

> "[For] the modern breed of radiologists doing barium enemas is not viewed as an exciting thing to do, so they were quite happy to involve radiographers in doing that sort of thing."
>
> Manager, non-teaching trust.

The fact that extended roles were known to have been introduced in other centres was recognised as a factor in introducing change in another trust as the following quotation illustrates:

> "A lot of radiographers were actually coming to the department with certificates saying they were competent to inject. 'Why can't I do it here, I did it elsewhere?' We put it to the radiologists and they were more than happy to hand over that task and so it was welcomed by the radiologists, welcomed by the radiographers, and obviously nobody was forced to do it."
>
> Manager, non-teaching trust.

One manager recognised the importance of the red dot system in promoting radiographer enthusiasm.

> "Red dot was a way of getting the radiographers involved and it helps with the quality of their work if they are actually looking at images themselves and thinking 'this has got to go out to casualty.' It obviously helps to keep the staff interested in what they are doing, so that they are not button pushers. So there is a way of extending their role there. A lot of them have a lot of expertise; some of the senior radiographers have been in post for years and are far better at interpreting the radiographs than some of the junior radiologists are."
>
> Manager, non-teaching trust.

Barriers to role extension

Some form of initial barrier or opposition to the adoption of extended roles was identified in all but two of the trusts. These barriers could be classified under three headings:

- radiological opposition;
- radiographic opposition;
- a shortage of radiographers to undertake radiography.

Radiological opposition

Despite the enthusiasm of some radiologists in promoting extended roles there clearly had been radiological opposition in some instances. At one of the teaching trusts the interviewee stated:

> "Yes, looking back to when we first started with IV injections, and to a certain extent with barium enemas, there was a lot of resistance. I can think of two radiologists who almost said "over my dead body!" and here we are, basically the radiologists are still there and we are doing it. But I think that they were forced into it almost because there weren't enough of them and just suddenly thought "Oh God, who can we get to do this?"
>
> Manager, non teaching trust.

In another trust the initial resistance was due to a concern over the training of junior radiologists, as one manager explained:

> "I had to overcome the barriers of radiologists who felt that the training of our specialist registrars would be undermined by radiographers doing barium enemas."
>
> Manager, teaching trust.

However, the worries of the radiologists turned out to be unwarranted in this case as the radiographer undertaking the barium enemas proved to be a valuable resource in teaching radiology registrars. Rather than being a barrier, the role adoption turned out to be a benefit. This was similar to the situation reported in the ultrasound section at the same trust, where the employment of sonographers had not prevented the training of junior radiologists. In fact, as the manager stated, one of the sonographers committed half of her time to training, which had subsequently become recognised as a training post.

One manager, discussing the issue of radiologists acting as barriers to radiographer role extension stated:

> "We have overcome quite a lot of resistance now and that was due to lack of radiologist support, particularly around barium enemas and barium meals, reporting etc, but we have worked on them quite hard and now they support us."
>
> Manager, teaching trust.

When questioned further on why radiologists had not been supportive, the manager said that she believed that they were somewhat anxious regarding their own roles.

Radiological opposition was not an insurmountable barrier provided there was at least one radiologist committed to supporting role expansion. In one case it was reported that the support of the clinical director had been the key factor in introducing the scheme in the face of opposition by radiologists. When asked a supplementary on how the radiologists had subsequently worked within the new arrangements the answer was as follows:

> "They basically have nothing to do with it. They don't take any of the responsibility for it, or for programmes instigated by the clinical director."
>
> Manager, non teaching trust.

It was not, therefore, a prerequisite for all radiologists to be in favour of radiographers extending their roles provided there was support for a particular role from one radiologist. One manager at another site classified radiologists into two groups:

> "The radiologists fall into two schools, those who are in favour, of which there are two of them, and those who are against, of which there are three or four in my department."
>
> Manager, non teaching trust.

In another case the radiologists originally considered ultrasound to be their role but their position had changed once the pressure of work became too much. This was exemplified by the following quotation:

> "Consultants wanted to do ultrasound; they were happy to do it and, in fairness, could cope with the volume of work. However, in the last six or seven years when they could not cope with the volume of work and the waiting lists were growing enormously. They recognised themselves that they had to do something to stop the complaints coming in. They were fully committed to what they were doing but they could not extend their working day any more so they opened it up to radiographers. Initially there were those who were happy to work with the radiographers and those who were totally opposed to introducing the radiographers but over a period of probably about twelve months when we brought our first radiographer in, they all changed, 'It is a jolly good idea'."
>
> Manager, non teaching trust.

In another trust, radiologist opinion constituted a barrier initially, but this had gradually been overcome.

> "Certainly the radiologists, at first, but I think there are still certain barriers. We have proved ourselves in IV because nobody has any problem, and we have proved ourselves in undertaking barium enemas as well and the ERCPs are just never done by a radiologist full stop, whereas they used to be done by them all the time. So I think we continually prove to ourselves that we can do it, and I think the barriers have got less."
>
> Manager, non teaching trust.

Acceptance of radiographer activity in some areas did not mean universal support by radiologists for all activities. For example, plain film reporting, which as revealed by the national surveys, has been the slowest of the extended role activities to be adopted, was still being resisted by radiologists at one of the trusts.

> "I know trusts just up the road have radiographer reporting and it has been going on for several years and it is just a matter of course but they still resist radiographer reporting here."
>
> Manager, non teaching trust.

Radiographer opposition

The radiographers themselves were the barriers in two centres and one disparaging comment was:

> "We had at the time two or three, 'long in the tooth' radiographers who felt they did not really want to do that sort of thing and if they don't want to they don't have to, so it was phased in gradually. All the junior ones do it and everybody does it now. It has become the accepted norm I think."
>
> Manager, non teaching trust.

At another site, the radiographers had not shown any enthusiasm or interest to take on new roles, as revealed by the manager, who, when asked whether the radiographers themselves had instigated any of the extended roles said:

> "In truth I would say no, in fact there has been a slight dragging of the feet."
>
> Manager, non teaching trust.

In another trust there was a reticence shown by both radiographers and radiologists.

> "Yes, there were two barriers, the radiologists and the radiographers themselves. Historically, not doing that role, worry about the responsibility involved, and remuneration of course came into it because of course they are highly motivated by money."
>
> Manager, non teaching trust.

One manager believed that there would be resistance from some radiographers to further role extension. This was a local issue where senior staffs of long standing wished to protect the status quo and were not as prepared to adopt new roles. As the staff in that trust comprised a static workforce it was not possible to promote radiographers from junior posts to senior posts which were in effect blocked to those seeking advancement. The manager viewed this as being a significant issue which will have a negative effect on service delivery.

Radiographer shortage

The third significant barrier raised by seven managers was the problem of who was to fill the radiographers' role when they themselves, were performing extended role tasks. This concern was succinctly stated by one manager whose comment was representative of those who had identified this barrier:

> "Obviously one of the difficulties is if we have radiographers doing radiologists' work, who is going to do the radiographers' work? And as we are chronically short of radiographers, expanding their role and mixing it can make it difficult to fill the posts they have created."
>
> Manager, non teaching trust.

Selection of staff to undertake new tasks.

A key question was around the selection of the staff to undertake new roles. In one centre, all staff who had been qualified for over six months were offered the chance to train to give IV injections; this offer was well received and only one individual had declined the opportunity. At the same trust there was a rolling programme to train radiographers to undertake barium enemas. Those selected for training had initially to convince the manager of their interest before having to go through an interview/selection process.

Annual staff appraisal was used at a number of sites to identify potential to undertake extended roles. However, at one site, at least, it was for staff to take the initiative and make known their interest to their manager.

> "It usually comes up during an appraisal and it comes from the staff themselves, identifying how they want to progress their career.
>
> Manager, teaching trust.

The manager saw her role and that of her deputy of encouraging staff to develop their skills but they had to ensure the needs of the department were met.
At another trust the initial process was to ask for volunteers and then to select staff that were thought to be suitable.

“Particularly for barium enemas, barium meals, A & E reporting, we tend to ask for volunteers for a particular role extension and then if we have to we will go through an interview process.”

Manager, non teaching trust.

Staff appraisal featured prominently at one trust but while being utilised to seek willingness to undertake a task it did not appear to be used to assess suitability for training.

“Part of their normal personal development process is for staff to sit down with their managers on an annual basis at least. This gives an individual the chance to say ‘I am keen to move into ultrasound/CT or whatever’ and explain what they would like to do. As part of the process, I sit down with the heads of departments at least once a year, if not twice a year, and we go through the issues of who wants to do this, who wants to do that.”

Manager, non teaching trust.

This tended to be the pattern, with apparently little consideration of whether the ‘willing’ were suitable to undergo the training. However, one interviewee gave an example of where he had thought that someone was unsuited for a role.

“It is possibly a question of selecting the right sort of people; also they have to know exactly why they want to do it and I have to make sure their motives are right. We had someone who wanted to do a course but we would not let her do it, we didn’t think she was right for it. She didn’t stay and actually left radiography completely. She has said since she left that we were probably right in stopping her taking the course. She felt she had to do something because she had been around a long time and others were doing things that she thought she should do, but when we said no, in retrospect even though she was disappointed, she felt we probably made the right decision.”

Manager, non teaching trust.

The same manager indicated that many of the staff were not sure what they wanted to do and as a consequence volunteered for everything.

“There is a tendency for some radiographers to think they should volunteer for everything without having thought it through. ‘This is a two and a half year course, do you really want to do this?’ ‘Are you sure you have thought about it because six months ago you wanted to do mammography and three months before that you wanted to go into

> CT and MRI?' so we go through it with them. So counselling advice and sorting it and then we will make the decision on the selection process."
>
> Manager, non teaching trust.

Radiologists were involved with the selection of personnel to undertake new roles but this depended upon the role to be developed. There was radiologist involvement at trusts where barium enema examinations were undertaken by radiographers. This was recognised to be critical as there had to be reliance on radiologists to contribute to training, often as a mentor.

> "If I just think of the separate role extensions, IV injections no; barium enemas yes, the radiologists are highly involved in the selection of the person who does the barium enema course."
>
> Manager, teaching trust.

Staff selection to undertake extended role activities in some instances was dependent on whether or not they were successful on a prior programme of study

> "With abdominal ultrasound this would depend on someone having the qualification."
>
> Manager, teaching trust.

In such cases the initial selection process entailed identifying someone's potential to benefit from undertaking a formal course of study. As five managers indicated this would be through the appraisal process.

Ensuring competence

All managers identified initial training as being essential to underpinning and supporting new roles. Training consisted of both in-house and externally provided courses. The length of training ranged from single study days for red-dot to two and a half years to obtain an ultrasound qualification.

Most trusts ran internal courses for IV injections, while, for barium enemas, reporting and ultrasound, staff attended external courses. However, three managers had moved away from providing an in-house programme to external courses for IV skills which were accredited by the College of Radiographers. This largely appeared to be as a result of pressure from staff to achieve accreditation for their acquired skill from their Professional Body.

Funding was an influence in deciding whether training was provided in-house or externally. One manager said that the department nurse organised the IV programme partially because there was no cost involved. However, cost was not generally

reported to be a major problem. Two managers referred to a special fund set up to provide for initial training purposes and for continuing professional development.

> "We have a fund to support any course anybody wants to do providing it is of value a) to the individual and b) to the organisation. So funds are not a problem, just a question of talking through with them to make sure why they want to do it is the correct thing."
>
> Manager, non teaching trust.

The following response was typical and illustrated the importance not only of value for money but value for the individual in terms of their work life balance.

> "Most of the courses are external. We look to see what are available, the benefits of each course and how it fits in both with the department and that person's personal life. There are some courses that we will not let people go on because we do not think they are worth going on. Things like the vena puncture, they will get on the job training as well – we have to allow time for that."
>
> Manager, teaching trust.

One manager commented on the need for developing the confidence of staff to adopt new roles and the support that was required for this.

> "All extended roles are supported with training, it's mainly about confidence in the initial stages and we ensure we have the correct support to give that confidence to someone. We also use national training courses such as the one at X."
>
> Manager, non teaching trust.

Most managers felt it was important to receive feedback on external courses attended. In one of the trusts there was an expectation that participants submitted a paper or gave a presentation to colleagues.

> "As part of agreeing to let people go on any sort of course or study day which we fund, they have to sit down with their line manager, who guarantees they should do it and be given the relevant amount of time and when they return there will be feedback. It may be a written paper they submit to say 'I did this course' describing it or just a 10 minute presentation at lunch time"
>
> Manager, non teaching trust.

All of the managers indicated that extended role activities were monitored with radiological involvement evident across the range of roles. The following was typical.

> "We assign a radiologist to every radiographer who is doing an extended role that involves being an independent practitioner. They have two weekly meetings and they do audits to see how they are measuring up against the radiologists' performance."
>
> Manager, non teaching trust.

The frequency of audit ranged from continuous to annual but in no situation was there dissatisfaction expressed with radiographers undertaking an activity.

For the main part, the response from a manager at a teaching trust was typical.

> "With tasks like barium enemas, we audit on a regular basis. In ultrasound, we have a superintendent who actually checks everybody's progress every year, so that is part of their own plan. In terms of intravenous injections, we audit this annually and an individual's outcome is discussed in the appraisal process."
>
> Manager, teaching trust.

At one of the sites the manager reported that audit was an integral part of their system of work which had been approved by the trust's chief executive.

> "For all the extended roles we would do a training scheme and write a system of work which is presented to the chief executive who then approves it. Within that obviously there is an audit where you have the training and system of work audited and to date any of the areas where we have extended, the results of the audit have been excellent. In actual fact in one of the areas we found that the radiation dose was lower and that was because the radiographer was being so careful about switching on and off and were only screening at certain stages. That was nice."
>
> Manager, teaching trust.

Apprehensions regarding extended roles

Asked whether there had been any apprehension or concerns expressed by staff when adopting the new roles, eight of the interviewees identified intravenous injections being a cause of concern. However, it was clear that only certain staff had concerns and this tended to be those that had been qualified for some time as one manager explained.

> "The newly qualified ones, no. Those who have been around for a long time experience a complete change or reverse of what they used to do. IVP injections is a typical example – for years they did not do it, you

had to patiently sit and wait for the radiologists and when we decided that they could do it, there were one or two who thought 'I don't know whether I want to do this'. Most of the new ones coming in were very keen to do it because their peers were doing them in other trusts and essentially once some of the more senior ones saw the juniors could do it they thought 'I could do this as well', but you have to run it at the right pace. Nobody had to do it. If they wanted to do it we were happy to support them and provide the training, but they didn't have to do it."

Manager, non teaching trust.

Three of the managers discussed the apprehensions that staff had from introducing a needle into someone. Although they would have witnessed this many times there appeared to be a major difference between someone observing the task and performing it. It was evident that managers understood these fears and no one was required to inject against their will. Those that did wish to extend their role in this area appeared to be well supported by the trust in terms of training and follow up audit. Another area of concern was not related to performing a task but to whether radiographers would be allowed to undertake it after training. This was put into perspective by one manager.

"Before we actually sent them on the course we agreed that when they had done the course they would be able to do the job and we delayed their training to get that agreement. So, I think the apprehension would have been 'Well if I go and train to do this, will I be able to do it when I get back or is it a waste of time?" We made sure that that didn't happen by having their (Trust Board) written agreement before they went on the course. I think the only apprehension is "Can I do it?" which you would have with anything new."

Manager, teaching trust.

In one trust it was not the fact that there was any apprehension on taking on barium enemas but there was over the time it took to get started.

"Radiographers have wanted to do it for quite a while and we were held back for a number of years because of lack of radiologist support. As soon as we got that support then they were champing at the bit and wanting to do it."

Manager, non teaching trust.

At one trust, where there was only one radiographer performing barium enemas, this led to the individual feeling isolated. This was despite the manager encouraging other people to do the course which would provide peer support but no one was willing to proceed. Barium enemas were also the cause for concern at another trust where the

radiologists were split 50:50 in whether they agreed that radiographers should perform the examinations. In this situation there was no hostility but the radiographers had to gain the confidence and support of the radiologists who were opposed to the radiographers and this was an added complication for the department.

Any apprehension at one trust of a radiographer undertaking barium enemas was dissipated by the performance of the radiographer.

> I have heard many a comment, certainly from two radiologists who said that – particularly of one of the radiographers who was the first to do it – that the enemas he produced, the films he produced, were better than they had ever seen in their lives, they were better than any the registrars or radiologists produced.
>
> Manager non teaching trust.

Reporting, however, was the cause for some apprehension. This centred on the possibility of abnormalities being missed but this fear was said to have dissipated at one trust as confidence in the radiographers concerned grew. The underlying apprehension was expressed by the manager who stated:

> "Well I think yes, initially there was. Staff did not take the role extension lightly - it was something that could only be done by a radiologist before. I think we had some people who were very conscious of the importance of their new role. I think it's important that it's taken very seriously, certainly with reporting you have to be absolutely sure that you're as accurate as you can be. The one that surprised me the most I suppose was that anybody was able to do IV injections. That surprised me more than anything. But yes there have been the normal apprehensions but nevertheless the apprehensions are greatly outweighed by the enthusiasm."
>
> Manager, non teaching trust.

Impact of extended roles

There was a range of responses to questioning regarding the impact of implementation of extended roles. Not all of these were positive but there was some degree of agreement across responses. All participants recognised the positive effect on waiting lists which the following quotations exemplify:

> "The waiting lists for barium enemas have definitely gone down and if we have a problem with it rising we get a few radiographer sessions in to meet Government targets. We have a more effective department in some areas such as MRI for example because they can actually inject

> and they are not held up. There is continuity for the patient and it means that examinations go through more freely."
>
> Manager, teaching trust.

> "We now find that we can tackle waiting list initiatives much more easily now that radiographers are involved because they are willing to change their working patterns to actually take on pressure times, which in fact we are doing at the moment."
>
> Manager, non teaching trust.

> "A positive impact on the waiting lists and also the fact that for the radiographers it gives an increased standard and it is a positive career"
>
> Manager, non teaching trust.

As well as the impact on waiting lists managers were quick to point out a boost in morale for staff and most significantly a better continuity of patient care.

> "We have I think increased the motivation of our staff. I think it makes life a lot more interesting and in many cases I think it actually improves patient care in that you have one person who is with the patient throughout the whole examination."
>
> Manager, teaching trust.

Team working was also seen to be a positive outcome and within that a change in radiologists' attitudes to radiographers and working.

> "The radiographers feel they have gained a lot more respect from radiologists, which has probably been there but now it is overt and they do work more as a team. In fact my radiologists lean on my radiographers quite heavily at times. The radiographers are much more flexible in their approach to the working day in terms of being able to sometimes show radiologists the way. Radiologists can be a little bit stuffy in their ways and now that radiographers are doing what they are doing they have a much more flexible approach to the whole aspect of working. So that has been for the radiographers and for the department a real plus.
>
> Manager, non teaching trust.

There appeared to be a price to pay and by and large the negative aspects related to the gap being left by radiographers adopting new roles. Three of the managers voiced their concerns about maintaining a viable workforce as an unintended consequence the adoption of extended roles.

> “If we are going to be extended up then someone has got to come in and fill the void.”
>
> Manager, non teaching trust.

> “If we are suddenly doing these extended roles who is doing the chest x-rays or whatever?”
>
> Manager, non teaching trust.

> “We have suddenly got radiographers who were doing chest x-rays before and who are now doing barium enemas so we are short of radiographers. We have extended our role but unfortunately it does avoid doing what we were doing before and that is definitely a negative thing.”
>
> Manager, non teaching trust.

Another manager raised a potential difficult issue over remuneration and staffing levels.

> “There’s a lack of remuneration for these new increased skills and
>
> `that’s a worrying aspect really. The staffing levels are a major problem because the increased roles are within the department’s establishment.
>
> Manager, teaching trust.

Further role extensions and barriers

Given that all trusts had introduced extended roles to some extent, managers were asked whether they had plans to introduce any additional roles and if so were there any foreseeable barriers. Despite the pressures that were being exerted by increasing workloads, which was common to all sites and indeed a major pressure to implement new ways of working in the first place, there were a number of additional extended roles that the majority of managers wished to introduce. These additional roles and barriers are presented in Table 4.5.

Table 4.5 Additional roles and barriers to implementation

Trust	Location	Status	Additional roles	Barriers
A	Northern Ireland	T	Femoral arteriogram Plain film reporting, CT head reporting and MRI reporting	Staff availability for training. No reason in principle why extension in these areas cannot be achieved but remuneration a problem for all areas.
B	Northern Ireland	NT	Barium meals Ultrasound reporting	Clinical director Radiographers
C	Scotland	NT	Image reporting, inc. CT, MRI & breast	Radiologists
D	N & Yorks	NT	Image reporting Barium meals Angiography Patient assessment	Radiologists Staffing levels Nursing staff
E	South East	NT	None	
F	Eastern	T	Image reporting of appendicular skeleton Cystography	Possible conflict with radiology registrars training needs Staff availability
G	Eastern	NT	Increase staff undertaking enemas	Inability to recruit staff
H	Eastern	NT	Image reporting of axial skeleton Colonoscopies Barium meals Angiography inc. patient assessment	None in early planning phase Possibly initial resistance from nursing staff on assessment.
I	Eastern	NT	Widen scope of barium studies Widen scope of image reporting to GP referrals	Time for staff to develop confidence Radiologists
J	London	NT	Venography Image reporting	Time to progress to a suitable protocol No need identified by radiologists Staff recruitment
K	South West	T	Widen scope of barium studies	Time to plan Staffing levels

Colonoscopies and patient assessment prior to angiography were the only ‘new’ role extensions identified by these interviews.

Managers did not intend introducing any new roles over and above those that had been identified in the previous national survey. Resistance to adopting additional roles were largely local factors; such as opposition by radiologists because of a conflict with training radiology registrars and radiologists not ready to support radiographers. One interesting comment related to radiographers undertaking barium meals as an initiative to reduce waiting lists. The manager stated that it had not been

introduced because “no one’s come up with the concept yet.” Obviously the manager had but was not prepared to take this forward; the reason being that the proposal had to be seen to come from the clinical director. The manager had planted the idea but needed to wait until the director had thought it through and was prepared to go ahead.

Ultrasound reporting by radiographers had not been adopted at one of the non-teaching trusts. The manager indicated that there was willingness and support provided by radiologists but it was the sonographers who were resisting adopting the responsibilities.

At one of the teaching trusts the manager wished to introduce reporting of the appendicular skeleton. A paper had to be presented to the trust board for approval but there was felt to be some opposition from radiologists. The resistance was felt to be not that it was a new concept but there was an issue about compromising the training of senior radiology registrars. The manager stated:

> “Well it is in a major teaching trust and if we do not train our registrars properly then we will never get radiologists out in the field.”
>
> Manager, teaching trust.

Two of the managers wanted the radiographers to be responsible for patient assessment before certain specialist procedures such as angiography and other contrast examinations but believed that there may be resistance from nursing staff as one to the two stated.

> “The inclusion of an assessment role within nurse practitioners remit is a threat because it seems to be getting more widespread and nurses are undertaking a wide range of tests and a lot of the time it is almost inappropriate. I think if patients gave radiographers the history then they could decide which examinations are necessary. Why does it have to be a nurse anyway? I am not sure that they are the appropriate personnel to be deciding which examination is appropriate particularly if we have a range of examinations, such as CT, ultrasound, barium enema, although
>
> someone has to make the decision it should be the radiographer.
>
> Manager, non teaching trust.

Interestingly, the success of role extension in some areas was seen to be a barrier by some managers to further extensions in both teaching and non-teaching trusts.

> “Role extension in some areas has not been possible. For example, where I’ve wanted to support staff I have not been able to do it because

> of staffing problems. This is because when radiographers are in training they are supernumerary and if there are no replacement staff to compensate for the loss of the trainees, that's it, training is put on hold so that is certainly a big downside."
>
> Manager, teaching trust.

Recruitment and retention of staff was identified by all of the interviewees as being critical. There was a general view that there has to be sufficient staff to meet current demands let alone those of the future as the workload continues to rise. The impact of an increasing workload and the Government agenda on waiting lists was, for one manager, going to force departments to reconsider how they utilise radiographers and on how roles could be extended further to compensate for the deficiency in the numbers of medical practitioners.

> "Availability of staff has got to be one (barrier). We are struggling for staff and if we want to include all these other roles it becomes impossible to take on any extra work"
>
> Manager, non teaching trust.

> "I think there may be a movement in radiography where the severe shortage in resources may impede or reduce clinical training. There is no funding or staff available to train and employ helpers, assistant practitioners, radiographers and post-graduates. Also, who actually does the job in-hand while everyone is in training? Also it needs to be said that the training has to be the best quality if we are to earn respect from our other colleagues."
>
> Manager, non teaching trust.

One of the Northern Ireland managers identified a unique issue and believed that while sufficient students were being recruited to their local university, many of the students were from the Irish Republic and returned there after graduating, which would lead to shortages at a time when the service was expanding.

Not all the managers, however, viewed recruitment and retention from a negative perspective and could see local solutions such as the one interviewee who was very positive about the new 'film-less' department in the trust. It was believed that the expansion and sophistication in technology were exciting developments and would be attractive to radiographers.

4.5.2 Section 2 Accommodating and supporting extended roles

This section of the interview was used to explore managers' understanding of the 'four tier' structure and how could it be applied and in particular;

- whether there was a common understanding of the 'four tier structure';
- the degree to which it is being implemented;
- its relevance to diagnostic imaging services into the future.

Managers were well informed about the four tier structure and overall expressed support for its introduction. There were four managers in particular who were very enthusiastic about the advantages they could envisage in terms of better recruitment and retention due to an enhanced career structure.

The four main enthusiasts made the following comments.

> "I certainly endorse it, I think it is extremely important that as we extend the role that the additional skills are recognised and there is appropriate remuneration for those and certainly this tries to set that out. I think this is a framework that is very acceptable."
>
> Manager, teaching trust.

> "I think it is excellent. It is the way we have to go because it will fit in with the agenda for change and moving towards a scale for all professionals within the Health Service. It also fits in with the NHS plan in terms of multi-professional working. It means that we can actually hopefully try and give people accreditation for competence based practice, which could be rewarded financially."
>
> Manager, teaching trust.

> "I think this is a good move forward because it is looking at clinically based skills and recognising that clinical excellence is the way forward. Certainly up to now it has been that you had to jump into management before you really got any further with your professional development."
>
> Manager, non teaching trust.

> "Within the department the consultant/lead practitioner is very much in early days although we have not really discussed it in depth. We have discussed in depth the technical work of the assistant practitioner and we are very keen to develop this role. We have benefited enormously from our helper grades doing the NVQ course but we feel as though they have been developed to their maximum potential now and that we

need a level in between and we think the assistant practitioner role is ideal for the department."

Manager, non teaching trust.

Not everyone, however, saw the introduction of the four tier structure as plain sailing and four interviewees said that radiographers would provide the largest barrier to the introduction of assistants. One of the managers described stated the following:

"Radiographers will be the biggest barrier to the change, particularly to the introduction of assistants. They will perceive them as a threat to their position as they see their job being done by someone less qualified. Its only natural if somebody comes along and threatens your profession, there is bound to be resistance.

Manager, non teaching trust.

One of the other managers who recognised radiographers as a barrier also made the point that they were happy to extend their role but did not want to give anything up.

I think the barriers are being set by the radiographers; they are reluctant to give things up. They are happy to take on at the top end but we are somewhat reluctant to give things up at the lower end, we still want to control everything and numbers don't allow us to do that, we have to be pragmatic and recognise that we are going to have to do something because we cannot cope with the volume of work coming through. So we are going to have to accept these people but there needs to be an approved training scheme recognised by the Society and the College [of Radiographers], I think that would get round some of the barriers and radiographers would accept assistants.

Manager, non teaching trust.

At the other end of the spectrum a manager recognised a potential difficulty in getting radiologists to accept consultant radiographers. But as with the acceptance of extended roles the manager was of the view that if there was need to introduce the role to ensure the work was done then the consultant role could be accepted.

"That is where I think the radiologists could find the consultant tier quite difficult to handle. It is possible that they might take it on board, but again I think it is all about pressures and need and if there is a need and if they didn't particularly want to do the job of the consultant there may be someone else to do it.

Manager, non teaching trust.

Further questions around the model were asked specifically to explore three of the proposed tiers: assistant practitioner, advanced practitioner and consultant.

Assistant practitioners

Unquestionably, this was the tier that provided the major focus for managers. The concept of an assistant practitioner was supported by all managers but they required much more clarity around the role and the training needed. Managers agreed that assistants could undertake basic radiographic tasks such as chest and extremity radiography but one felt that the scope of practice would include pelvis and spines.

> "Basic radiography, on general practitioner referrals who come in for hands, feet, chest, pelvis, lumbar spine, the bread and butter type thing, not complicated. Most GP patients walk in the door and they are relatively fit with some relatively minor complaint and I think there is definitely a role for people to do things like that."
>
> Manager, non teaching trust.

The potential of this role proved to be attractive to managers on two main counts; one in filling the void left by radiographers who were adopting extended role tasks and secondly as a strategy to offset radiographer recruitment and retention problems. This was set out clearly by one manager whose response was typical:

> "Five years ago I would have said; 'assistant practitioners or whatever you want to term them, no chance, there is not going to be someone coming in and doing my job', but I think because of the way we are extending our roles, there is going to be a lack of radiographers who want to do chest and hand x-rays because they all want to do these extended role type tasks."
>
> Manager, non teaching trust.

However, one manager, who was not in isolation, was concerned that radiographers would lose their radiographic skills but showed a sense of realism in a changing situation.

> "We are going to leave a hole behind us which I suspect that assistant practitioners are going to fill. It is not a move I would see as altogether positive, mainly because I know a lot of colleagues that are quite keen to keep their general radiography and if you ended up with a tier, maybe bringing in somebody with a two year diploma or something, just to do chest x-rays this would be an issue. However, I am very much aware that you cannot have everything as we develop and leap

forwards in the profession. You cannot hold on to everything, there is going to be some time when you have to let go."

Manager, non teaching trust.

In the same vein another manager was concerned that the potential for de-skilling radiographers would be a barrier to the introduction of assistants.

Radiographers I suspect will be the biggest barrier. If somebody comes along and threatens your profession or in effect undermines your profession by saying somebody less qualified can do it, then there is always going to be resistance.

Manager, non teaching trust.

Against the case of radiographers as a barrier to the introduction of assistants was the need for a workforce to meet the increasing demands of the service. One manager put recruitment into perspective and indicated how the introduction of assistants would help:

"I should have just over 54 radiographers. I normally run with a vacancy of at least 8 or 9, sometimes 10, 11 or 12. We are desperately short of radiographers to cope with the volume of work we currently do; expanding into all these other roles makes it even more difficult."

Manager, non teaching trust.

Another manager was forceful in getting over the point that a shortage of radiographers would determine the introduction of assistant practitioners and felt that any resistance by radiographers was misplaced.

"This is going to go ahead anyway because we have no radiographers. We need a person who is between helper and radiographer grade and we need undergraduate training to be more flexible. This would allow links to be made between the assistant practitioner and radiographers. There is some resistance amongst radiographers but personally I feel it's arrogant to assume assistant practitioners cannot take on some of a radiographer's role without the correct training and support.

"Manager, non teaching trust.

Training was also an issue that had not been addressed to any great extent but there was a common view that any qualification should be accredited nationally. This view was promoted by several managers one of whom stated the following:

> “I think really there should be a nationally recognised qualification for assistant practitioners. Their scope of practice also needs to be clearly defined or else it gets very confusing as to whose role things are.”
>
> Manager, teaching trust.

For another manager the implications of the introduction of assistants would not be without difficulty:

> “Assistant practitioners have got to be employed in this hospital but they have got to be introduced properly. Their training has to be recognised and trainees will have to be supervised by radiographers who may not have the time to do so. One of the biggest problems is how do you recruit to assistant posts when currently those posts do not exist and we have no money within the budget to recruit. But if you have these people and they need massive amounts of supervision by radiographers and you are doing this because you can’t recruit, you are actually putting an increased burden on those people you are trying to help. Until we have got some kind of clarity about how these courses are going to run, what exactly these people are going to do and how we are going to fund them, I think we are a bit of a way off putting them into place.”
>
> Manager, non teaching trust.

Advanced practitioners

Five of the managers had not considered the introduction of advanced practitioners to any great extent. Three of these, although being aware of the four tier structure, were unclear as to where an advanced practitioner would fit and how it related to the current structure. This was almost certainly due to the fact that they had not spent any time considering the implications of the model in any depth and of the advanced practitioner in particular, although they were keen to engage in conversation and explore the potential of the tier.

The remainder (6) were keen to see recognition of practice they recognised to be at advanced level. One manager felt that a number of staff would fit the role and certainly those who practised CT, ultrasound or enemas; advanced practitioner would give them recognition of their practice. The majority of managers saw ultrasound in particular as a priority for recognition within the advanced practice arena as it was seen as an area where radiographers are totally independent practitioners. One manager felt that all ultrasonographers should be advanced practitioners.

> "I would like to see all our ultrasonographers be given advanced practitioner status immediately."
>
> Manager, teaching trust.

This manager continued by saying that staff designated as advanced practitioners should be rewarded for their expertise by placing them on a different pay spine. One manager had already tried this without waiting for a lead from the NHS. However, a union become involved and were opposed to local agreements so it was not pursued.

Outside of ultrasound there was less commitment and it would depend upon what individuals were doing.

> **"**I think it just depends, because at the moment ultrasound is the only area where people are totally independent practitioners. In bariums we validate peoples' reports for the consultants as we do in breast screening. If you have someone who does barium enemas and they do these all week and then you can persuade the consultants to say they can independently report which happens in some areas, then you can put them in the advanced practitioner role. If they are only doing it one day a week or half a day a week, then it becomes more difficult to put them into the advance practitioner role because you could say that yes whilst they are doing that, but the rest of the week they are doing other things.
>
> Manager, teaching trust.

One manager considered that there were still some basic principles with which to come to terms on what constituted advanced practice.

> "At the moment we are looking at developing this role. We are not sure what to call them; we think it may be lead radiographer or specialist radiographer, because we feel that in the modalities we have got some very able radiographers who could lead. I am thinking perhaps of gastro-intestinal practice, even theatre radiography. There has been to be someone who has got a high level of knowledge and clinical practice who could take some of this forward. Another idea is maybe we have a lead radiographer in orthopaedics for instance who takes that forward and becomes an integral part of the orthopaedic team. There are lots of ideas flying around at the moment.
>
> Manager, non teaching trust.

This manager was acutely aware that what was being suggested would constitute a radical change to the current structure and felt there would be resistance from some superintendents and some senior radiographers who would feel threatened by the

change. But the manager was convinced that it was a route the department had to go down because the whole structure was better and would recognise clinical expertise in terms of status and financial remuneration.

Consultant Practitioners

The concept of consultant radiographers was supported by nine managers but a number of potential barriers and difficulties were identified.

The financial implication of establishing a consultant post was seen as a barrier by eight managers. The main problem identified by the managers was not being able to access their Trust budgets but felt that there should be new funding made available from Government to establish consultant posts. One of the managers summed it up as follows:

> "Trying to get the money from the finance department when we are already strapped for cash is going to be very difficult and it may be that we have to have an initiative that we tap into some kind of money from Government using the multi-disciplinary approach."
>
> Manager, teaching trust.

Another manager saw parallels with nursing.

> "I believe the financial aspects are great. How do you pay these people? The nurses have gone down this route and they have obviously had implementation problems, we need to learn from these.
>
> Manager, teaching trust.

One manager who supported the introduction of consultants foresaw a problem in ultrasound of attracting the right calibre of person from a relatively small pool.

> "There is a big issue, especially with sonographers of the right calibre to practice at consultant level. These are few and far between. We also have to be fair and introduce a system that will not poach people from our neighbouring trusts."
>
> Manager, non teaching trust.

Another manager did not see 'poaching' as an issue and wanted to see competition for posts but felt there was an issue of the transferability of practice between different parts of the country.

> "In terms of a consultant ultrasonographer they ought to be the same as consultants in Leeds or Scotland or wherever, so you do need to have some sort of parity across Trusts because then you can go out to fair competition and people can actually move if they want to."
>
> Manager, teaching trust.

Another point in relation to implementation of consultant posts was not without a certain degree of cynicism:

> "I have given it some thought and I am not certain where it will lead to. I think it is a bit like the consultant nurse role. I have an opinion that it may be a gimmick for the Government to say that radiographers, other allied health professionals and nurses can progress to this level but the actual number who will get to those levels will be miniscule across the country. Nurse consultants are, like 40 across the country I think, so that wouldn't even be one in every acute trust. So I just do not see how it will pan out in practice."
>
> Manager non teaching trust.

Despite the problems envisaged there were many positive comments and four managers believed that the introduction of radiographer consultants would be helped by the precedent for appointing nurse consultants.

There was a degree of optimism as with advanced practice, ultrasound was believed to be the modality as the most likely where consultants would emerge as typified by the following.

> "I would like to introduce consultant radiographers in ultrasound because effectively they are taking the place of a consultant. They would vet requests; they would perform the procedures and would look at what the registrars are doing and so on. I have an opportunity which I would like to try and advance this in the next three months."
>
> Manager, teaching trust.
>
> "Ultrasound has been established for a long time, radiographers are accepted for doing that and it could be a natural progression that they move on to a higher level than. I am not certain where it would fit in with CT and MRI."
>
> Manager, non teaching trust.

Although there had been opposition to extended roles from some radiologists, nonetheless, some managers did not believe that radiologists would be a barrier to consultant radiographer roles. The following was typical of the managers' views.

> "Consultants: radiologist-wise I can't see it because I think that they recognise that we are doing extra things and that we are a profession and we are not just the button pushers that maybe they saw as once being and so I really cannot see any resistance."
>
> Manager non teaching trust.

The manager at a teaching trust felt that medical staff would welcome the role of a consultant sonographer.

> "I think they would support a consultant in ultrasound. In a teaching trust you have slightly less ability to do some of these things that you do in a DGH because of the training role that we have. A consultant sonographer could make an important contribution to the workload and this is an important aspect to consider."
>
> Manager, teaching trust.

There was, however, one manager who was doubtful of the acceptance of consultant roles and thought that it may be difficult for radiologists to handle the concept of radiographer consultants but they might take it on board given increasing workload pressures.

Radiographers on the other hand were not seen as barriers to consultant roles despite the fact the evidence of some radiographers being resistant to extending roles. One manager was sure that radiographers would welcome the development of consultant posts as exemplified by the following:

> "I think radiographers would welcome it because it is a good thing for the profession and I suspect will give the profession greater recognition and if the consultant practitioner brings more recognition for the profession then it is better for all the radiographers."
>
> Manager, non teaching trust.

Although not expressed in terms of a barrier there were issues raised about defining the consultant's scope of practice. A manager felt that radiographers were at a disadvantage with physiotherapists who seemed to have more autonomy as clinicians. But his view was that this was a real opportunity for radiography practitioners to become autonomous in their own right. The manager also believed that the Regulatory Body, the Health Professions Council would help in this respect.

While five managers took the opportunity to express a view that they press for the implementation of consultant roles there was only one manager who was contemplating making a consultant appointment within the following six months. Most managers were calling for further information on consultant posts as exemplified by the following:

> **"**I would like to see more information on consultant practitioners; in particular I would like to see the role defined more nationally. It's important that this isn't 'fudged' and we would need the correct person to be able to maintain clinical accountability and also earn the respect

of the medics. The person would need to have links with research and teaching, perhaps with links to local universities."

Manager, non teaching trust.

This was an issue was raised by another manager who felt the lack of information and clarity about the role was a major issue.

"There has to be clear recognition as to what the role of the person is and at the moment it is not clear what these consultant radiographers would be doing. I think once that becomes more clear and we get them up and running somewhere people will then decide for themselves whether it is a valid opportunity and is worth progressing."

Manager, non teaching trust.

On the question of time scale for the implementation of the four tier structure overall two managers expressed their views as follows:

"I think in five years time we will almost inevitably be towards the four tier system. I think assistant practitioners have got to be in place, that is inevitable but we have got to fill the void but hopefully by then the recruitment issues should be starting to be eased slightly. If we can get assistants in, then the demand for radiographers as fully qualified will be slightly less because we can have assistants who are doing slightly less work."

Manager, non teaching trust.

"I think the demands are increasing in certain areas – CT, MR and ultrasound – and I think they probably will continue to increase, but the assistant thing will definitely make a big difference and if we can get them on board and five years is enough time, there should not be a problem and that will make a big difference."

Manager, teaching trust.

4.5.3 Section 3 - Education and training to support new ways of working.

The final section of the interview dealt with developments and needs from an educational perspective.

All managers believed that there had to be some change to education and training in order to meet the demands of the profession, these are summarised in Table 4.6.

Table 4.6 Summary of changes required to education and training

Trust	Location	Status	Education changes
A	Northern Ireland	T	Emphasis on research skills. Increase in student numbers.
B	Northern Ireland	NT	Include IV injection skills. Improve problem solving skills.
C	Scotland	NT	Include IV injections in undergraduate programmes, apart from that about right.
D	N & Yorks	NT	Restructure to a two year programme on basic radiography and a third year to specialise.
E	South East	NT	A greater emphasis on clinical skills but overall the balance was right.
F	Eastern	T	Restructure to a two tier system, practically orientated. Gateway to advanced practice. Emphasis on multi-professional education.
G	Eastern	NT	IV injections to be included in undergraduate programmes. Greater emphasis on practical work especially film interpretation to assist A&E doctors with film viewing.
H	Eastern	NT	More post grad developments for barium enemas and reporting. Greater emphasis on research skills.
I	Eastern	NT	IV injections to be included in undergraduate programmes. Image interpretation. Greater knowledge of pathology, disease processes and other diagnostic tests. Greater clinical knowledge to assist with overall clinical management of the patient with a fast track to advanced and consultant status.
J	London	NT	Clear pathways to different specialisms and advance practice.
K	South West	T	About right but to include IV injections.

The main issues were around skills development with a greater emphasis to be placed on practical radiography in undergraduate curricula. Four managers wanted the inclusion of IV injections in undergraduate programmes and only two managers referred directly to image interpretation skills although one wanted more reporting and barium enema courses at post graduate level.

All managers considered the balance between clinical and academic training in the curriculum with which they were familiar; only three thought it to be about right. One of these interviewees was critical of the university system in the early days of degrees because of too great an academic focus which took the emphasis away from practical aspects such as image quality and technical issues.

> "In the early years too many students were 'academic' and had to be retrained but now more rounded radiographers are being produced."
>
> Manager, non teaching trust.

A sentiment was expressed by one manager who felt that educationalists were leading on what was required rather than following the clinician's lead.

> "We cannot have educationalists dictating what clinicians do; they must provide the education that clinicians want but there must be good dialogue between clinicians, educationalists and confederations."
>
> Manager, teaching trust.

Two interviewees held the view that the introduction of assistant practitioners would have a major effect on future course requirements as exemplified by the following quotation.

> "It [practical radiography] depends upon whether assistant practitioners will be introduced, if not then training needs to be more practical. There is too much being crammed into three years and basic radiography is being compressed."
>
> Manager, non teaching trust.

One manager believed that radiographers would benefit from an interprofessional approach to education and could follow the lead given by other professions.

> "Radiographers are not good at problem solving as are physiotherapists and speech therapists for example."
>
> Manager, teaching trust.

The same manager suggested the way ahead to overcome the problem was by reorganising education delivery.

> "We need core modules with other disciplines. No room for schools of radiography but we need schools for allied health professionals where they provide the discipline core but can offer a wider agenda."
>
> Manager, teaching trust.

Another approach to placing greater emphasis on clinical skills was a post-registration year as a period of consolidation which would allow students the time to assimilate knowledge and basic skills.

> "At undergraduate level there is too much academic emphasis rather than clinical. A year post registration should be a year when competencies are assessed. At one time radiographers would be asked to dive in from day one but now it can be up to 12 or 16 weeks but too much time is spent on specialised modules. However at about nine months they can be in advance because of the knowledge they have gained from the degree programme, it is the first few months that are the problem."
>
> Manager, teaching trust.

What seemed to be a different approach was expressed by another manager who believed there was scope to change undergraduate education to include a greater emphasis on the specialist modalities. At first sight this could be interpreted to be a contradiction to the previous view but on closer examination there was a common theme of protecting time for practical radiography training.

> "It may be that a radiographer will come in and train for two years and do general work and then in the third year will specialise, something like nursing I suppose, and do CT or ultrasound or whatever in their third year. Maybe this is the way to proceed at undergraduate level or extend training to four years.
>
> Manager, non teaching trust.

The interface between radiography and radiology was also a consideration for one of the teaching trust managers who felt that a stronger radiology component could be included in radiography programmes. It was suggested that there could be a transition zone, for advanced radiographers who would undertake a common core programme alongside registrars entering radiology. This particular manager took up the theme about the academic overload and was another who was suggesting an extension of training to a fourth year.

The possible impact of the four tier structure on education and training was raised by the interviewees. One manager did feature and one manager believed that there would need to be an overall restructuring to accommodate the needs of each tier.

> "We went from diploma status to a degree status and we are turning out people who do not necessarily want to do basic radiography. Graduates are good at research but actually sometimes we are missing the people who are very practically good but not academically brilliant. So I believe we could see a two tier system for entrance into the profession, where you have the equivalent to diploma radiographers, who could be assistants and are much more practically based, and radiographers that have a much wider remit and have a more academic purpose."
>
> Manager, teaching trust.

It was apparent that the manager was unsure whether 'diploma equivalent' radiographers would be assistants or not. The feeling was that if they were assistants they would have to work under direct supervision all of the time which would not be as beneficial as someone who did not.

A possible solution was suggested by another manager.

> “It may be that what we do is to train radiographers to degree level but following different pathways to include preparation for extended roles as we are doing currently. Some of the extended roles would become part of the syllabus, this would give you an advance practitioner status when you are qualified, so you could bring the diploma type students into being state registered.”
>
> Manager, teaching trust.

In support of redesigning the undergraduate curricula to fit with an overall education structure for the profession one manager stated:

> “There should be a fast track to advance practice; graduates should be qualifying with vena puncture image and interpretation skills.”
>
> Manager non teaching trust.

A note of caution was expressed by one manager who had a concern that the inclusion of extended role tasks in the undergraduate curricula could raise expectations unrealistically.

> “We need to include extended role type tasks but need to guard against too high expectations as they would be insufficient extended role type tasks to go around.”
>
> Manager non teaching trust.

4.6 Discussion

The trusts had been selected in part on the basis of the range of actions in which they were engaged. At all trusts radiographers were administering IV injections, barium enemas and participating in red dot systems. Plain film reporting was undertaken at only three trusts but at two others radiographers were undergoing training. Ultrasound examinations were being reported at 10 of the 11 trusts but at two of these the radiographers produced preliminary reports only. Although radiographers undertook barium enema examinations at all trusts, at only two sites did they produce the final report; a preliminary report was produced in four others.
Interviewees had also been asked whether any new tasks had been introduced since the time of the survey. A number of new roles were identified; arteriography, cystography, barium meals, ERCP and parotid sialography and video fluoroscopy.

The interviewees revealed that the overriding driver for the adoption of extended roles was the increasing demand being placed on imaging services, exacerbated by an insufficient number of radiologists. The demand for radiologists was greater than their supply, a problem that had been recognised by the Royal College of Radiologists (2002). It is questionable whether, without the shortage of radiologists, radiographers would have been allowed to develop new skills to undertake what had been traditionally seen as radiological tasks. This was illustrated by one manager, who stated that, in the CT section, where radiologists were available on a full time basis there was no requirement to have a radiographer to inject contrast media. This was in direct contrast with the MRI scanner suite in the same department where radiologists were not available on a full time basis and so radiographers were trained to inject. This probably says more about the organisation of the department and failure to embrace skill mix across modalities although this would need to be explored further. It was also clear that across the sites many radiographers were keen to adopt new roles and this was identified as a crucial feature enabling the transfer of work from radiologists to radiographers to take place. Peer pressure was also identified as a positive force for change; radiographers reacted to fellow professionals undertaking extended roles at other sites and wanted to see these introduced at their own trust. Although the study showed that radiologists supported and, in most cases, initiated change, conversely they could also be the greatest barriers to change. Those radiologists who were against radiographers extending their roles fell into three groups. Firstly, there were those who were opposed, but the necessity of meeting the needs of the service prevailed over their objections. Secondly, there were those who did not personally sanction role extension, despite work pressures and thirdly, there were those radiologists in teaching hospitals where priority was given to teaching radiology registrars. The concern for this last group was that if examinations were

being conducted by radiographers, then this would decrease the training opportunities for trainee radiologists. However, in practice, at one of the teaching trusts, at which a radiographer had taken on ultrasound duties, this had turned out to be advantageous as the ultrasonographer became a useful teaching resource for the registrars.

The lack of radiology support did not prevent role extension provided at least one radiologist was willing to champion a new role.

In some cases radiographers themselves were the barriers to role extension. There were concerns of some older staff who were worried about additional responsibilities and the accompanying accountability for tasks which had been traditionally undertaken by radiologists. This did not appear to be such an issue for the younger generation of radiographers; it was apparent that managers believed that a new breed of radiographer was entering the profession. By virtue of their graduate training and perhaps greater motivation than some of the older staff they were enthusiastic and were prepared to adopt new roles. Managers in turn were keen to use this fact to motivate older members of staff who had seen that the newcomers were able to perform at the required level. This appeared to be a successful strategy to give existing staff confidence in their own potential ability. Examples were given of older members of staff changing their mind and agreeing to take on new roles and by virtue of their greater experience their involvement in new roles was an asset. There is also the possibility that this might also be because this group of staff felt threatened by the younger generation and would not want to 'lose face'. However, there were also radiographers who sought additional remuneration before agreeing to extend their roles; but this could only be partially addressed with discretionary increments.

The greatest radiographer barrier to role extension was a shortage of radiographers. If radiographers are to take on labour intensive tasks such as gastrointestinal studies and reporting then time has to be allocated for these to happen. The problem was that, as a result of the redeployment to the new tasks, additional staff would then have to be employed to fill the void. This was not a straightforward proposition for managers, particularly as there was no guarantee of additional funding to support replacement costs.

Despite the reluctance of some radiographers to adopt new roles it was evident that there were plenty of willing volunteers. At most sites this seemed to be the main criterion for initial selection rather than selecting staff because they had some special skill or aptitude. However, it would be fair to comment that managers and radiologists would have some idea of a radiographer's interest and ability within a particular modality from their day to day performance and from appraisal. All trusts had reasonable policies of encouraging those with an interest to train for new roles.

However, being selected for training did not necessarily mean that a radiographer would automatically undertake a new role unsupervised; to an extent, this would depend upon the training outcome. Initial training appeared to be taken seriously at all trusts, with the extent of training being dependent upon the complexity of the role to be undertaken. Training courses ranged from in-house to externally certificated and/or accredited programmes. Typically this would range from an in-house course of one day for the red dot scheme to an external course lasting eighteen months to two years for an ultrasound programme. It was evident was that staff in some trusts were circumspect in many cases about in-house courses as, these did not lead to recognised qualifications so that the skill was perceived not to be transferable if the employee moved to another trust. On the other hand in-house courses were viewed by managers advantageous because there was little or no cost involved.

Securing the funding to support training was problematical for half of the managers. To circumvent this problem, at two trusts, a special fund had been set up to support developments rather than from the mainstream NHS training budget. It was also clear that managers believed that trusts would need to provide ongoing funding if radiographers were to continue to be trained to perform new roles and, in addition, for those already trained to maintain their competency.

In some cases a great deal of reliance was being placed upon a relatively small number of staff to provide the particular service. An all too common observation was that where a member of staff had been trained for a particular role, there was no succession training. There was some justification offered for this in that staff could not be made available for training because of workload constraints. One trust appeared vulnerable as only one radiographer had been trained to undertake barium enemas.

Managers were clear as to the benefits of utilising radiographers for extended role tasks. Reduced waiting lists were major gains as was the increased continuity in patient care. Increased staff morale and improved team working were also identified as positive outcomes which were accounted for by improved working relationships between radiologists and radiographers. It was commented upon by more than one manager that the attitude of radiologists to radiographers had changed with the former developing a greater respect for the latter.

Those who had thought through the implications of the four-tier structure were confident that it would be advantageous and provide a much improved career pathway which would value and reward the development of clinical expertise. However, most of the interest shown in the four-tier structure was focussed on the introduction of assistant radiographic practitioners. This was viewed as a ‘quick fix’ by

managers, as assistants would be able to undertake the basic radiographic techniques which they believed would offset the recruitment and retention problems of radiographers. However, there was some negative comment directed against assistants and in some respects such views also mirrored the opposition of those radiologists who were protecting their professional boundaries against radiographers extending their roles. In a similar vein to radiologists, some managers were in the process of changing their views from a position of hostility to one of a recognition that the needs of the service had to be met and the employment of assistants was key if radiographers were to extend their role.

Those managers who had seriously considered advanced and consultant practice were mostly supportive but felt that they were a number of questions that had to be answered before these tiers could be introduced. These were concerned with the lack of clarity on what constituted advanced and consultant practice. The fact that radiographers undertook extended roles was thought to be sufficient by some managers, but for others it was the level of expertise to be attained. No manager was clear on how to define expertise but from points raised in the interviews, the level of qualification and being able to practise independently (of a radiologist) would seem to be significant factors. Although experience would also seem to be an important characteristic this was not a factor that featured in the interviews to any large extent.

Of the particular modalities discussed, ultrasound was recognised as an area in which advanced practice could be readily accepted because of the independent nature of the work. There was more uncertainty about other modalities but at least one manager was keen to make progress in gastro-intestinal and orthopaedic imaging.

Consultant practice for radiographers was largely welcomed and as a concept was probably understood more than that of advanced practice. The objective of establishing Consultant AHP posts has received a fairly high profile originating in the NHS Plan (2000) which was followed up with the publication of core and supporting functions for consultants (Department of Health, 2002). Interestingly enough, managers were of the opinion, that having overcome radiological opposition to extended roles, opposition to consultant roles would not be a major barrier. Funding, however, was seen as the stumbling block for consultants. While the NHS was keen to promote new ways of working with new roles it was not clear how the funding was to be made available.

In providing education to support new ways of working managers wanted undergraduate curricula to facilitate the assimilation of greater clinical knowledge. The ability to administer IV injections was one skill area identified by a number of managers. Although there was already a precedent for this as one manager had

experience of graduates who had been prepared in this field, hence, the reason for the manager not categorising this as an extended role skill. There was also a need to improve the level of clinical knowledge overall which would allow practitioners to play a greater role in patient management. The introduction of a new practice model would seem to be imperative if the radiography/radiology interface is to managed efficiently. This not only would assist managers in supporting extended roles but in producing a level of worker to focus on *basic* radiography. The four-tier structure could also address the situation where the development of new roles are being blocked by older and long serving staff but managers will need to address the CPD needs of this group of workers to ensure that they have the opportunity to develop their skills consistent with the needs of the service. Younger staff would have greater opportunity to progress through the tiers based upon their ability rather than upon the length of time in post rather than seeking employment elsewhere in order to progress. Overall, the issue of managing extended roles will have to be addressed since, under prevailing conditions, further developments will be problematic unless funding, succession training and career pathways are addressed.

4.7 Summary

This study enabled an in-depth exploration with managers of imaging departments of the reasons that encouraged or resisted the adoption and diffusion of extended roles, together with educational implications.

The key to developing new roles was the increase in workload combined with the shortage of radiologists, although the actual introduction of new roles was dependent upon other 'secondary' local factors. Foremost among these was the support of a radiologist or radiologists at the particular trust. Without such support it was clear that roles would not be adopted.

The degree of enthusiasm for role extension by radiologists was important in some trusts where individuals who were less enthusiastic or resistant to change, they tended to take a pragmatic position in support of new roles because of workload demands. Furthermore, there was evidence provided to show that once a radiographer had performed at the level required and the confidence of dissenting radiologists had been gained, this then improved morale and teamwork.

There was some evidence of concerns of the possibility of radiographers blocking training opportunities for radiology registrars. These were not well founded and there was evidence that radiographers, in fact, could provide an important resource in facilitating the training of registrars. There were, however, radiologists who disagreed with radiographers undertaking extended roles at all, and refused to participate in

implementation but this was not sufficient to prevent adoption of new roles provided there was at least one radiologist willing to provide support.

Willingness of radiographers to adopt new roles was another key 'secondary' ingredient; this was influenced by peer pressure and knowledge of developments at other trusts. The enthusiasm for change appeared to come mainly from the new generation of graduate radiographers. There had been no compulsion, so far, for radiographers to take on new roles, and resistance had been observed from some It was reported that resistance was often from longer serving staff who did not want the added responsibility for work that than been traditionally undertaken my medical staff. This is an issue that will need to be addressed at some point if the maximum benefits from skill mix are to be achieved. This might be, dependent, however, upon the introduction of a sub-professional worker to undertake less complex radiographic tasks. This would lead to a release of radiographers to undertake the extended role tasks and allow radiologists to focus more on interventional work. The four-tier structure was viewed as offering managers a way of overcoming staffing shortages while providing an improved career framework for radiographers to advance their professional status and manage skill mix issues across the department.

The examples of the new tasks being instigated were being driven by service need but were also dependent upon radiologist and radiographer enthusiasm. For example, one trust had introduced a radiographer to undertake sialography; another wanted to implement this activity but radiologist resistance was the barrier. This would seem to confirm the ad hoc nature of extended role adoption.

Some of the problems that managers experienced in supporting extended role development were attributable to the fact that they are expected to manage these changes within existing resources at a period when practice is going through a period of transition. While introduction of the four-tier structure could assist this situation and ease the transition to advanced practice, (with a supporting tier of assistant practitioners to perform basic radiography), there would be no guarantee of additional resources.

The four-tier model itself would be a strong driver of future educational provision. Managers suggested there would need to be a two tier arrangement for initial education and training, with the lower tier focussing on practical radiography and the upper tier on advanced practice skills and specialist modalities. If this was to be the case, then clearly educational provision would have to be restructured to mirror this

and support all levels of practice from assistant to consultant. In essence, this would mean a four-tier model for education as well as for practice. This could provide a more direct route to advanced practice but not necessarily the fast-track that was suggested by some managers.

CHAPTER 5

FURTHER DEVELOPMENTS OF EXTENDED ROLES AND THE IMPLEMENTATION OF THE 4-TIER STRUCTURE

5.1 Background

The two previous national surveys reported in Chapter 3 enabled the mapping of the adoption and diffusion of extended role activities across the United Kingdom. Data from the second survey showed that the number of NHS trusts utilising radiographers to take on extended roles has continued to increase. The second survey was followed up by a series of planned interviews with imaging department managers to elicit their views on the implementation of role extension and issues arising from their implementation. These issues were reported in Chapter 4.

It was reported that managers of some imaging departments were experiencing difficulties in managing role extension. In addition to the shortage of radiologists (Royal College of Radiologists, 2002) which had not improved there were concerns over a shortage of radiographers in some departments. Data from the Department of Health's (2004 d) vacancy survey for March 2004 revealed a three month vacancy rate of 4.8% for diagnostic radiographers in England; although this was a reduction from 6.1% in March 2003. The impact of the shortages of both radiographers and radiologists are brought into perspective against the 17.3% overall increase in the number of imaging examinations, 26,138,027in 1995 to 30,648,272 in 2004 (Department of Health, 2004 a). This situation was making it difficult to manage the radiographic workload as those radiographers performing extended roles were not necessarily being replaced by other radiographer to compensate). The situation also made it difficult to release radiographers for extended role training which meant a lack of succession training. In a paradoxical situation, while radiographers were helping reduce the burden of the radiological workload they were becoming an obstacle in meeting with the radiographic workload.

Some managers were of the view that the 4-tier structure, which was being promoted by the Department of Health Learning and Personnel Development Division (2003) offered a solution. Whether or not the 4-tier system was being adopted at a local level was unclear. The Department of Health Learning and Personnel Development Division (ibid) provided sketchy information. There was no up to date information on whether the growth in extended roles was continuing, or even in decline. Consequently, a further survey was undertaken in order to continue to map the extent

of extended role developments. This 3rd survey also investigated the extent to which the 4-tier structure had been adopted.

5.2 Purpose

The purposes of the survey were to:

- update information on the adoption and diffusion of extended roles obtained from previous studies in 1998 and 2000;
- identify any regional patterns in the adoption of extended roles;
- investigate the implementation of the 4-tier model,

5.3 Methodology

5.3.1 Participants

Imaging managers at 258 UK acute trusts were invited to respond to the questionnaire. Managers were selected whose position within the organisation would enable them to provide accurate and authoritative responses to the questions asked.

NHS trusts were identified from the Institute of Health Services Management Year Book. Only acute NHS trusts were included in the survey as by far the majority of diagnostic radiographers are believed to practise in that sector.

The surveys were targeted at the total population this would ensure that the 'sample' was not biased and unrepresentative.

5.3.2 Materials and questionnaire design

A structured questionnaire was utilised for the survey. The full questionnaire is presented in Appendix 7.

The questionnaire design was similar to those used in the two previous surveys. It was deliberately kept succinct and restricted to two sides of A4 paper.

In constructing the questionnaire, extended role activities were the same as those presented in the previous survey but with an additional category of barium meal included. Additionally, there was a section included to investigate the extent to which the 4-tier structure had been adopted.

Respondents were asked to identify the region in which their trust was located, whether it was classified as a teaching or non-teaching and the number of radiographers and radiologists in their departments. For convenience English trusts were classified under the NHS boundaries which had been used in the previous studies but with one exception, the addition of Thames Valley and Northamptonshire as a separate geographical entity.

Managers were asked to indicate if radiographers undertook any of the following; intravenous (IV) injections, barium enemas, barium meals, and reporting. Reporting was further divided into nine sub-categories, appendicular skeleton, axial skeleton, chest, barium enemas, barium meals, mammography, nuclear medicine, paediatric and ultrasound.

For each activity, further information was sought on the date of implementation and the number of radiographers involved. In the case of reporting, an additional question was included that was not included in the previous survey. The question asked whether the report was made independently of a radiologist. Information was also sought on abnormality detection (e.g. red dot system) although not an extended role category it was included as it could be viewed as a precursor to full reporting by radiographers. Two further questions asked whether there were any other extended role tasks being performed and any that would expect to be introduced in the following twelve months.

The section on the implementation of the 4-tier structure sought information on the numbers of personnel classified as assistants, advanced and consultant practitioners and the modality or area of practice.

5.3.3 Procedure

The questionnaire received ethical approval from the University of Hertfordshire.

The questionnaire was placed in envelopes addressed to the Imaging Manager at a named NHS acute trust. A letter was included with each questionnaire explaining the purpose of the survey. A pre-paid addressed envelope was also included for convenience of return.

5.4 Results

Returns were received from 177 managers, representing a 68.6% response rate; 87 (49.2%) of the trusts were identified as teaching; 87 (49.2%) as non-teaching hospitals. In 3 cases (1.7%), the status was not provided. The response by region is shown in Table 5.1.

Table 5.1 Questionnaire response by region

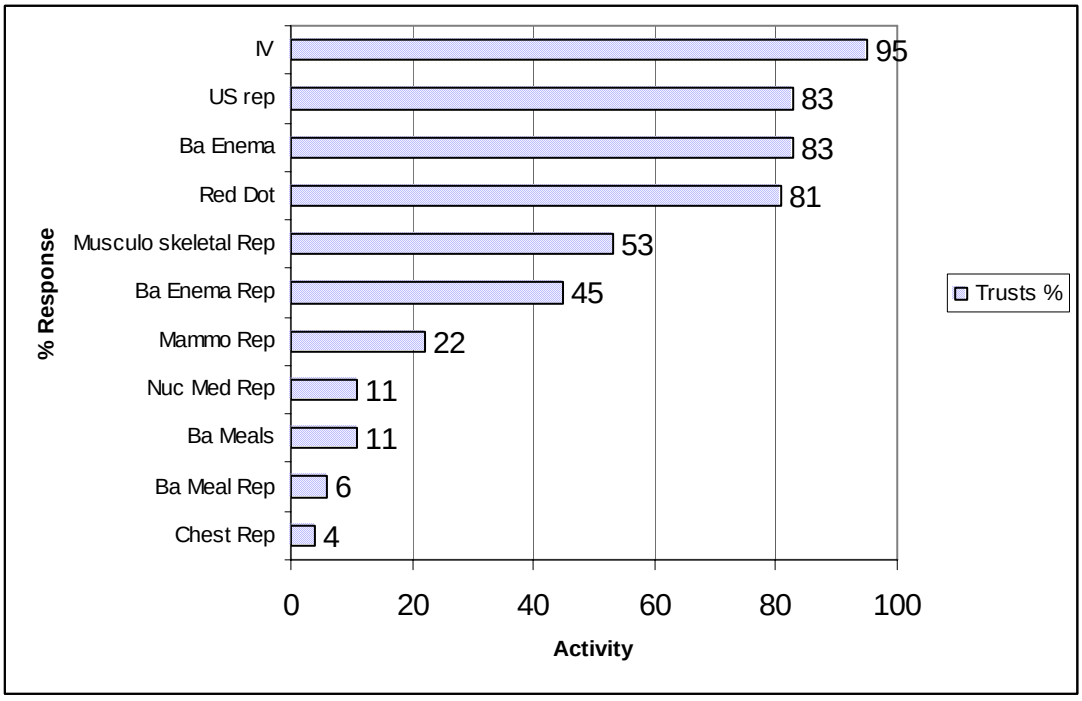
Region	Sent	Returns	Response %
South East	24	24	100
Eastern	19	16	84
London	34	24	71
North West	30	21	70
Wales	16	11	69
Scotland	28	20	68
Northern & Yorkshire	23	15	65
South West	16	10	63
Thames Valley / Northampton	10	6	60
N Ireland	13	7	54
West Midlands	24	12	50
Trent	21	10	48
Not given	-	1	
Total	258	177	68.6

The national picture for extended role activities, including procedures and reporting, is presented first. This is followed by regional differences in these activities. Then the national situation with respect to staffing and the 4-tier system is reported, followed by an analysis of regional differences

5.4.1 The national picture of extended role activities

The proportions of all activities reported from this survey are shown in Figure 5.1. The most frequent activity being IV injections and the least chest reporting.

Figure 5.1 Proportion of activities for sample



Recipients were also asked what other extended roles had been introduced into their department since the last survey in 2000; these are shown in Table 5.2.

Table 5.2 Other roles introduced since 2000

Extended role tasks			
CT head reporting	8	Amniocentesis	1
Barium/video swallow	4	Bronchograms	1
MCUG	4	CXR comment system	1
Venography	4	Cystograms	1
Breast biopsy	3	NJ tube insertion	1
Hickman line	3	Orthopaedic triage	1
HSG	3	Picc placement assessment	1
MRI spine	3	Prostatic Biopsies	1
Sialogram	3	Radiographer led breast clinic	1
Small bowel enemas	2	Renal biopsies	1
Angiography	2	Sclerotherapy	1
DEXA reporting	2	Small bowel meals	1
Piccline insertions	2	Ultrasound guided breast localisations	1
Proctogram	2	Venflon insertion for CT	1

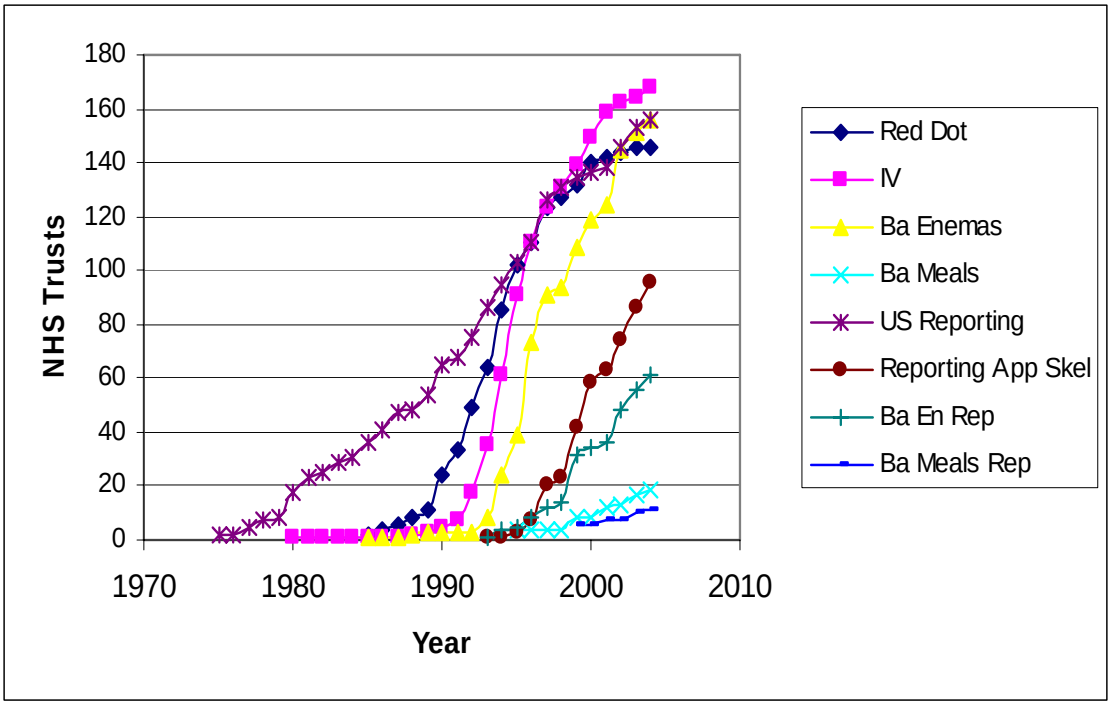
Utilising data from the three surveys, 1998, 200 and 2004 the percentage increase of trusts employing radiographers for IV injections, barium enemas, barium meals red dot and reporting categories are presented in Table 5.3.

Table 5.3 Increase in Extended Role Activities since 1998

ACTIVITY	% Response Trusts		
	1998 data	2000 data	2004 data
IV injection	89	94	95
Ba Enema	53	64	83
Red Dot	70	76	81
Ba Meals	-	-	11
Reporting			
US	65	72	83
Red Dot	70	82	82
Musculo-skeletal	16	36	53
Barium enema	16	19	45
Mammography	4	10	22
Nuclear medicine	2	6	11
Barium meals	-	3	6
Paediatric	0.4	3	6
Chest	0	1	4

Also by combining data from the previous surveys in 1998, 2000 and now from the most recent, 2004 survey, it is possible to demonstrate the cumulative effect of adoption and diffusion of extended roles showing the increasing scope of radiographic practice over time. This is presented in Figure 5.2.

Figure 5.2 Adoption and diffusion of extended roles (cumulative)



The questionnaire also asked if any new roles were anticipated to be introduced in the next twelve months, responses are shown in Table 5.4.

Table 5.4 Extended role tasks anticipated to be introduced over the next 12 months

Anticipated extended role tasks			
A+E reporting	8	IV injections	2
Abdomen reporting	3	IVU	10
Angiography	2	Line insertions by radiographers & nurses	1
Angioplasty	2	Mammography reporting	4
Appendicular reporting	14	MRI head reporting	1
Assistant 2nd checking contrast	1	MRI knee reporting	3
Axial reporting	14	MRI reporting	8
Barium enema	4	Nephrostomies	1
Barium enema reporting	14	NG tube insertions	1
Barium meal	3	NJ tube insertions	1
Breast FNA	1	Nuclear medicine reporting	5
Breast ultrasound	1	Proctograms	1
Clinical governance radiographer	1	Radiographer discharge from A&E	2
CPD co-ordinator	1	Radiographer see and treat for A&E	1
CT head reporting	32	Red dot	1
CXR reporting	8	Reporting	9
Further GI examinations	2	Ultrasound reporting	2
Hickman line	2	Venography	1
HSG	5	Video fluoroscopy	3
IM buscopan	1		

Reporting

Reporting was divided into the nine sub-categories of appendicular, axial, barium enemas, barium meals, chest, mammography, nuclear medicine, paediatric and ultrasound. A new question was introduced on this occasion which asked whether radiographers reported independently of radiologists. The reporting sub categories and whether reports are issued independent of a radiologist are shown in Table 5.5.

Table 5.5 Radiographers Reporting 2004

Reporting Field	Trusts where activity undertaken		Radiographers undertaking activity (WTE)	Trusts where radiographers report independently of a radiologist	
	Number	%		Number	%
Ultrasound	146	82	689 (9*)	134	92
Paediatric	11	6	26 (3*)	10	91
Plain film – appendicular	81	46	172	72	89
Plain film – axial	70	40	159.5	62	89
Chest	7	4	14	3	43
Mammography	38	22	66 (10*)	14	37
Nuclear medicine	20	11	24 (5*)	8	33
Barium enemas	78	44	175 (17*)	15	19
Barium meals	11	6	10	1	10

*not stated by Trust

In addition to the categories listed in Table 5.5 above, 28 Trusts stated that radiographers reported in other categories, these consisted of computerised tomography (CT) head scans (8), intravenous urography (6), sialography (4) video swallows (3) magnetic resonance (MR) (3), venography (2), proctograms (2), micturating cysto-urethrograms (2), breast ultrasound (1), angiography (1), nuclear med VQ scan (1), general practitioner (GP) reporting (1), vascular ultrasound (1), HSG (1), urodynamics (1), ultrasound foetal assessment (1), osteo CT (1), dacrocystography (1).

5.4.2 Regional differences in extended role activities

Regional differences in the adoption of extended roles were investigated further. A simple process of awarding points to each region for extended role activity is shown in Table 5.6. For each activity one point was awarded to the region with the highest recorded percentage utilisation, two to the second highest and so on up to a maximum of 12 for the region with the least activity. The positions based upon the total scores for each region are shown in the final column.

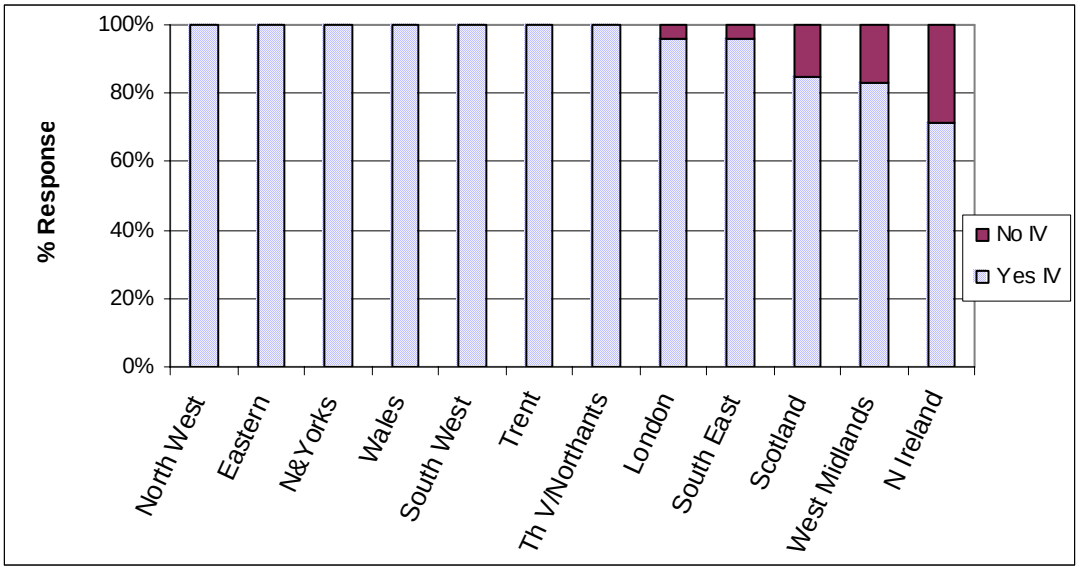
Table 5.6 Rank Order of Regional Differences by Activity

Region	IV	Ba Enema	Ba meals	Red dot	App Skel	US Rep	Ba en rep	Total Score	Overall Rank
North West	1	4	7	4	1	1	3	21	1st
Eastern	1	5	5	3	2	5	3	24	2nd
N&Yorks	1	1	3	8	8	1	2	24	2nd
South West	1	1	6	1	6	11	1	27	4th
ThV/Northants	1	7	4	5	6	1	5	29	5th
Trent	1	1	8	10	3	1	7	31	6th
South East	8	7	1	2	5	6	9	39	7th
Wales	1	6	8	6	11	7	8	47	8th
W Midlands	11	10	1	11	4	10	9	56	9th
Scotland	10	9	8	7	12	8	6	60	10th
N Ireland	12	11	5	9	9	12	11	69	11th
London	8	12	8	12	10	8	12	71	12th

Intravenous injections

One hundred and sixty eight (95%) managers reported that radiographers in their trust performed intravenous injections. Only 4 teaching and 5 non-teaching trusts did not have radiographers undertaking this activity. Twelve trusts (7%) had adopted the activity since 2000. Earlier surveys had revealed the earliest reported date of implementation was 1980, with the greatest increase being in 1996, when 49 sites commenced this activity. The number of radiographers undertaking IV injections from the sample was 2,183, an increase from 1,544 in the year 2000. The distribution by region is presented in Figure 5.1

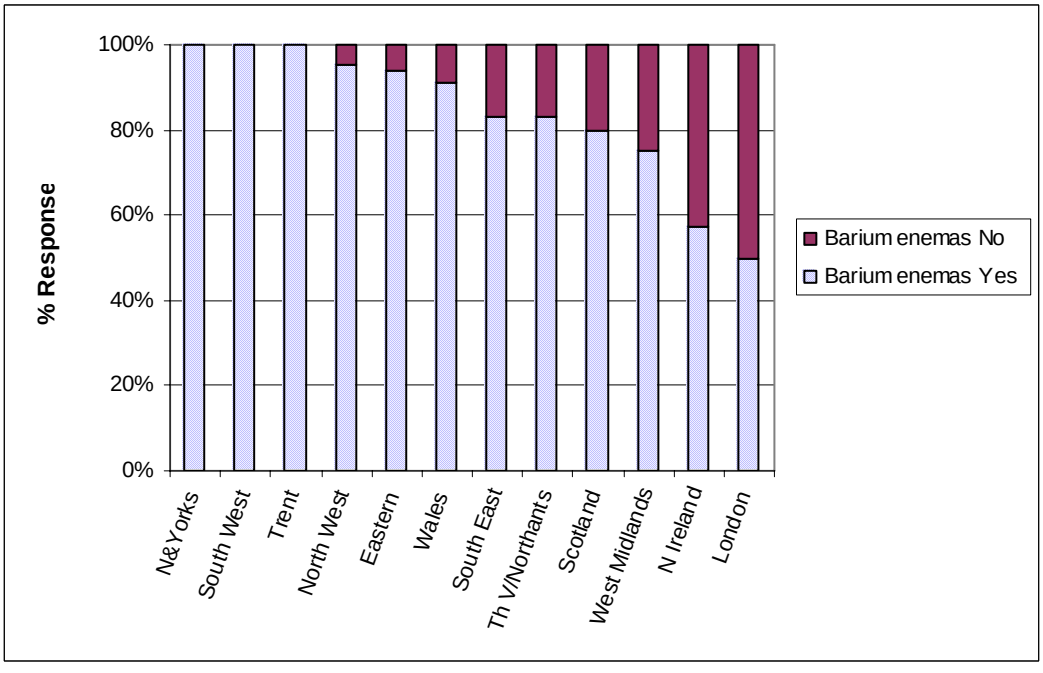
Figure 5.3 IV injections by region



Barium Enemas

One hundred and forty six (82%) of managers reported this activity was performed by radiographers; this was in 81% of teaching Trusts and 87% of non teaching trusts. The earliest reported implementation was in 1985 and the year of the greatest adoption rate was 1997 with implementation being reported at 38 sites. Thirty three trusts (19%) had adopted this task since 2000. A total of 473 radiographers were stated to be undertaking this activity as opposed to 322 radiographers reported in 2000. The distribution by region for this activity is shown in Figure 5.4.

Figure 5.4 Barium enemas by region

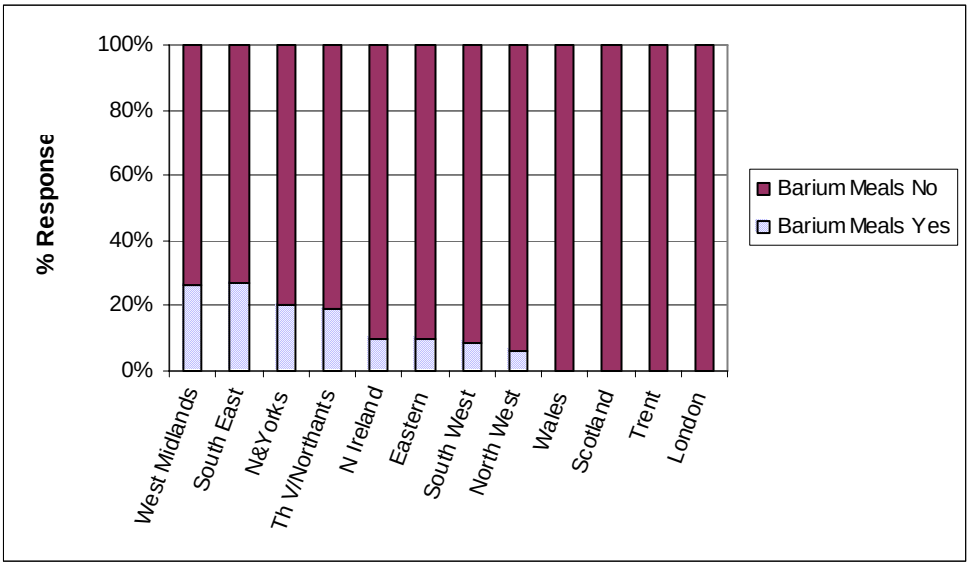


As reported in Chapter 3 London remains as the region with the smallest percentage of trusts utilising radiographers undertaking barium enemas.

Barium Meals

There were 19 (11%) trusts reporting this activity by radiographers, 8 teaching and 11 non teaching. This was a new category added for the 2004 survey. Eight trusts claimed that this activity was being undertaken before 2000 and eleven trusts had adopted this activity since 2000. A total of thirty two radiographers were reported to be undertaking barium meals. The distribution by region is presented in Figure 5.5.

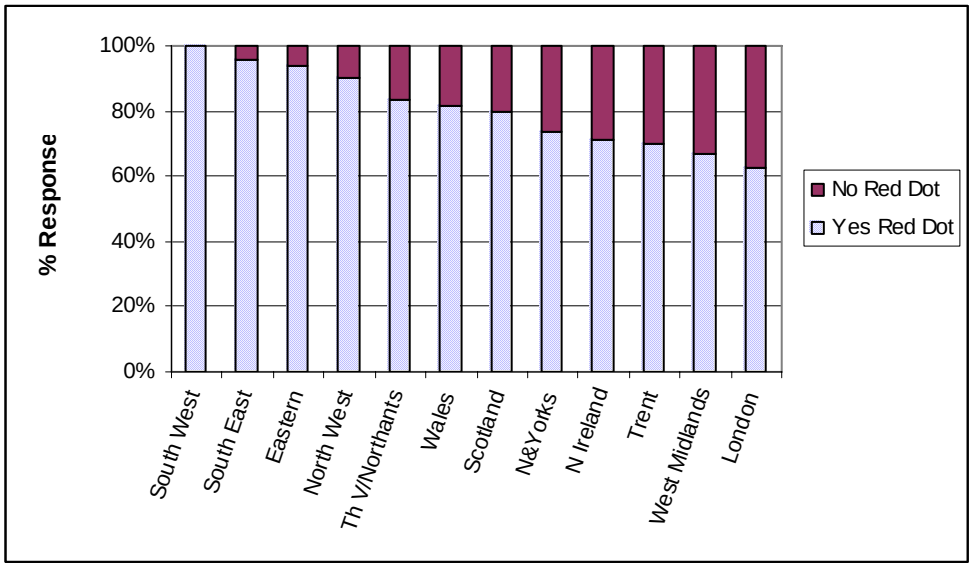
Figure 5.5 Barium meals by region



Red Dot Schemes

One hundred and forty three (81%) respondents reported that a red dot system was in operation in their trust. There were six Trusts that had adopted the system in the period since 2000. The total consisted of 66 teaching and 75 non-teaching Trusts. The year with the greatest adoption rate for this activity was 1994 with 21 Trusts implementing the system. The number of radiographers participating in red-dot schemes totalled 3,336, an increase from 3,040 in 2000. The regional distribution is shown in Figure 5.6.

Figure 5.6 Red dot by region



The regional distribution for the three most prevalent reporting categories, plain film appendicular, ultrasound and barium enemas are shown in Figures 5.7 to 5.9 respectively.

Figure 5.7 Plain film – appendicular skeleton reporting by region

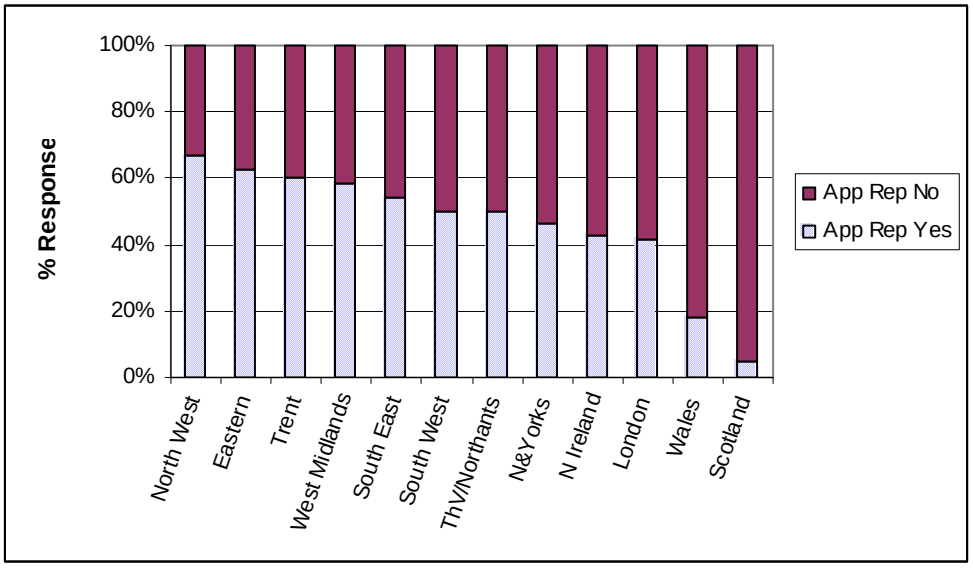


Figure 5.8 Ultrasound reporting by region.

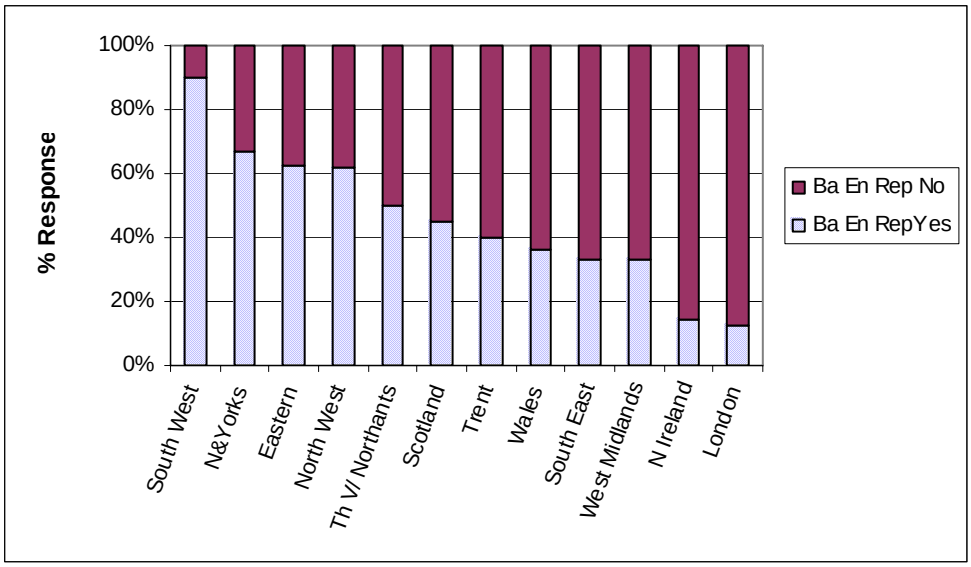
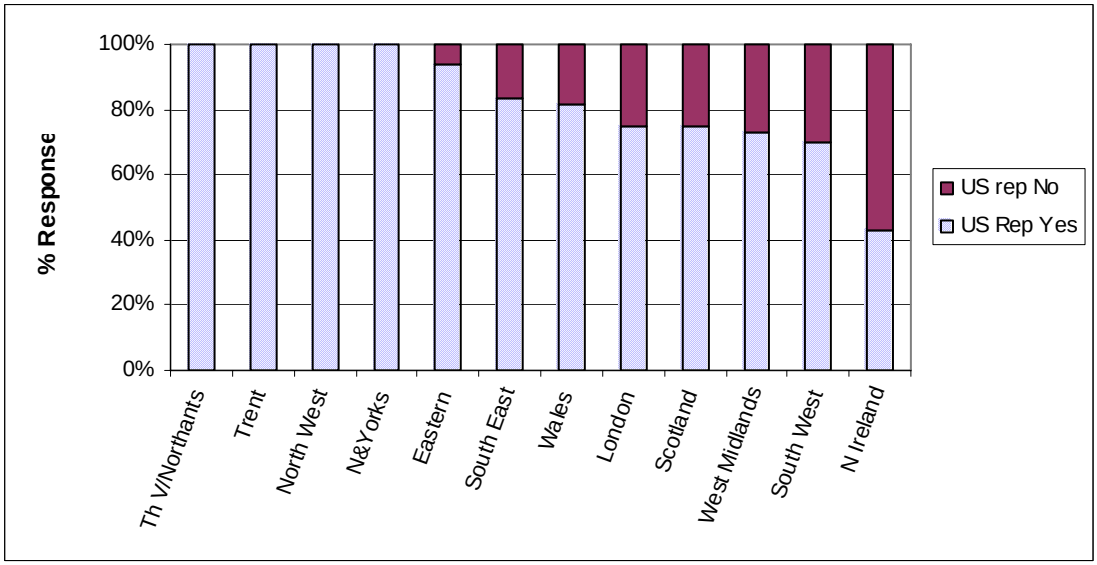


Figure 5.9. Barium enema reporting by region.



5.4.3 National implementation of the four tier structure and staffing

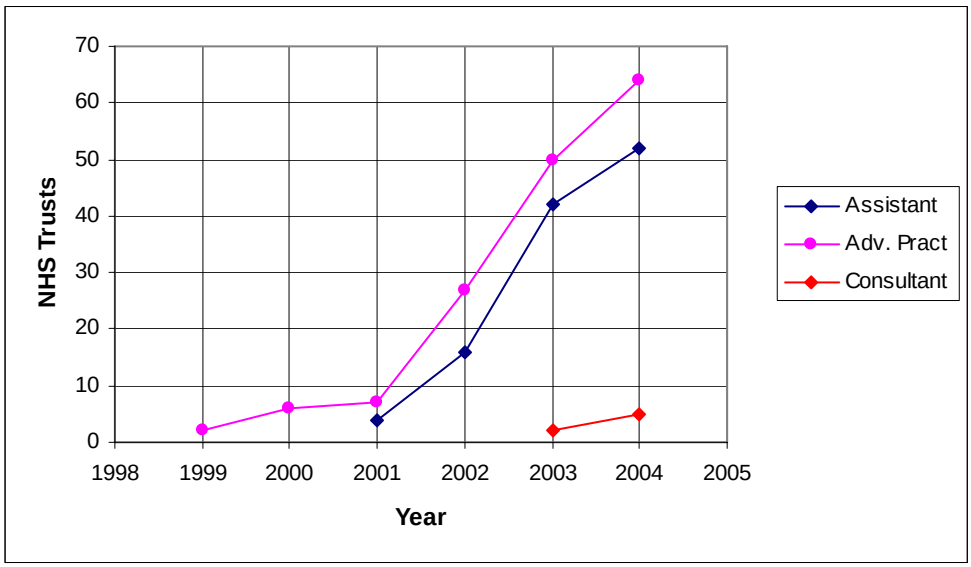
To discover the extent to which new levels of practice had been introduced the survey included questions on the implementation of the four-tier structure. Managers were asked whether they had any staff designated as assistant, advanced or consultant practitioners, if so, what was the year of introduction and the modality or area of practice.

There were 58 (33%) of Trusts with assistant practitioners; 83 (47%) with advanced practitioners, and only 6 (3%) with consultants. The whole time equivalent number in post was 158.5 assistants, 623.5 advanced practitioners and 6 consultants. The

cumulative adoption and diffusion of the four-tier model from 1998 to 2005 is presented in Figure 5.10.

For those trusts that had implemented the four-tier structure the first year of implementation of assistants was 2001, 1992 was claimed as the year for the first advanced practitioner and 2003 for the first consultants.

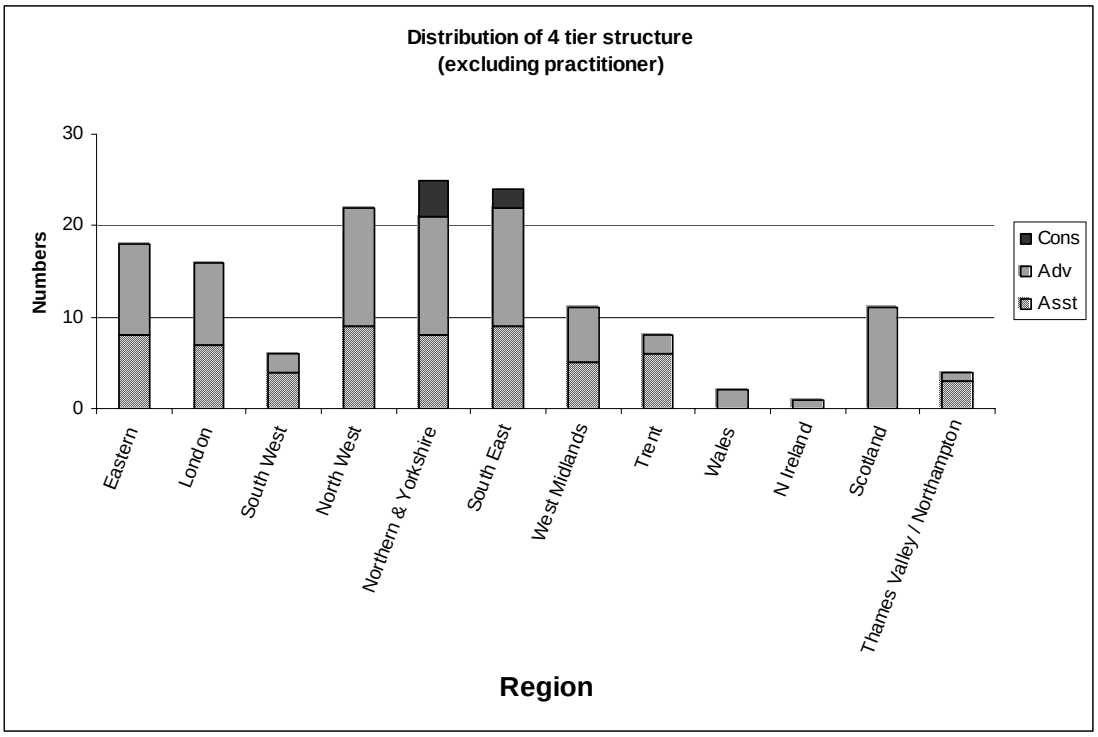
Figure 5.10 Implementation of four-tier structure (cumulative)



5.4.4 Regional differences in the four tier structure and staffing

The regional distribution of each category of radiographer is shown in Figure 5.11.

Figure 5.11 Distribution of four-tier model by region



The most frequently stated area of practice undertaken by assistants was radiography of the appendicular skeleton with 38 responses. Other areas included mammography, dental and chest radiography. Ultrasound practice with 60 responses was the most frequent modality practised by advanced practitioners; other responses included plain film reporting, gastro-intestinal (GI) reporting and mammography. Of the six consultants these posts were in neuro-radiography, plain film reporting, accident and emergency (2), mammography and GI practice.

When asked about future intentions, 36 managers indicated that assistants would be introduced over the next two years, 35 trusts would be introducing advanced practitioners over the next two year period and 31 claimed they would be introducing consultant practitioners over the same period.

The questionnaire further sought details on the numbers of full-time equivalent radiographers and radiologists employed in each trust in order to investigate whether the ratio had any bearing on the adoption of extended role tasks. The ratio of radiographers to radiologists on a regional basis is shown in Table 5.7. Comparison of this ratio with the regional differences in extended role activity is presented in Table 5.8.

Table 5.7 Ratio of Radiographers to Radiologists

	MEAN	MIN	MAX	STD DEV	Rank position
West Midlands	7.4	4.6	16.0	3.56	1st
N Ireland	6.7	4.0	10.0	2.14	2nd
Wales	6.2	2.5	12.0	2.54	3rd
N & Yorks	6.0	3.2	12.5	2.73	4th
Trent	5.9	2.6	11.3	2.47	5th
North West	5.8	2.1	11.7	2.37	6th
Th Valley/Northants	5.8	4.8	7.2	0.89	6th
Scotland	5.1	3.2	7.1	1.14	8th
Eastern	4.9	1.3	10.7	1.96	9th
South East	4.5	2.1	9.6	1.74	10th
South West	4.1	1.8	5.3	1.15	11th
London	4.0	1.3	8.1	1.86	12th

Table 5.8 Regional Differences/ Ratio of Radiographers to Radiologists/

Region	Total Score (all activities)	Overall Position	Ratio Radiographers / Radiologists	Ranking of ratio Radiographers / Radiologists
W Midlands	56	9th	7.4	1st
N Ireland	69	11th	6.7	2nd
Wales	47	8th	6.2	3rd
N & Yorks	24	2nd	6.0	4th
Trent	31	6th	5.9	5th
North West	21	1st	5.8	6th
ThV/Northants	29	5th	5.8	6th
Scotland	60	10th	5.1	8th
Eastern	24	2nd	4.9	9th
South East	39	7th	4.5	10th
South West	27	4th	4.1	11th
London	71	12th	4.0	12th

The non-parametric Spearman's rho correlation between radiographer activity and the ratio of radiographers to radiologists is a low -0.09 and does not approach statistical significance. However, it may be noted that London and the South West have the lowest means of the ratios of radiologists to radiographers than elsewhere. London is the region with the least amount of extended roles taking place but the South West is 4th in the region in the extent of activities undertaken.

Only three trusts had implemented all four tiers of the four-tier model. There was no discernable pattern to emerge to point to any reason why the particular trusts were early implementers. In the two regions where consultant radiographers were employed (Northern & Yorks and the South East, Fig. 5.11) the ratio of radiographers to radiologists ranged from the maximum to the minimum and in the South East were close to the mean. Consultant radiographer posts were across non teaching and teaching trusts alike. The numbers in each tier of those trusts that had appointed a

consultant radiographer along with the numbers of consultant radiologists and ratio of radiographers to radiologists are shown in Table 5.9.

Table 5.9 Four-tier implementation in trusts where a consultant radiographer was employed

Region &Trust Status	Consultant radiologists	Consultant radiographer	Advanced practitioner	Radio-graphers	Assistant practitioner	Ratio of radiog to radiol
Northern & Yorkshire (not given)	2	1	Number not stated	Number not stated	0	12.5
Northern & Yorkshire (NT)	2	1	1	25	0	10.8
Northern & Yorkshire (T)	3	1	8	11	0	6.6
Northern & Yorkshire (T)	26	1	15	114	11	5.1
South East (NT)	7	1	6	23	4	4.3
South East (T)	15	1	20	29	2	3.3

5.5 Summary

This survey, the third in a series has continued to map the changes taking place to the scope of radiographic practice. The response rate for each survey has remained high for a postal survey with response rates from NHS acute trusts of 83%, 68%, and 69% for 1998 (230/276), 2000 (172/253) and 2004 (177/258) respectively. Despite the reported continuing radiographic staff shortages the adoption and diffusion of extended role tasks has continued to increase in the period since the first survey in 1998. Over the period the undertaking of intravenous injections by radiographers has become firmly embedded within the scope of radiographic practice. Other areas such as GI imaging and reporting continue to gain ground and will almost certainly become adopted universally in time. The fact that there are were large numbers of trusts where reporting by radiographers was independent of a radiologist, particularly in plain film radiography and ultrasound, are suggestive of a standard of service equivalent to that delivered by radiologists.

Data were received from individual trusts and when the results were grouped together geographically there were once again regional differences apparent in the adoption of

extended roles, although there has been ‘catching up’ in some regions since the last study especially in Northern Ireland, Scotland and Wales. However, it would seem that the opportunity for radiographers to extend their role in some trusts is limited. It may be that such differences could influence the choice of employment destination of radiographers wishing to choose a destination to progress their career in a particular direction, especially if extended role options are high on their list of priorities. This could cause a particular problem in London where vacancy rates are higher and the extent of extended role activity is low compared to other regions.

Nevertheless the evidence is that a majority of trusts are responding to ‘The NHS Plan’ (Department of Health, 2006) by continuing to introduce, and for many, consolidate, new ways of working. However, this movement was clearly well underway before 2000. ‘The NHS Plan’ and ‘Meeting the Challenge: A Strategy for the Allied Health Professions’ Department of Health (2000) appeared simply to encourage new ways of working which were already being adopted by a number of trusts.

The survey has also shown that a number of trusts are beginning to implement the 4-tier structure with the greatest number of staff (excluding practitioners) categorized as advanced practitioners and with consultants being the least in number. The full implementation of the 4-tier structure to support new working practices will be fundamental to maintaining an effective service that utilises the full potential of skill mix. The increased opportunities for career development arising out of extended role activities should make the profession appear more attractive to potential recruits to the profession who seek a challenging career. However, the need to increase number of radiographer consultants to provide leadership and role models for junior staff should not be underestimated.

Of the trusts that were early implementers of consultant radiographer posts only three had implemented all of the tiers. Further work will be important to track the continuing implementation of the four tier structure and in particular the numbers in each tier and to investigate in detail the precise nature and scope of the roles across a sample of trusts and to assess their impact on workload and patient care. In particular it would seem that research is indicated to investigate why the number of radiographer consultants is low despite criteria for their appointment being set out by the Department of Health in 2001.

In the meantime however, the areas of development identified by the survey indicate where priorities should lie for current continuing professional development initiatives. The implications for education, training and CPD are taken up in the next chapter.

The questionnaire was similar to those developed in the two earlier surveys and had similar limitations and strengths. The conciseness encouraged data return by the managers at the expense of greater detail. This enabled the national picture to be updated, but as in the previous two surveys there was little opportunity to explore the factors impacting on the changes. However, this issue from Survey 2 had been addressed by the interviews reported in Chapter 4. In this case further interviews would not have added to the information already obtained. The important point about the study reported in this chapter was that it did fulfil the purposes stated in 5.2.

The study has provided an update on the extent to which trusts are utilising the skills of radiographers by supporting the extended scope of radiographic practice and the introduction of assistants. The scope of radiographic practice has widened significantly since the mid 1990s with radiographers now performing tasks which were once the remit of medical practitioners. With trusts reporting new areas of activity, it would be difficult to try to define the limit of practice that could be undertaken by a radiographer. It seems clear that the adoption and diffusion of new roles by radiographers will continue.

The study also has important implications for future education and training needs for radiographers. The continuing blurring of role boundaries and the utilisation of skill mix within multidisciplinary environments indicates that radiographic education will need to be responsive to the demands of practice in order to meet changing priorities.

CHAPTER 6

THE ROLE OF EDUCATION AND TRAINING

6.1 Background

The initial consultation with clinical managers and radiologists reported in Chapter 2 identified a number of emerging issues that clearly would have a fundamental impact on the role requirements of radiographers. One of the key 'software' issues to emerge from the early consultation was the future education and training requirements for radiographers. The overall consensus was that significant change to both pre- and post-registration training would be required to equip radiographers to fulfil changing role requirements. Chapter 3 illustrated the rate and the extent to which roles have been extended in NHS hospitals across the UK, however, there has been little work conducted to date that would indicate the extent to which education and training of radiographers is being developed to support new working practices.

Moses and Mosteller (1985) identified the impact of new technology which included: the discarding of old procedures and the introduction of new; a shift in the definition of accepted practice; old equipment replaced by new; the review of text books; and lastly, changes in curricula. A key question, therefore, is the extent to which curricula have changed in response to changing service needs which have themselves been influenced by new technology. If, as claimed by Moses and Mosteller (ibid) there is a time lag between shifts in practice and changes to curricula, then how are practitioners being prepared at present for new and extended roles? This chapter investigates the extent to which radiographic education and training is changing in response to the introduction of new technologies. Three studies were undertaken: two of these investigated the situation at the pre-registration stage and the third considered post-registration issues.

Specifically the three areas were as follows:

i) Study 1 investigated the preparedness for practice of three groups of newly qualified radiographers.

ii) Study 2 examined the extent to which shifts in practice influenced the development of undergraduate curricula across the UK.

iii) Study 3 considered the type and nature of training provided by employers for radiographers in preparation for new roles.

6.2 Study 1- Prepared for Practice

6.2.1 Purpose

The purpose of the study was to investigate the preparedness for practice of three cohorts of newly qualified radiographers.

Specifically the objectives of the study were to:

- enable a comparison of the outcomes of pre-registration education and training with the requirements of practice;
- identify any gaps in training;
- identify skills that the respondents would like to see developed further in themselves and in radiographers in general;
- identify any additional or new skills that the respondents believe will be needed by newly qualified radiographers over the next 5 years;
- ascertain opportunities for CPD in supporting role requirements.

6.2.2 Methodology

Williams and Berry (1997) in their study to establish a model of competence for newly qualified diagnostic radiographers found a wide variation in understanding of what to expect from a newly qualified radiographer. However, in general they felt that a period of around three months was needed to allow a new person to settle into their first post[3].

Therefore to determine the state of preparedness amongst newly qualified diagnostic radiographers a survey was conducted by postal questionnaire approximately six months following graduation. This was considered a sufficient time lapse from graduation to allow the sample to reflect on the requirements of practice and the extent to which the skills that had been developed during training had, or had not been: a) sufficient and b) used in this early stage of their career.

Participants

The sample used in the study was comprised of three cohorts of diagnostic radiography graduates of the University of Hertfordshire who had qualified in July 1999 (n = 38), July 2000 (n = 49) and July 2001 (n = 34), an overall total of 121.

Materials and questionnaire design

The questionnaire (Appendix 8) consisted of 15 questions of both open and closed type, with 4 sections.

[3] However, the law considers a radiographer to be fully competent from their first day in post.

The first section sought information about the respondent: gender, age, month and year of state registration, period in employment and the geographical region where employed.

The second section was concerned with the appropriateness and relevance of pre-registration training. The questions focussed on three areas: tasks unable to be undertaken because of deficiencies or omissions within their programme of study; areas in which they believed more extensive training would have been beneficial; and, thirdly, topics (or individual subjects) on which too much emphasis had been placed.

The third section contained questions relating to employment experience. Information was sought on areas of practice (i.e. experience), the extent to which skills were being utilised, training received since employment and plans for CPD.

The final section sought their views regarding likely future developments. Respondents were asked to identify any skills that they personally wished to develop further, and secondly, whether there were any additional or new skills that they believed would become essential for newly qualified radiographers over the next five years.

Procedure

Ethical approval of the questionnaire was sought and granted by the Joint Ethics Committee of the Departments of Radiography and Physiotherapy at the University of Hertfordshire.

The questionnaire was piloted on ten students in their final year of the undergraduate radiography BSc. While this sample was unable to provide information on employment experiences they were able to provide useful information and feedback on questionnaire design and matters of interpretation. As a consequence of feedback a number of amendments were made.

Questionnaires were printed on A3 paper, each sheet was then folded so that questions appeared on four consecutive pages. Adhesive labels were printed with the name and address of the investigator and attached to the return envelopes. Postage was pre-paid.

For each person invited to participate in the study a questionnaire was sent to the last address recorded in the student's University file. The names and addresses of potential respondents were printed on self-adhesive labels and attached to A5 envelopes. A letter setting out the purpose of the study and thanking the recipient in advance for their participation was addressed to each individual by name. The letters, questionnaires and return envelopes were inserted into an A4 envelope and

dispatched approximately six months following graduation in each of the years in which the study was conducted.

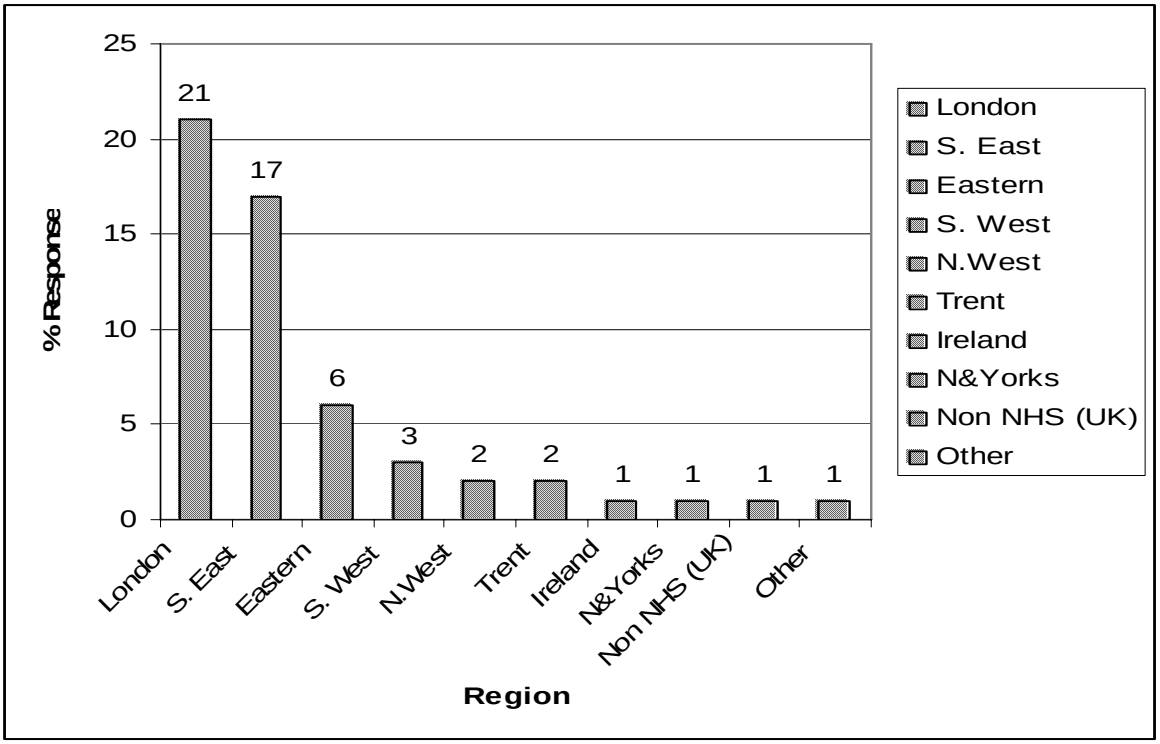
6.2.3 Results

Data about the respondents

Overall, a total of 55 questionnaires were returned from the three cohorts with 14 (37%), 21 (43%) and 20 (59%) from the 1999, 2000 and 2001 graduates respectively. This represented an overall response rate of 45%.

Of the respondents, 43 (78%) were female and 12 (22%) male. These accounted for 43% of the total female population and 52% of the total male population receiving questionnaires. All of the respondents were state registered with 48 (89%) registering within two months of qualification. The length of time registered at the time the questionnaire was returned ranged from four respondents registered for less than six months to two who had been registered for nine months (these two were late returns). The mean time of registration was 5.8 months. The region and distribution of responses are shown in Figure 6.1.

Figure 6.1 Frequency of response by region employed



Pre-registration data

Twenty six (48%) respondents indicated that there had been tasks they were unable to undertake when they first commenced employment. Of the tasks specified, five areas predominated. These were: theatre radiography (four responses); skull radiography (four responses); dental radiography (three responses); trauma (three responses); and manual handling techniques (two responses). Single responses included inserting enema tubes, intravenous pyelography, quality assurance duties and training students. With the exception of manual handling the tasks were directly related to radiographic techniques where a common feature reported was that insufficient time had been available to practise these tasks during clinical placements. This was summed up by one respondent who stated:

> "I felt unsure at first about doing theatre work as I felt that not enough time was spent on this during my clinical training".
>
> 1999 graduate.

Forty-nine respondents (89%) indicated that there were areas in which they would have liked to have received more extensive training. Of these, twenty seven identified a single area, a further seventeen respondents identified two areas of practice while five identified three or more areas. With regard to the subjects or topics, twelve people identified theatre radiography; nine respondents cited adaptation and modification of techniques and the same number identified pathology.

The need to adapt techniques was particularly related to the need to deal with trauma cases and cited by a number of respondents. The following quotation was representative of these.

> "These cases often only come in at night when on call and are seen less rarely during day hours. Although I had seen a few it is challenging when you're on your own and have to cope with the first few bad cases."
>
> 2001 graduate.

Trauma radiography was an area cited by seven respondents with several linking this with the need for greater depth of knowledge of pathology to assist in the recognition of radiographic appearances. A 1999 graduate provided the link between accident and emergency radiography and pattern recognition:

> "Pattern recognition skills are paramount when doing on-call in accident

> and emergency radiography. These should include the ability to recognise normal variants as well as abnormalities."
>
> 1999 graduate.

Dental radiography was a topic identified by six respondents, while areas that attracted responses from just one or two individuals were largely related to specialised areas such as MRI, CT and cardiology, although one non-technical area was self defence[4]. For one respondent it was the transition from student to practitioner.

> "Nothing during training addresses how different the real world actually is."
>
> 2000 graduate.

Thirty three (60%) respondents considered that there had been too much emphasis in some areas. Of the respondents, twenty two identified a single subject or topic, eight identified three topics and three identified four topics. Psychology was given by 10 respondents; a further 10 stated specialised vascular techniques. Eight respondents identified physics; aspects of photographic imaging were given by eight the same number that suggested topics that could be classified as professional knowledge. Subjects put forward by single respondents were IT, statistics and the third year project.

First experiences

In response to the questions on employment experience and post qualification training, conventional radiography was, unsurprisingly, the modality in which most of the respondents had practised accounting for fifty one (93%) of responses. The four that had not worked in this modality comprised of three who had worked in computed radiography (CR) and one who had worked in CT.

A large majority (71%) had experienced practice in more than one modality. Those who had experienced only one modality consisted of thirteen who had worked in conventional radiography, two in CR and one in CT only. Ultrasound and nuclear medicine were modalities only experienced by one and two respondents respectively. Only two people had experienced working in five modalities, in each case, conventional radiography, CR, CT and MRI were common to both respondents. The experience that was not common was urodynamic screening and angiography. These

[4] While outside the scope of this thesis it should be noted that attacks on hospital staff have increased in recent years and have become the subject of media attention. The risk of assault was obviously a concern for the particular graduate.

two were working in London but it was not possible to know whether the experience was gained in the same hospital.

The geographical distribution of respondents' experience by modality is shown by region employed and presented in Table 6.1.

Table 6.1 Experience gained by region of employment

Region	No. Emp.	*Experience in Modality*						
		Con. Rad	**CR**	**CT**	**MRI**	**Nuc. Med**	**US**	**Other**
London	21	19	13	10	1	1	-	2
S. East	17	15	7	12	1	1	-	6
Eastern	6	6	1	2	-	-	-	1
S. West	3	3	1	1	-	-	-	-
N.West	2	2	-	-	-	-	-	-
Trent	2	2	1	2	1	-	-	1
N&Yorks	1	1	1	-	-	-	-	-
Non NHS (UK)	1	1	-	-	-	-	-	-
Ireland	1	1	1	1	-	-	-	-
Other	1	1	-	-	-	-	-	-
Total	**55**	**51**	**25**	**28**	**3**	**2**	**1**	**10**

Key: No Emp – Number employed; Con Rad – Conventional radiography; CR – Computed radiography; CT- Computer tomography; MRI – Magnetic resonance imaging; Nuc Med – Nuclear medicine; US – Ultrasound;

Training post employment

Twenty six respondents reported receiving training in conventional radiography, fifteen in CR. Of the twenty eight who had worked in CT, twenty four of them had received training. In the more specialised areas, the respondents who had worked in MRI and nuclear medicine had been in receipt of training but, surprisingly, the single person who had worked in ultrasound claimed not to have had any training. The most prevalent form of training could be classified as 'on the job' where typical responses that described this category included:

> "No formal training in any modality, just the opportunity to work in these areas."
>
> 1999 graduate.
>
> "None needed except for specialised views."
>
> 1999 graduate.
>
> "Trained how to use the new equipment."
>
> 2000 graduate.

"Practical training with senior radiographers."

2000 graduate.

"I required training in the web browser, PACs and HISS systems."

2001 graduate.

"Learning on the job and training from a company specialist."

2001 graduate.

The number who reported that they received training in the various modalities following employment along with the numbers who reported they had work experience only is shown in Table 6.2.

Table 6.2 Practice experience

Modality	Practice Experience	Received Training	Received No Training
Conventional radiography	51	26	25
CT	28	24	4
Computed radiography	25	15	10
MRI	3	2	1
Nuclear medicine	2	2	0
Ultrasound	1	0	1
Other modality	10	10	

Other areas where training had been received were in the red-dot system, angiography, manual handling, industrial relations, radiation protection, chest interpretation, IV injecting, mentorship, computer training, risk assessment and fluoroscopy. A number had attended study days on forensic and paediatric radiography and one a study day on child protection.

Future training

Forty two (76%) respondents stated that they would be undertaking education or training in the following six months. These comprised 10 males and 32 females who accounted for 83% of males and 74% of females respectively. Intravenous injection courses and image interpretation were identified by fourteen respondents; the latter including red dot study days, image reporting and chest x-ray interpretation. Six respondents reported that they would attend non-clinical study days while four respondents specified CT training. Areas with fewer than four responses included

barium enema training, dental, student training, risk management, IT, research and sign language.

The number of respondents who had made plans to undertake CPD in the following twelve months was 31 (56%). This group of respondents consisted of four males (33%) and twenty seven females (63%), with IV training being the most popular single issue for CPD with eight responses. The second most prominent choice was aspects of clinical imaging modalities (six responses) while five respondents indicated formal post-graduate education. Student training was given by four respondents. The remainder of responses included study days, image reporting and research training.

Access to formal support for CPD from within their departments was reported by forty nine (89%) respondents, although only thirty seven (67%) indicated they had a personal plan. Of these, seventeen (31%) had developed their plan in conjunction with their manager while the remainder had done so independently.

Twenty three respondents (42%) stated that that their skills needed no further development and just over a third believed that no further development was necessary for *'radiographers in general'*. Of the majority who stated that development was needed *'in themselves'* and for '*radiographers in general'*, the skills are shown in Table 6.3.

Table 6.3 Skills development

	Skill				
	IV	**Image reporting**	**CT**	**Communi-cation**	**Barium Studies**
'In themselves'	10	8	4	-	1
Radiographers in general	3	22	4	4	3

In addition to the responses shown in Table 6.3 there were skills attracting single and double responses. Clinical skills included angiography, barium studies, dental radiography, MRI, paediatric imaging, theatre radiography and a set that could be described as transferable skills included CPD, leadership, nursing procedures and research were mentioned. For *'radiographers in general'* the responses paralleled those provided for the responses to *'in themselves'.*

Thirty two (58%) respondents answered that their work relevant skills and attributes were being used to their full potential while twenty three (42%) said they were not. Further analysis revealed that eleven (92%) of the males agreed that their skills were

being used to their full potential as against twenty one (49%) of the females. This gender difference is illustrated in Table 6.4.

Table 6.4 Skills and attributes used to full potential

Skills & attributes used to full potential	Gender		
	Male	**Female**	**Total (Sample)**
Yes	11 (92%)	21 (49%)	32 (58%)
No	1 (8%)	22 (51%)	23 (42%
Total	12 (100%)	43 (100%)	55 (100%)

The single male who answered 'No' was unable to use his IV injection skills, which was also an issue with seven of the females. Other skills and attributes given by the females were CT (six responses), fluoroscopy (two responses) and one who stated that her skill with children was not recognised or accepted by senior staff.

Five respondents stated concern over radiation protection and the lack of acknowledgement of the risks by medical staff.

> "Some doctors lack respect for radiographers and their 'just do it' attitude instead of accepting their responsibility for justifying exposures. This is due to inadequate back up by senior staff and may be resolved with the introduction of the new Ionising Radiation (Medical Exposure) Regulations."
>
> 1999 graduate.

Sixteen respondents qualified their responses by explaining that the reason why they considered their skills were not being used, was that these were recognised currently only for senior radiographers. Four respondents stated that they were promised rotation through certain areas but because of poor organisation by senior staff this had not happened. Only one respondent stated that lack of rotation through different work areas was due to staff shortages.

At the outset it was not the purpose of the study to investigate gender differences. However, given the apparent difference between males and females, i.e. 92% of males indicating that their skills and attributes were used to full potential as opposed to 49% of females, it was decided to explore if there was an association between the two sets of responses. The alternate hypothesis (H_A) states that there is an association between gender and whether skills and attributes are used to full

potential, H_o states that there is no association. A Chi-square test found the association to be significant [χ^2 =7.07, df=1, *P*= 0.008].

Following the gender association demonstrated above it was decided to investigate whether there were any further associations. Chi-square tests of gender association were applied to the following questions:

> Question 4.
> In your first post, was there any task or tasks that you were asked to undertake and felt you were unable to do because they were not addressed in your pre-registration education and training?
>
> Question 5.
> Are there any areas in which you would you like to have received more extensive training?
>
> Question 6.
> Were there any topics (or individual subjects) on which you feel too much emphasis was placed during your pre-registration and training?
>
> Question 8
> Have you a personal plan for CPD?

In each case the association was found to be not significant at the 95% confidence level (Q4 χ^2 = 1.525, *P = ns;* Q5 χ^2 = 0.105, *P = ns;* Q6 χ^2 = 0.24, *P = ns;* Q8 χ^2 = 1.798*, P = ns*).

Skills for the future

Finally, the respondents were asked to identify any additional or new skills that they believed would become essential for newly qualified radiographers over the next five years. Nine respondents (16%) did not respond to this question and those that did were not restricted to a single choice. Responses are shown in Table 6.5.

Table 6.5 New skills required by profession

New Skills	Responses
Image reporting	14
IV injection skills	14
CR	13
CT	11
IT skills	9

Image reporting and IV injection skills each attracted fourteen responses followed by CR thirteen responses, CT eleven responses and IT/computer skills with 9 responses.

A number of respondents recognised the need for radiographers to be able to integrate a range of skills. The following two responses are representative of those who held this belief.

> "Multi-skilling of radiographers will be essential in 5 years to keep up with the workload."
>
> 2000 graduate.

> "Radiographers have to be able to diagnose, be more aware of clinical conditions in order to work effectively with nurses and doctors."
>
> 2000 graduate.

A number of respondents recognised a changing relationship with patients and emphasised communication skills and the increasing demands placed on staff. This view is represented by the following quotation:

> "Stress management skills are important. Patients are becoming more like consumers, increasingly demanding."
>
> 2000 graduate.

6.2.4 Discussion

The survey revealed that overall, slightly less than half of the respondents (48%) indicated that there were tasks they could not undertake because they had not been addressed in their pre-registration education. Nearly twice that number, 89%, said that there were areas in which they would have liked to receive more extensive training. Not surprisingly, there were areas of commonality given in the answers to these questions with theatre radiography, trauma radiography and dental radiography each being identified in responses to both questions. There is a clear indication that

training programmes should be reviewed and revised to ensure that future students obtain experience of these techniques.

Access to CPD in departments was encouraging; with 89% of participants indicating that support was available. However, the overall total number of respondents having a CPD plan was somewhat less, at 67%. The proportion of respondents having a CPD plan from the 1999 and 2000 cohorts was 64% and 62% respectively but for the 2001 cohort it was 75%. The number of departments offering CPD also increased over the period. In the first two years of the survey it was around 80% - 85%, while in 2001 all graduates reported the availability of CPD in their departments. It was also evident that reports of managers being involved in designing an individual's personal plan increased over the period via the appraisal process. For each of the cohorts the proportion of CPD plans with manager involvement increased from 22% to 26% to 60% respectively over the three years of the study. The increase in both CPD activity by individuals and the support provided by departments could well reflect the initiatives taken by the NHS (1999; 2001) and the College of Radiographers (2002) to promote lifelong learning. In particular, the NHS Executive (1999) set out guidance about establishing a learning culture in the NHS to support the lifelong learning of all staff that presented principles and criteria for establishing local systems of CPD. NHS organisations were expected to have development plans in place to support CPD for the majority of staff by April 2000.

There was some confusion regarding what counted as a CPD activity which was reflected by 33% of the sample who claimed that they did not have a plan but would be undertaking some form of education and training in either the following six or twelve months. Those who indicated that they did not have a CPD plan but cited future training activities were perhaps making a differentiation between CPD as a systematic long term process as opposed to discrete, unrelated, training activities. However, it was interesting to note that there was little difference in the type of education and training to be undertaken by those who had a CPD plan and those who professed not to have a plan. Many of the activities given for future training consisted of what could be considered as role extension activities: IV training, red dot, barium studies, chest interpretation or modality training, i.e. CT, MRI or nuclear medicine. Although the respondents had only been qualified for a short period, six months, the nature of the activities selected for training were directed to supporting individuals' practise development and was consistent with responses regarding individual development and requirements for the profession in general.

There was no evidence of respondents moving to work in the specialist modalities immediately following qualification, despite the fact that the three cohorts in the study

had studied an optional modality course in their third year in ultrasound, nuclear medicine or MRI. The sample did, however, contain twenty two respondents who had experienced both conventional radiography and CR. The majority of respondents had been given the chance to practise in more than one modality, although a minority had commented on the lack of rotational opportunities.

There was some anxiety expressed about the lack of opportunity in some departments by a number of respondents who considered that all of their work relevant skills and attributes were not being used to their full potential. Comments on a lack of opportunity to rotate through different modalities were varied. These ranged from the respondent who recognised that she was new to the post and therefore could not expect to do so initially, to a number who commented upon poor organisation by senior staff. A number implied that there was a clear hierarchical distinction between seniors and juniors which meant that there was no expectation for the latter to undertake particular tasks. This was evidenced by responses which indicated that 'only seniors' were allowed to work in particular areas' such as IV injections, fluoroscopy and CT. This situation had led to some frustration with one graduate commenting that modality training was wasted because there was not the opportunity to utilise skills in these areas and time at the university could be better spent. Only a small minority of students had gained some work experience in MRI, ultrasound and nuclear medicine. Previous work (Price, High and Miller 1997) reported that these three modalities were largely seen as post graduate options. It was the 'all-round' education and training that was recognised as crucial to developing the knowledge and skills base of radiographers prior to specialisation. Whilst there has been discussion around setting up a pre-registration qualification in ultrasound (Webb and Wainwright 2000) this has not come to fruition. If there is a need for reviewing initial education and training it would be to ensure that students were given the opportunity to gain greater experience in aspects of clinical practice such as theatre and dental radiography. However, there was a contrast in responses as far as CT was concerned, 51% of the sample had experienced CT in their first post as opposed to those who identified CT skills as being an attribute not being used to full potential.

While 60% of the sample thought their skills were being fully utilised quite a large minority did not; and of the two-fifths who fell into the second category, almost all were female. The small sample size meant that the power to detect a significant difference due to gender was low. However the trend appeared to be indicative of a gender segregated pattern of reporting, and so merits further investigation. It is unclear why the males considered that their skills and attributes were being utilised to their full potential but there are a number of suggestions for this observation. Firstly, as a group, they could be more skilled than the females and hence are chosen more

often for more demanding tasks. However, this would appear unlikely given personal knowledge of the cohort. Secondly, they may have greater confidence than the females and put themselves forward for tasks for which less confident people may have hesitated. Thirdly, it could also be that females were less likely to obtain posts with wider opportunities. Fourthly, it may be that once females enter employment, managers do not give them the same opportunities as males; if this is was a factor it would point towards discrimination against females. Whether or not any (or indeed all) of these suggested explanations are correct it is impossible to confirm without further questioning of the individuals and their managers.

The differences between individual departments could also account for frustration by some of the respondents who indicated that particular skills were not utilised or deemed relevant for a first post but were considered to be skills expected of senior radiographers. If this is the case then there has to be some meaningful debate between educators and managers on the requirements of the radiographer grade, especially for a first post. Although it could be considered short sighted to ignore the needs to prepare students for a long term career the priority for a clinical department is to meet the demands placed upon it, many of which are short term. Managers have to utilise the available pool of skills in the way most appropriate and the expectation is for new graduates to work in general radiography. For an individual to be given an opportunity to practise in a specialist area a manager would almost certainly have to move that person away from one area of work, in which it is presumed that they are functioning adequately, to one where supervision is required. By doing so, the overall availability of the workforce is reduced, at least initially. Perhaps there is a need for greater consideration of how skills acquired by, and available in, new graduates are utilised by employers, otherwise new recruits could become frustrated when career expectations are not realised. The risk of ignoring these needs is that the situation will arise in which graduates will not get the opportunity at an early stage to maintain or develop existing skills and will then need re-training to re-establish the same skill at a later stage; this is obviously costly in terms of both time and expense. In addition, individual departments are likely to suffer when staff become demotivated and likely to seek alternative employment.

On such grounds there could be a temptation to conclude that students are over qualified on graduation. However, 58% stated that their skills or attributes were being utilised to full potential and of these, 75% graduated in 2001 and therefore such a claim would be premature. However, the engagement with CPD and the support offered by managers is indicative that the longer term needs of career development are being addressed.

Although respondents were reasonably clear on their own training need (despite any misunderstanding over meaning of CPD) they were also fairly clear on the future needs of the profession in general. With regard to training needs at 6 and 12 months many of the targeted areas were predominantly in the extended role category including IV injections, reporting. This was also true for the response to the question on the essential skills for newly qualified radiographers *'in the next five years.'* Whilst there was perhaps disappointment on the extent of practice at approximately six months it was clear that respondents had given thought to future career directions and a lack of initial opportunity was no deterrent.

The overall response rate of 45% was disappointing, but comparable with published data on response rates of postal surveys (Hicks, 2004). The invitation to participate in the study at approximately six months following graduation was believed to be appropriate in that the sample had not been away from university for any considerable length of time. The relatively short time span meant that the respondents would be able to relate the requirements of practice to the nature and scope of their education and training. It also exceeded the time of a 3 month settling-in period reported by Williams and Berry (1997). However it has to be accepted that the study of three cohorts at one university may not be generalised to the national scene. However, the work provided important information on the experiences of new graduates in their first post at a range of NHS Trusts. This study conducted over a three year period did prompt newly qualified practitioners to:

- reflect on their experiences of pre-registration education and training;
- evaluate their preparedness and progress in practice;
- consider future training needs for themselves and the profession as a whole.

Hence, this study has enabled a comparison of the outcomes of pre-registration education and training with the requirements of practice. It could well be that the survey at six months was appropriate to relating first experiences of practice with pre-registration education and training but a further questionnaire at 12 months would have given a clearer picture of the transition from student to radiographer.

The gaps identified in training concern aspects of clinical practice where students did not appear to gain sufficient experiences in theatre and dental radiography and sufficient opportunity to adapt and modify techniques. However this latter point could perhaps be expected, as such opportunities to adapt and modify techniques occur with increasing time and experience. The increasing importance of pattern recognition, together with the need to link to pathology, was also an important finding.

6.3 Study 2 Pre-registration Curricula Review

6.3.1 Background

Radiography is one of the professions regulated by the Health Professions Council, and, prior to that, by the Radiographers Board at the Council for Professions Supplementary to Medicine. Part of the process of regulation is approval of programmes of education and training and of the institutions that deliver these programmes. Successful completion of an approved programme gives eligibility to register as a Radiographer with the Health Professions Council. Programmes are also accredited by the Professional Body which enables graduates to apply for professional membership of the Society of Radiographers. While the Regulatory Body needs to be assured that all registrants are safe and competent practitioners and can meet standards set at a 'threshold' level, the Professional Body is also concerned that curricula should reflect contemporary practice.

Moses and Mosteller (1985) found that one unintended consequence of the impact of technology was that curricula lagged behind practice. Where innovation and diffusion are rapid this is understandable. An important question that arises therefore is the extent to which contemporary practice is reflected in radiographic curricula, and the degree to which developing practice is underpinned by education and training. There is some doubt whether this happens in all instances. For example, one manager, as was reported in Chapter 4, felt that educationalists were leading on what was required rather than following the clinician's lead. Furthermore, approximately a quarter of the managers believed that the balance between clinical and academic training was not correct with too much emphasis on academic aspects.

6.3.2 Purpose

The purpose of the study was to investigate the extent to which undergraduate curricula reflect and support contemporary practice. This was achieved by analysing the formal curricula of UK institutions awarding radiography qualifications.

6.3.3 Methodology

Documentary interrogation and content analysis was used to investigate the nature and relationship of the documents against the context of developing practice.

Content analysis is described by Moser and Kalton (1992) as typically a systematic analysis and description of the content of communication media. Robson (1993) described it as an indirect and unobtrusive method of documentary analysis because instead of directly observing or interviewing subjects, the analysis is of documentation produced for some other purpose. Krippendorff (1980) defined content analysis as a

research technique for making replicable and valid inferences from data to their context.

Document Sample

The documents analysed came from 22 universities and two colleges of higher education in the United Kingdom. The dates of the curricula meant that they would all to some extent be in use over the period 1998 to 2005, but with a number coming up for review within that time frame. All Higher Education institutions (HEIs) providing documents reviewed offered a BSc honours degree in diagnostic radiography, with the exception of one which offered a BHSc (Bachelor of Health Sciences) (Hons) in Radiography. The reason for this anomaly was not clear but was not important as far as the study was concerned as the degree was recognised as providing eligibility for membership of the Society of Radiographers and state registration.

Procedure

A letter was sent to the education officer at the Society of Radiographers with a request to review how curricula have developed in response to advancing technology, to both the equipment - 'hardware' and practice skills - 'software'. It was estimated that the study would take three days. Permission was granted provided that the anonymity of institutions was respected.

Twenty four diagnostic radiography degree documents were included in the study. A total of three visits to the Society of Radiographers were required to complete the content analysis. The first two visits focused on 20 available documents; the documents from four other centres were being replaced by new programmes and it was decided to exclude these from the study at the times of the first two visits. It was decided however, to make a further visit when the new documents were available. This was approximately six months after the first visits.

Demographic data were not recorded; each document is identified only by number in the subsequent analysis.

Content analysis focused upon the rationale and philosophy underpinning the degree and the aims, outcomes and content. An analysis table was prepared with three columns, one with the number allocated to the HEI, the second was headed rationale and philosophy and the third, aims, outcomes and content. Key phrases, critical statements or descriptors which were identified as drivers for change which would impact on the scope of practice were inserted into the appropriate grid square for each HEI. These included reference to new technologies, role development, role extension, radiographer reporting, image interpretation, IV injections, barium studies and red dot.

6.3.4 Results

The phrases, statements and descriptors for each of the HEIs numbered 1 to 24 are presented in the following Table 6.6.

Table 6.6 Programme Descriptors for Higher Education Institutions (HEI)

HEI	Rationale/Philosophy	Aims/Outcomes/ Content
1	Rapid change in diagnostic imaging requires radiographers educated to honours level. Aims to develop core skills and critically appraise current research. Prepare for technical, managerial and developmental responsibilities. As technology advances, radiographers must be competent and capable of responding to change and initiating change,	Advances and developments in imaging technology. Pattern recognition, reporting normal and abnormal image appearances in ultrasound and general radiography. Development of intellectual and practical skills, basis for research and additional responsibilities. Academic base for progress to study specialist fields at postgraduate level. Changing professional boundaries. Multidisciplinary working, awareness of the nature of health care.
2	Evolved to embrace the changing demands made by the service and subsequent needs of the student. A programme to meet the demands of a contemporary health service.	Discuss and evaluate contemporary issues in diagnostic radiography. Typically student spends 1 week in CT. MRI, US and angiography. Advanced professional studies, developing role, ethics, technical reporting, red-dot. Engagement in CPD.
3	Evaluate and improve service to meet patients' needs. To support the advancing role of the radiographer. Rationale based around meeting needs of patient, service, student & profession.	MRI, nuclear medicine and ultrasound electives. Managing barium sessions. IV injection; 1st line image interpretation skeletal examinations. Participation in CPD.
4	Broader base for imaging, receptive to change. Ability to work in multidisciplinary teams. Opportunities due to changes in the NHS and skill mix.	Develop extended role and reporting. Perform IV injections under supervision and single examination of the GI tract. Evaluation of examinations including CT, US, RNI, MRI, mammography.
5	To meet role changes influenced by new technology and the drive of government policies. A radiographer of the 21st Century will be a multi-faceted healthcare professional. A recognition that the degree is at a particular stage in the development of imaging education. Its development will have to acknowledge trends towards specialisation and generic practice. The production of quality graduate radiographers require technical and social skills which are academically underpinned. These outcomes must be complemented by a clear understanding of the need for continuing professional development; a commitment to lifelong learning.	*[Nothing explicit to support developing or extended roles].*

HEI	Rationale/Philosophy	Aims/Outcomes/ Content
6	Recognise changes in clinical practice due to developing technology. A programme that is flexible in order to embrace changes in practice. Recognition that programme has flexibility to embrace changes and reduce emphasis on practice that is losing favour, e.g. skull angiography unless in digital format has been dropped.	Developing role. Reporting, IV and barium enema. Increase in amount of pathology to support interpretation.
7	To practise diagnostic imaging and to apply the principles of evidence based practice. Emphasis on multi-disciplinary access. Learning will be supported by technology developments in teaching and learning.	Issues in health care management. Role expansion, skill mix, pattern recognition, report formulation. Impact of developing technology. Esoteric and specialist modalities.
8	An expectation of a radiographer to produce of high quality images of the internal aspects of the body.	*[Nothing explicit to support developing or extended roles].*
9	The need for a radiographer to produce high-quality diagnostic images. Reference to diversity and increasingly working as an in sit dependent practitioner and in advanced practice roles. Recognition that radiographers are also undertaking some clinical examinations carried out by radiologists e.g. Ba enema, IV injections, developments in reporting - widely accepted in a range of ultrasound examinations. Other opportunities to include business or technical management. Clinical specialism, teaching or research.	Evidence based practice. Multi skilling, skill mix. Role development (Ba enemas, IV injections, image interpretation). CPD
10	Radiographers with the ability to use professional knowledge, skills and attributes in the solution of problems and by use of applied research. Radiographers to have skills necessary to develop extended roles.	Role development; to undertake IV injections, active participation in red-dot system. Students will gain clinical reporting skills within named area. Electronic imaging but no explicit mention of modality.
11	The change in title of the programme to medical imaging reflects changes in technology and professional practice.	Image interpretation to enable new roles. Demonstrates the initial skills necessary to participate in abnormality detection system. Strategies introduced for image analysis as opposed to image viewing. Intravenous injections. Outcome to show and enhanced ability to make informed judgements on the process and justification for an examination. Intended learning outcome be able to identify and critically explore the application of MRI, NM and US in imaging the A&E patient

HEI	Rationale/Philosophy	Aims/Outcomes/ Content
12	Detailed knowledge of anatomy and physiology. The continued evolution of technology in diagnostic radiography will place extra demands on the role of the radiographer in the future. Radiographers must cope with rapid change including technological change.	Radiographic anatomy and pattern recognition. Evaluate the factors involved in radiographic pattern recognition and Decision making skills. Professional practice modules in Principles of Diagnostic Radiography include IV and evaluation of imaging modalities and management of the patient in angiocardiography, CT, mammography, MRI, RNI US and interventional procedures.
13	General philosophy contains a statement that a radiographer must be a competent diagnostic imaging practitioner, skilled communicator, be able to reason critically and creatively. The programme will instil a more rigorous form of image analysis in the students. Students are will be able to critically analysis a wide range of modern imaging techniques - have the capacity to actively participate in the introduction of emerging technology and by research to develop new practices.	IV injection of contrast media. Pattern recognition and abnormality detection Fulfil the objectives for clinical placements in each of the following specialised areas, cardio-thoracic imaging, RNI and NM, MRI and neuro imaging.
14	A programme which is flexible to support the developing role of the radiographer.	Visual perception and digital imaging processing. Theoretical knowledge and understanding theories of image processing. Be able to discuss the role of interventional procedures.
15	Radiographers need to embrace critical thinking and hence the decision making process.	*[Difficult to identify changes that support role development].*
16	Medical, technological and professional advances in diagnostic imaging dictate a change in role of the radiographer. The intention it is to build on fundamentals radiographic principles. The changing nature of the x-ray department to a medical imaging department needs to be reflected in the content and delivery of learning.	Computer applications in diagnostic imaging, sectional imaging. Evaluate how the changing roles affect professional practice.
17	A curriculum to ensure relevance to current and future practice, it recognised the driving forces of government reforms and technological advances. Radiographers require professional and personal knowledge, attitudes and behaviour is essential for safe effective practice. Incorporate modules which will better prepare newly qualified radiographers for the future role in the NHS.	Role development; red dot, skills for reflective practitioner. Demonstrate an ability to carry out IV injections. Professional practice includes US/CT, quality assurance. Supervised practice in specific area of role development, red dot, IV injections

HEI	Rationale/Philosophy	Aims/Outcomes/ Content
18	Graduates must be prepared for the changing role of the radiographer. Courses must be developed and modified to reflect technical developments and change in clinical practice but graduates must retain the skills associated with patient care and interpersonal relationships.	Principles and practice of complimentary imaging modalities. Opportunities to obtain in-depth experience in a modality US/CT/nuclear medicine/MRI. Image quality in complimentary imaging
19	A sound academic base for the development of radiographic skills as well as promoting the personal growth and development of students.	Recognise and discuss normal and radiographic appearances.
20	A vision which seeks to train radiographers who will be caring professionals with two complementary strengths – i) justifiably confident in their technical ability, and obtained by a strong academic foundation and ii) the ability to empathise with and relate to patients while working effectively in a multi-professional environment. A focus on interprofessional education and use of a skills escalator approach to prepare students for lifelong learning.	Interprofessional education, skill mix with flexible working between professions; new types of worker. Awareness of current developments in practice and theory of diagnostic radiography. Ability to make evaluative judgments on the technical outcomes in imaging procedures and report the findings accordingly.
21	Changes in the programme have been influenced by changes in technology and by changes in legislation. Encourages the development of critical thinking and adaptability and the ability to make judgments on evaluation of practice by informed, decision-making and high-quality innovative delivery of health care provision.	A reference to image evaluation and other aspects that would support the developing role of the radiographer.
22	The curriculum is designed to facilitate growth and development of professional knowledge and the clinical skills required for registration. A programme to develop the radiographer who can comment on diagnostic images of optimum quality from a current evidence base, whilst simultaneously ensuring a high level of patient care.	Focus on producing flexible and responsive practitioners. Critical evaluation of how CPD may be used to extend the role of the radiographer in various areas
23	The programme development has been guided by the government's modernisation agenda and the need to produce a substantial increase in the NHS workforce. To provide knowledge and understanding of current imaging technology and its most appropriate indications.	Recognise and described the principal clinical features including pathology, normal variants demonstrated on skeletal, chest and abdominal images and assessing the result in radiographic appearances.
24	To produce a diagnostic radiographer with the skills, knowledge and understanding which underpins competence and ability required of the diagnostic radiography to practice on initial qualification. To facilitate the development and use of key transferable skills, which underpin all aspects of professional practice including the use of information technology.	Description of normal anatomy and physiology and common variants in relation to imaging examinations. Consolidate and extend knowledge of image interpretation of musculoskeletal pathologies. Foster long-term professional development of image interpretation in CT and MRI.

A number of themes emerged from the analysis, although there were clear differences in the emphases and style of the documents.

The need for curricula to respond to developments in technology (hardware) was directly or indirectly mentioned nineteen documents. Role development (software) was identified as a major theme being referred to in seventeen out of the twenty four documents. Fourteen documents made direct reference to the specific elements of role extension; of these seven referred to IV injections; three to gastro-intestinal examinations and thirteen to image interpretation which were referred to under a number of guises; pattern recognition, red dot systems; reporting, and abnormality detection. It was evident that students were being given practical instruction in IV injections but in only one document was it suggested that graduates would be competent to inject on qualification. One document made reference to the potential of preparing students to be able to attain an advanced practitioner role. Ten of the seventeen documents referring to role development included the need to provide experience in special modalities such as CT, MRI, nuclear medicine and ultrasound.

Nine institutions recognised the drive that Government and NHS reforms were having on the need to develop and modernise practice. These same documents made a link between the need for modernisation with advances in technology. It was noted that these documents were dated after the publication of the NHS plan (2000).

A theme advanced by seven institutions was the need to prepare students for continuing professional development and lifelong learning, although only six made any connection to the link between research and evidence based practice. An interesting observation from one institution identified the link between development of transferable skills and advancing practice.

> "The rapidly developing and changing structure of diagnostic imaging means that many of the facts taught to students will soon be relevant to their professional practice. The course is therefore designed to enable students to develop transferable skills in order for them to develop their scope of practice when qualified."

The recognition here being that topics were not currently within the expected scope of practice but developments would ensure that they would be in the future.

One institution which, at first examination, appeared to take a different stance from the view presented set out their position as follows:

> "A very rapid rate of changes in the technology of radiographic practice and the ever-increasing demand on imaging services to support significant amount of the teaching of specific technology is out of date by the time the graduate uses a material in clinical practice a few years after graduation. The concentration in the final years of the course is therefore more on practice principles and the transferable skills which will facilitate lifelong learning when graduates encounter new clinical situations or new technology."

This HEI was being circumspect about the teaching of some technologies and questioned the value that would be obtained by students. Their approach was clearly to deal with practice principles rather than with the specifics of a technology which could become obsolete. Their approach, therefore, was similar to that of the position of the institution whose position was stated above. The strategy facilitated the development of transferable skills to enable assimilation of new skills following qualification.

One document summed up the impact of all the drivers and pressure for change and how radiographers should address this within their career:

> "The profession of diagnostic radiography has seen significant changes over the last few years. These are changes have been influenced by changes in technology and by changes in legislation. These changes have allowed radiographers to expand their professional horizons and become involved in new aspects of diagnostic imaging. This changing professional relationship results in a radiographer who is adaptable and committed to lifelong learning."

Three of the documents which were newly validated made references to the Subject Benchmark Statement for Radiography (Quality Assurance Agency, 2001) and The Society and College of Radiographers Curriculum Framework (2003). It is likely that in the future there will be a greater consistency in programme outcomes as HEIs will be able to demonstrate how they intend to meet and fulfil the expectations of the these two publications.

6.3.5 Discussion

The only other study of a similar nature was reported by Price, High, and Miller (1997). That study, however, was more wide-ranging; the investigation considered all aspects of the curriculum including issues of organisation and structure, assessment, clinical practice and teaching methods. The twenty nine documents analysed were all introduced by 1995 and with 21 of these being introduced over a three-year period from 1991 to 1993. Those documents were the first wave of degree documents which replaced the syllabus of the Diploma of the College of Radiographers. The documents reviewed here consisted of second and third iterations of degree programme documentation from approved institutions.

The earlier study identified a similar theme to one that emerged from the current study; the need for curricula to respond to changes in technology. This had been something that the syllabus of the College of Radiographers had not done. The early 1990s was therefore a period where, for the first time, there was a considerable degree of freedom and flexibility in curriculum development. CT, MRI, ultrasound and nuclear medicine had all been excluded from the national syllabus (although the latter two had been catered for in post registration training overseen by the College of Radiographers). It was interesting to note that, while the theme of the need to respond to changes in technology remained prominent in the current study, two HEIs were questioning the effectiveness of time being spent on specialist modalities, preferring to help the student develop transferable skills which would help them adapt to new technologies following graduation.

Unsurprisingly, many of the documents included in the current study made clear reference to the impact of Government and NHS reforms which were facilitating skill mix changes. This was made evident by the documents referring to developing roles and, in particular, role extension into fields traditionally undertaken by radiologists. The increase in extended roles and skill mix in radiography has been shown to be a phenomenon of the 1990s (Chapter 3). It would have been unreasonable to expect that documents produced in the early to mid 1990s to have referred to extended roles unless education was driving practice. If practice was driving education then as Moses and Mosteller (1985) proposed, there would be a lag before curricula caught up. Evidence from Chapter 3 showed that there were a number of trusts which had adopted extended roles in the early 1990s. As these trusts were the innovators they would be unlikely to have impacted greatly on curriculum development at undergraduate level at that time although, there was one document in the earlier

study that referred to the extended role of the radiographer in pattern recognition and first-line diagnosis which could have been influenced by the early role developments.

The situation had advanced in the period leading to the current study, to the extent that some fourteen institutions now made explicit reference to extended roles and the preparation needed to prepare students to fulfil new practice requirements in fields such as IV injections, barium examinations or red dot systems. Nevertheless, this was still only approximately 60% of the HEI documents being examined, illustrating significant difference in the approach to education and training.

6.4 Study 3 Post registration education and training for extended roles.

6.4.1 Background

The importance of training to support extended roles was considered in Chapter 1 and cannot be overstated. As discussed in that chapter the Department of Health and Social Security in Health Circular HC(77)22 (1977) presented criteria for extended roles. The key points are again presented here.

> "In an action for damages, a nurse may be held legally liable if it can be shown either that she has failed to exercise the skills properly expected of her, or has undertaken tasks she was not competent to perform.
>
> a. The nurse has been specifically and adequately trained for the performance of the new task and she agrees to undertake it;
> b. this training has been recognised as satisfactory by the employing authority;
> c. this new task has been recognised by the professions and by the employing authority as a task which may be properly delegated to a nurse;
> d. the delegating doctor has been assured of the competencies of the individual nurse concerned."
>
> Health Circular (77)22

Although the circular referred to nurses the same principles apply to other health workers, including radiographers. The College of Radiographers (2002) in its *'Statements for Professional Conduct'* stated that radiographers must identify and acknowledge any limitations in their knowledge and competence (Statement 5) and they must maintain and strive to improve their professional knowledge and competence (Statement 6). The former Regulatory Body, the Radiographers Board at the Council for Professions Supplementary to Medicine (2002) stated that:

No registered radiographer should:

> by any act or omission do anything or cause anything to be done which he or she has reasonable grounds for believing is likely to endanger or affect adversely in a substantial way the health or safety of a patient or patients.
>
> Radiographers Board 2001

Its successor, the Health Professions Council (2003), in its *Standards of Conduct, Performance and Ethics*, stated that registrants must keep professional knowledge and skills up-to-date and must act within the limits of their knowledge, skills and experience. Failure to meet the Regulatory Body's requirement could result in a radiographer being cautioned, suspended or at the very worst struck off the register. The latter penalty would mean that an individual would not be able to use the protected title of Radiographer and the individual would be unable to practise and therefore lose their livelihood. Therefore the implications of failing to undergo appropriate training to support an extended role are patently clear.

In order to meet the requirements of the professional and regulatory bodies the onus is on both the individual registrants, radiographers in this case, and on their employers. The employer is vicariously liable for the actions of staff undertaken during employment and must take all reasonable care therefore to employ competent staff and ensure that competency is maintained. By requiring staff to extend their roles the employer has to ensure that any training is of a satisfactory standard and specific and appropriate for the new task to be undertaken. It would seem that there is also an onus on the professions to recognise any new task as being appropriate for their members (and for others if a role is being delegated). A case in point regarding the latter is the statement on reporting by the Royal College of Radiologists (1995) when the College stated that delegation should be proper, agreed, planned and audited. The College of Radiographers has set out requirements for approval of courses leading to certification of competence in administering intravenous injections, (1998, 2005). The certificate indicates that a radiographer has reached the standard required to administer IV injections (Keenan et al 2001).

In image reporting the College of Radiographers (1997, 2005) stressed the need for continuing professional development in order to maintain performance. In addition, the 2005 publication, *'Medical Image Interpretation & Clinical Reporting by Non-Radiologists: The Role of the Radiographer'* stated that image interpretation skills and clinical knowledge should be embedded within undergraduate programmes. In the case of nuclear medicine and ultrasound the College of Radiographers instigated

training and controlled the syllabuses from the 1970s until the 1990s when HEIs took on the responsibilities for curriculum development and for the award.

While the literature is not extensive on the nature and extent of training available for radiographers preparing to adopt extended roles, a number of authors have reported on specific aspects. For example, Mannion et al (1995) discussed a barium enema training programme for radiographers referred as the 'Leeds Barium Enema Course.' They assessed the programme by comparing the first 50 unsupervised examinations with those performed by senior radiology registrars. They found no difference in the parameters assessed when comparing the two groups. When they assessed a further 50 examinations at one year it showed that initial standards had been maintained and a three year follow up showed no missed pathology. Their conclusion was that delegation of double contrast barium enemas to trained radiographers is safe and acceptable to the patients. Bewell and Chapman (1996) claimed that formalised training means that there is less risk of serious difficulties arising.

Loughran (1994) established a six month training programme for three radiographers to report on orthopaedics and skeletal trauma films. At the end of the training there was a significant increase in the sensitivity for fracture detection from 81.1% to 95.9%. Also, while, at the beginning of the training there was a significant difference in the rates of fracture detection between radiologist and radiographer but no statistical difference during the last two months. However, Loughran reported a significant difference between radiologist and radiographer in specificity where radiographers produced a higher number of false positive reports. Nevertheless, Loughran claimed that a programme of training and certification in fracture reporting could alleviate the radiologist's workload of plain film reporting. Loughran, however, did not qualify what he meant by certification whether this was by a radiologist, trust or external course.

Prime, Paterson and Henderson (1999) undertook a case study of six centres providing courses in radiographic reporting. They found that the institutions were responding appropriately to the highly contentious innovation of radiographer reporting and highlighted the importance of close links between academic and clinical sites with an emphasis on teamwork. Price, High and Miller (1997), whilst not identifying the type of training available, noted that some radiographers had concerns about access to costly University programmes on the one hand but also on the other regarding in-house non-accredited courses that did not provide transferability of skill recognition between different employers.

With the significant increase in radiographers extending their roles there was little data available on the nature, level, provider and extent of training nationally and whether course were accredited or not. To investigate these, a survey of imaging managers was undertaken to identify the education and training for extended roles facilitated by their trust. The study was undertaken in parallel with study 2, the second national survey of extended roles which was reported in Chapter 3.

6.4.2 Purpose

The purpose of this study was to discover the nature and extent of education and training provided to radiographers preparing to undertake extended roles.

6.4.3 Methodology

Participants

The participants comprised of managers of UK imaging departments at acute NHS trusts (n =172). The participants were the same as those who responded to Survey 2 reported in Chapter 3.

Materials and questionnaire design

An open ended questionnaire was designed for this part of the study. The questionnaire took the form of a Table divided into five columns and twelve rows. The columns were headed:

- Activity
- Type of training, (e.g. taught course, in-house, MSc);
- Duration (e.g. 1 day a week for 6 weeks);
- Who delivers the training? (e.g. hospital, university, manufacturer);
- Validated or accredited by any external organisation e.g. university, Professional Body.

At the left-hand side, in a column labelled ‘Activity’, the extended roles which were identified in survey 2 (Chapter 3) were listed. These were: intravenous injections; ‘red dot’; barium enemas and the reporting categories; axial skeleton; appendicular skeleton; chest; paediatric; mammography; ultrasound; barium enema; nuclear medicine and other.

The respondents were asked to provide the information required and insert into the appropriate cell. The layout of the questionnaire can be seen in Appendix 9.

Procedure

The questionnaire was sent to 232 NHS Trusts. The procedure for the questionnaire distribution was described in Chapter 3.

6.4.4 Results

Returns were received from 172 managers, representing a 68% response rate. Although some managers did not provide information to every question, only one manager failed to provide any training data. Additional information on the breakdown of responses can be found in Chapter 3.

Intravenous injections

There were 154 valid responses to the questions on the type of training undertaken. Of the remainder, fifteen did not have radiographers undertaking IV injections and three managers did not provide any information on the type of training. The type of training varied considerably, although the majority of trusts (92) provided in-house training. A large proportion, 54 (35%), sent their staff on external courses, and this group included two centres that supported training to postgraduate certificate and diploma levels. Another eight trusts used a combination of in-house and external courses. This breakdown is shown in Table 6.7.

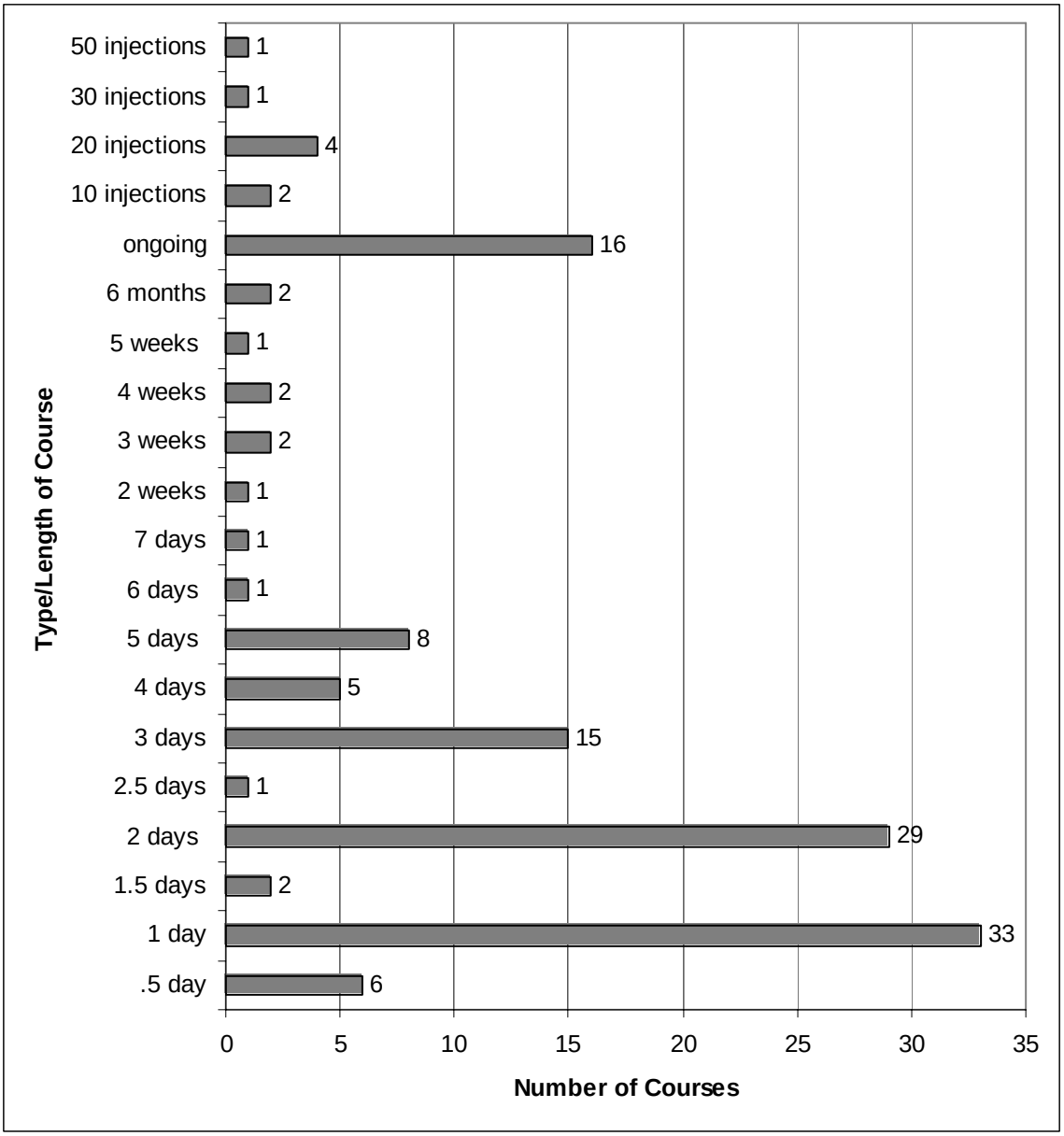
Table 6.7 IV Injections: Type of Training

Type of training	Frequency	Per cent
In-house	92	59
Externally taught	51	33
Taught + in-house	8	5
Pg Dip	1	1
Pg Cert	1	1
Other	1	1
Total	**154**	**100**

There were 133 valid responses on the duration of training (24 managers did not provide any information). The length of training varied from half of one day to six months. One and two day training courses were the most frequently cited, there were 32 (24%) one-day courses and 29 (22%) two-day courses. Four trusts (3%) did not give a time but stated the duration in terms of the number of injections required which were 10, 20, 30 and 50 injections respectively before they could inject without supervision. Sixteen (12%) trusts stated that the training was ongoing but gave no

further information. For those trusts that stated the duration of the training the distribution is shown in Figure 6.2.

Figure 6.2 Distribution of IV courses by duration



Of the 154 managers who reported that that their trust provided training in delivering intravenous injections for radiographers 145 gave information regarding the source or provider of the training. Some 78 managers (46%) said that courses were delivered in-house, 37 (26%) by universities, 23 (16%) delivered by the trust in combination with a university and 4 (3%) by a combination of the trust and a manufacturer.

Of the trusts where radiographers gave IV injections there were 138 valid responses to the question on course accreditation (this excludes 19 trusts that provided no

information). The majority, some 73 trusts (53%) said that courses were not accredited. Of the rest, twelve trusts (9%) recorded that courses were accredited by a university, 33 (24%) by the Professional Body and 10 (7%) responded that the course was accredited but did not indicate by whom. Frequencies are shown in Table 6.8 below.

Table 6.8 Intravenous Injections: Accreditation

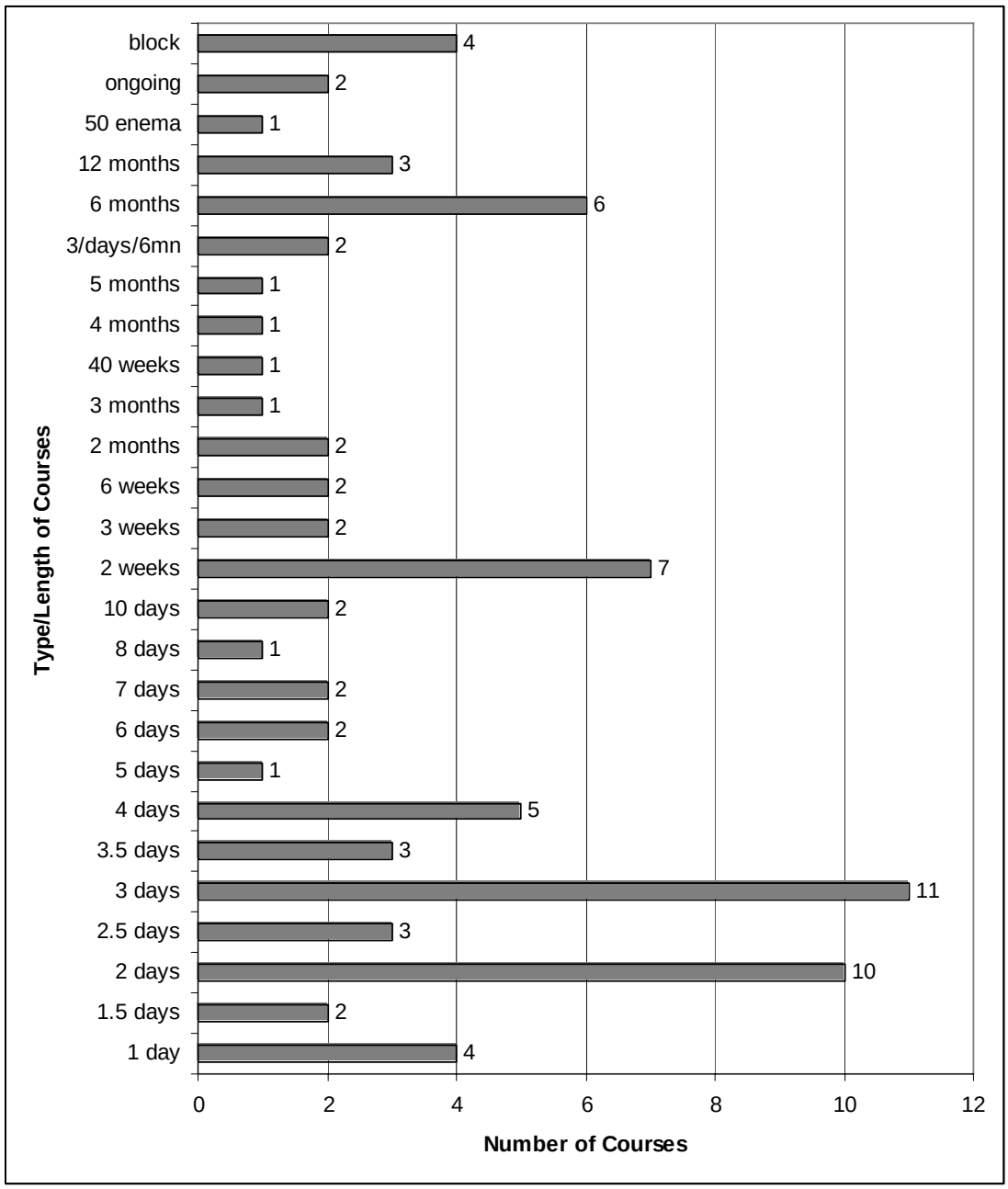
Accreditation	Frequency	Percent
None	73	53
Professional Body	33	24
University	12	9
Other	5	4
Accreditation Body not given	10	7
Univ. + Prof. Body	5	4
Total	**138**	**100**

Barium Enemas

Forty-seven trusts (42%) indicated that radiographers attended an externally-taught course, six trusts (5%) used in-house training, 12 trusts (11%) sent staff to postgraduate courses, in 11 trusts (10%) staff attended a combination of an externally-taught and in-house course and 35 trusts (31%) specifically mentioned the Leeds barium enema course.

All respondents stated the length of training except, one trust which gave the number of enemas (50) which had to be completed before training was considered completed. Responses are shown in Figure 6.3

Figure 6.3 Distribution of Barium Enema Courses by Duration



On the deliverers of training twelve managers did not provide any information. A majority of 44 trusts (44%) used a university course, but this percentage increased to 59% if the trusts who stated that training was undertaken at a university and the hospital are added. Some 39% indicated that training was undertaken within the hospital. The providers of training are shown in Table 6.9.

Table 6.9 Barium Enemas: Deliverers of Training

Provider	Frequency	Percent
University	44	44
Hospital	39	39
University + hospital	15	15
Manufacturer + hospital	1	1
Other	1	1
Total	**100**	**100.0**

Regarding accreditation of barium enemas, some 52 managers (54%) stated that the courses to which they subscribed were accredited by one or more external bodies; 3 (3%) were accredited by '*other'* which were not further identified; 1 (1%) internally by the hospital and 23 (24%) of training programmes were unaccredited. These are shown in Table 6.10.

Table 6.10 Accreditation of Barium Enema Courses

Accreditation	Frequency	Percent
Professional Body	23	24
Yes but not stated	23	24
University	19	20
None	17	18
'Leeds course'	8	8
University + Prof. Body	2	2
Other	3	3
Hospital	1	1
Total	**96**	**100**

'Red dot'

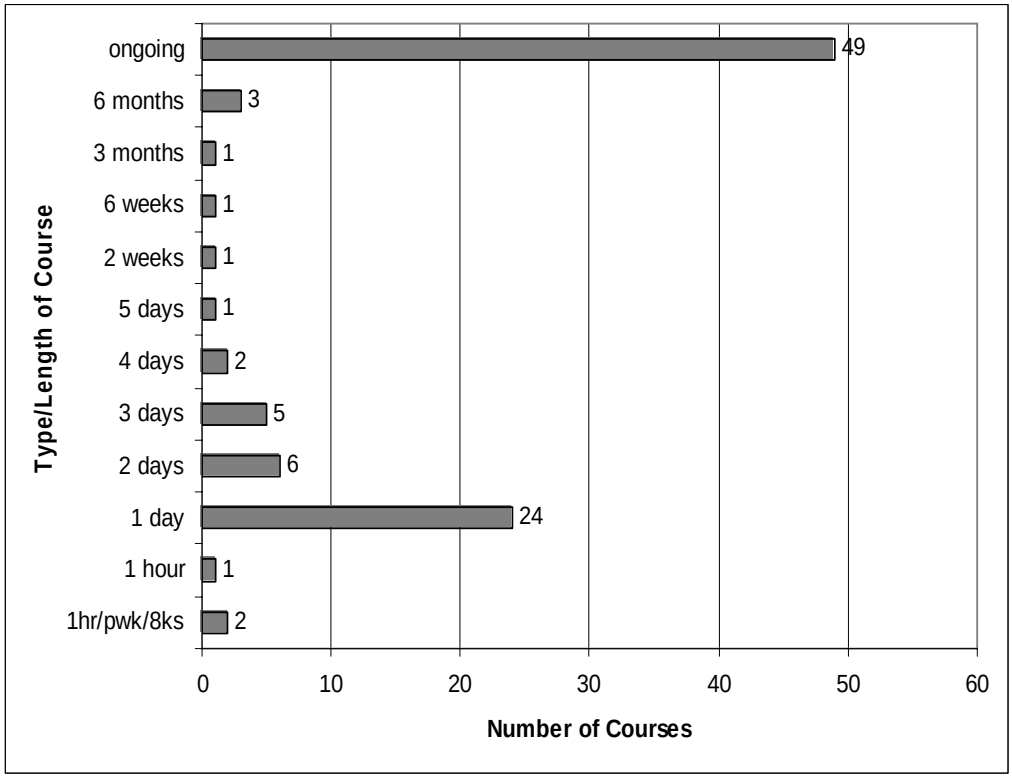
The number of trusts that declared that radiographers were involved in 'red dot' activity was 141 but only 128 managers provided responses on the type of training. By far the largest majority of managers (89 or 70%) used in-house courses while, 39 (30%) used some form of external course. The break down of these is shown in Table 6.11 below.

Table 6.11 'Red Dot': Type of Training

Type of Training	Frequency	Percent
In-house	89	70
Externally-taught course	27	21
Externally-taught + In-house	7	5
Other	3	2
MSc	2	2
Total	**128**	**100**

The great majority, 96 respondents (89%), gave information about the length of training that was provided for red-dot systems. Of the valid responses, 49 (51%) managers stated training to be on going but without any qualification of time. The next highest category comprised of 24 (25%) trusts that provided one day of training. The remainder consisted of a range from one hour to six months. The distribution is presented in Figure 6.4.

Figure 6.4 'Red dot': Distribution by Course Duration



Out of the 129 trusts that supported the 'red dot' system, 91 (71%) provided their own in-house training; 7 (5%) used a university; 9 (7%) combined their training with a university and 22 (17%) did not give an indication.

There were 126 valid responses regarding accreditation of 'red dot' courses; 70 (56%) provided no accreditation of training, 7 (6%) used a university accredited course, 3 (2%) stated the course was accredited by the Professional Body and 3 (2%) stated *'other'* form of accreditation.

Image Reporting

Image reporting was divided into eight separate categories;

- Axial skeleton
- Appendicular skeleton
- Chest
- Paediatric Reporting
- Mammograms
- Ultrasound (US)
- Barium Enemas
- Nuclear medicine.

Ultrasound training was the most subscribed to followed by appendicular and axial skeleton reporting. In-house training alone featured very little for all areas; ultrasound, with only 18 managers out of 98 stating this was the type of training undertaken. The breakdown of the type of training declared by the managers for all categories of reporting is provided in Table 6.12.

Table 6.12 Reporting Courses: Type of Training

Course	Axial	Append -icular	Ches t	Paed- iatrics	Mammo- grams	US	Ba En.	Nuc. med	Total
Taught course	16	21	0	3	9	20	7	1	77
MSc	7	14	0	0	7	17	0	3	48
Pg.Dip	3	7	0	0	0	37	0	0	47
In-house	1	0	2	1	2	18	6	1	31
Pg.Cert	5	9	0	1	1	2	4	0	22
Externally-taught+ in-house	1	1	0	0	1	4	1	0	8
Not stated	1	1	0	0	0	2	0	0	4
Total	**34**	**53**	**2**	**5**	**20**	**100**	**18**	**5**	**237**

Ultrasound, axial and appendicular skeleton reporting plus barium enema reporting were the most established categories.

Axial skeleton reporting courses varied from 1 day per week, although the overall length of the course was not stated, to 18 months, appendicular skeleton from one

week by one trust to eighteen months by 6 trusts with the greatest frequency being twelve months by 15 trusts (38%). In ultrasound 81% supported training programmes that ranged from 10 weeks to twenty four months. The duration of barium enema reporting training ranged from two days by 2 trusts to six months by one trust; 4 others indicated that training was ongoing but without further qualification. The training durations for these four categories are presented in Figures 6.5 to 6.8.

Figure 6.5 Axial Skeleton Reporting: Course Duration

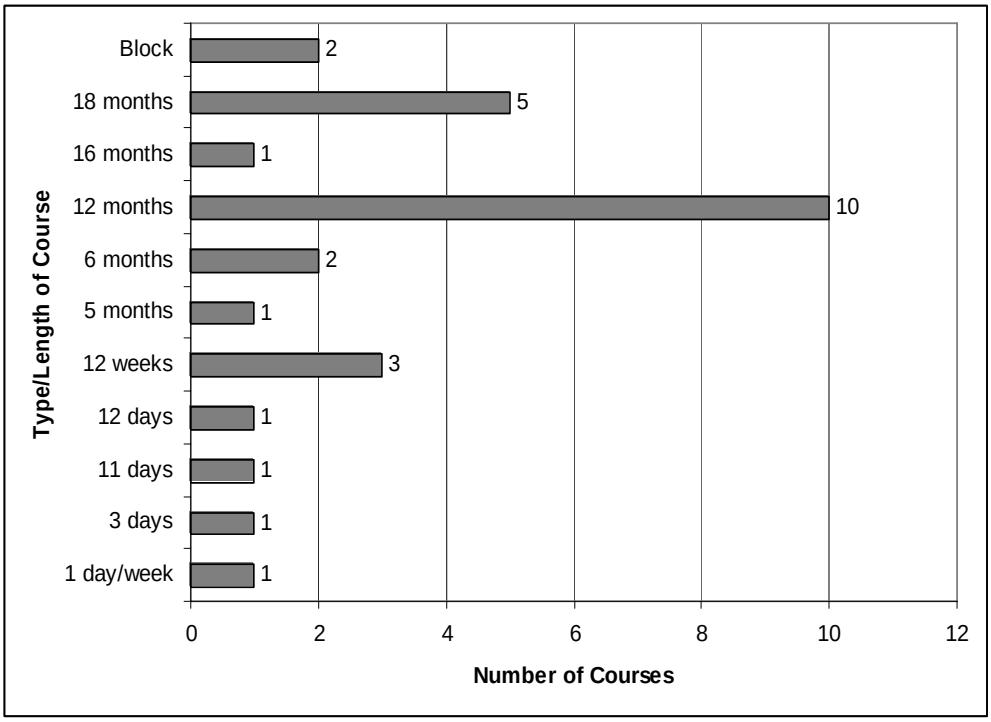


Figure 6.6 Appendicular Skeleton Reporting: Course Duration

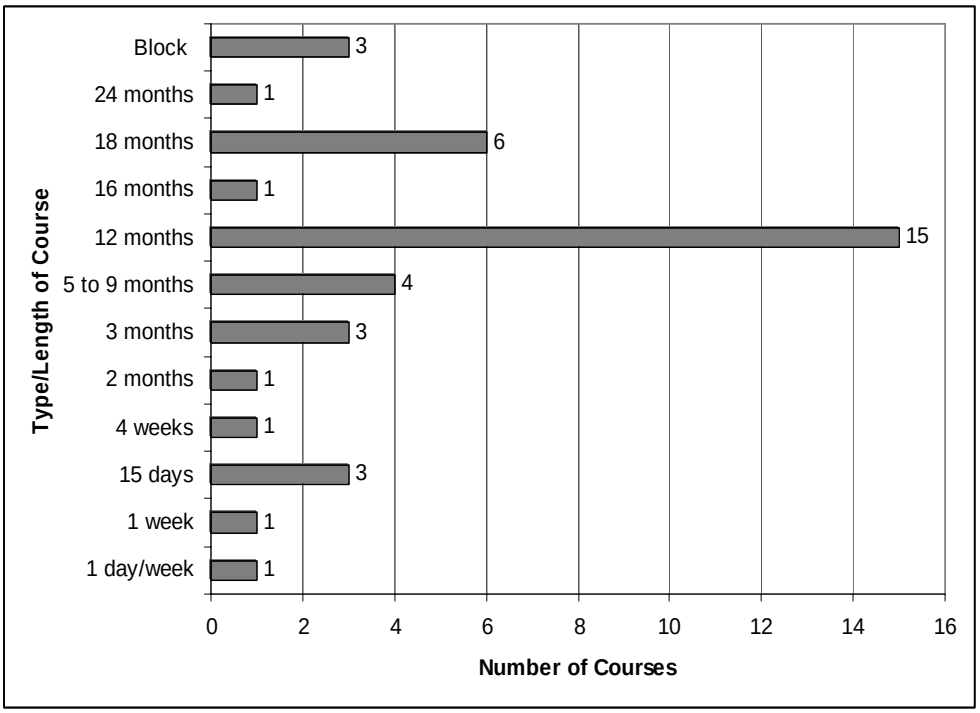


Figure 6.7 Ultrasound Reporting: Course Duration.

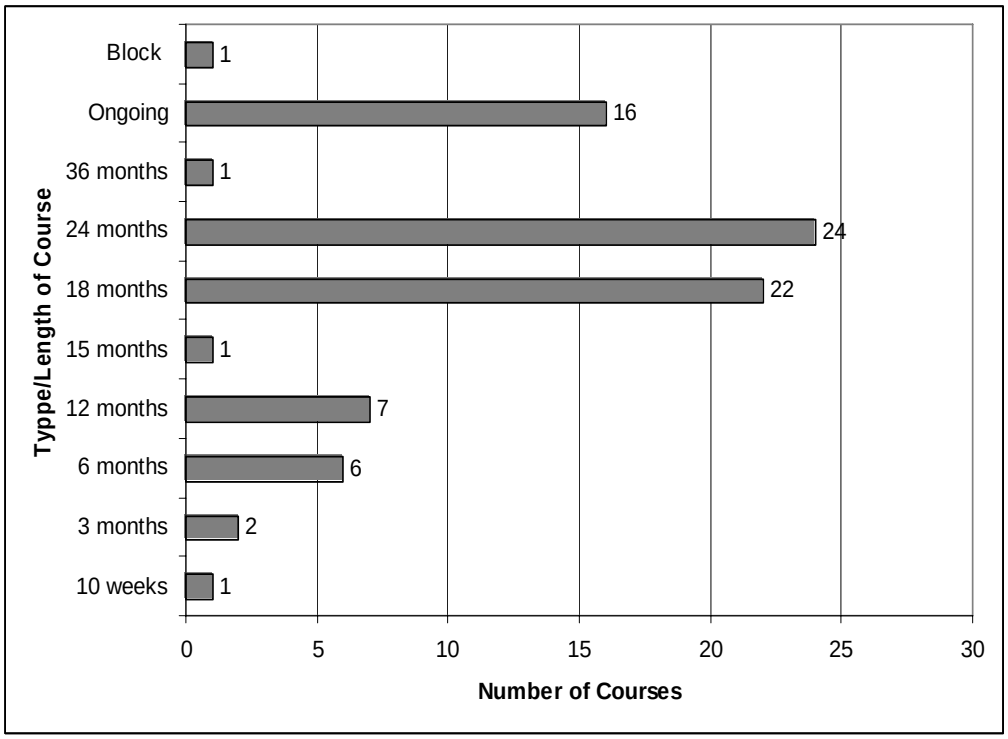
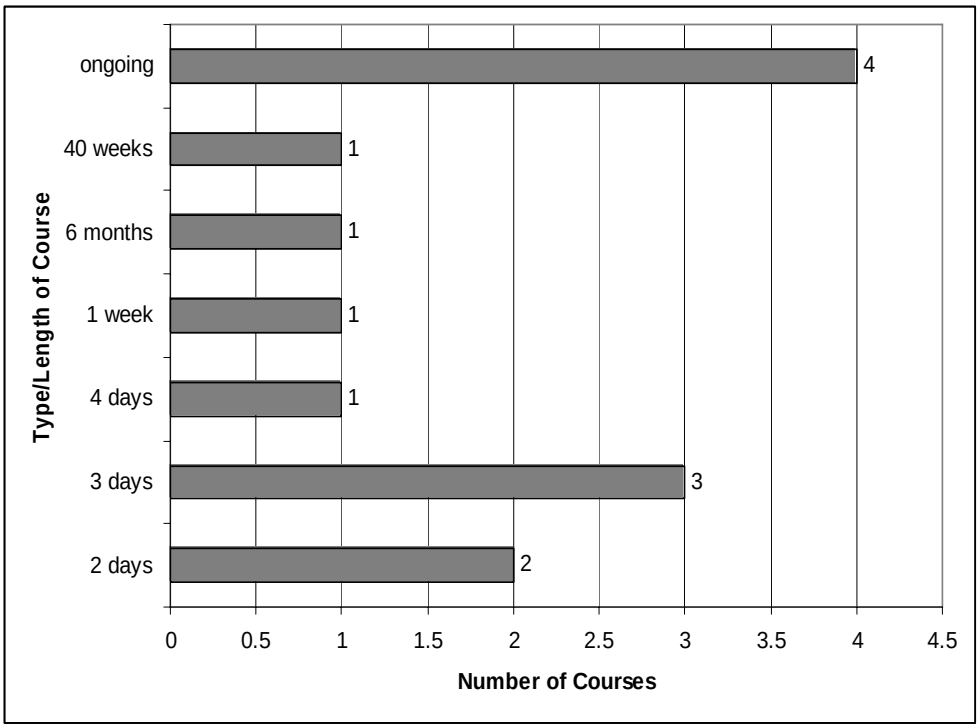


Figure 6.8 Barium Enema Reporting: Course Duration



Less common reporting categories

In the less common reporting categories of chest, mammograms, paediatrics and nuclear medicine there were variations between and within categories. Two trusts who trained for chest reporting returned *one day* and *on-going*. Paediatric reporting had 2 trusts stating twelve months, one at eighteen months and one for thirty six months. In mammography 5 trusts supported training for twelve months, 3 for six months and the 4 remaining for 3 days, two weeks, four weeks and ongoing respectively. In nuclear medicine, 2 trusts supported training for twenty for months and one other for one day per week but did not qualify for how long overall. For these other categories of chest, paediatrics, mammograms and nuclear medicine the durations are shown in Table 6.13.

Table 6.13 Chest, Paediatric, Mammogram and Nuclear Medicine Reporting: Course Duration

Category	Chest	Paed-iatrics	Mammo-grams	Nuclear medicine
1 day	1			
1 day/wk				1
3 days			1	
2 weeks			1	
4 weeks			1	
3 months				
6 months			3	
12 months		2	5	
18 months		1		
24 months				2
36 months		1		
ongoing	1		1	
block			3	
Total	**2**	**4**	**15**	**3**

The providers of reporting training were predominately university led; the breakdown is shown in Table 6.14.

Table 6.14 Reporting: Training Providers

	Axial	Append -icular	Chest	Paed-iatrics	Mammo -grams	US	Ba Enema	Nuc Med	Total
University	23	37		4	12	56	5	1	**138**
Uni + Hosp	6	8	1	0	4	22			**41**
Hospital	2	1	1	1	1	20	7	2	**35**
Total	**31**	**46**	**2**	**5**	**17**	**98**	**12**	**3**	**214**

Universities and the Professional Body dominated in terms of accreditation but a fairly large number, 39 trusts (20%) stated that training was accredited but did not specify the body or bodies involved. The accreditation status for each category is shown in Table 6.15.

Table 6.15 Reporting: Accreditation

	Axial	Append -icular	Chest	Paed-iatrics	Mammo-grams	US	Ba enema	Nuc. Med	Total
University	9	18			6	27	2	1	**53**
Prof. Body	6	10		2	4	24	2		**48**
Yes (but accreditor not stated)	13			2	4	20		1	**39**
None			2			13	5		**17**
Uni+Prof. Body		2			1	7		1	**13**
Other	1	1			2	6	2		**12**
Total	**29**	**31**	**2**	**4**	**17**	**97**	**11**	**3**	**194**

6.4.4 Discussion

While most trusts used some form of training to prepare radiographers for extended roles, in-house training was the most frequently employed for IV injections and red dot, 59% and 70% respectively. Only six trusts (5%) relied upon in-house training for barium enemas and for reporting (all categories), in-house training was utilised by only 31 trusts (13%) and with 18 of these in ultrasound.

Much of the IV injection and red dot training was not accredited, 53% and 56% respectively. In the case of barium enema courses 18% were not accredited. In the reporting categories nearly 9% were unaccredited but at least 49% of the reporting courses were accredited at master's level. This proportion could be higher but 39 managers (36%) who stated that their staff attended a taught course did not give any indication of the type of course or level.

There was considerable variation in the duration of training in preparation for each role. IV training varied from half a day by 6 trusts to six months by 2 trusts; barium enemas ranged from one to twelve months and for red dot the shortest time was one hour by one trust to ongoing by 49 trusts (51%). While there was variation in the duration of reporting courses the times noted were consistent with masters' level programmes i.e. postgraduate certificate, postgraduate diploma and MSc and corresponded and matched the information provided by the managers' responses.

Inevitably there have to be questions about the quality and standards of training. Different lengths of time devoted to training must almost certainly translate into differences both in the extent and depth of coverage and opportunities to practise the skills. In the case of IV injections, the activity engaged in by the largest number of trusts, there is a national accreditation scheme operated by the College of Radiographers. Yet 73 trusts (53%) supported non-accredited courses and while the

remainder stated that the course they supported was accredited, only 28% were by the Professional Body.

A key issue not just with intravenous injections but across the whole range of training activity is the question of transferability and recognition of a particular skill by another employer. This was a concern raised by radiographers in the study conducted by Price, High and Miller (1997). Recognition of the skills of individuals as they move between trusts should not only be important for the individual but also for trusts in maintaining the skill level in their workforce. It is difficult to see how this can be achieved easily without recognised accreditation of training programmes, preferably at a national level or within a framework recognised nationally. If employers require new members of staff to be retrained to a local standard this can be both costly in time and money before radiographers can practise the particular extended role. These are the reasons why the Professional Body has a specific accreditation system for IV courses. However, it has to be noted that accreditation within the College scheme is voluntary and the evidence shows that the majority of trusts are operating outside of the scheme.

In terms of complexity of role, IV and red dot probably do not rate as high as conducting barium enema examinations or reporting. This could explain the number of courses conducted in-house for IV and red-dot where employers believe they have the resources to deliver the training and do not have to pay an external organisation to deliver or accredit training. An added consideration related to red dot schemes is that this has not been classified strictly as an extended role. It is a 'secondary' system of flagging abnormalities or variants which may be of use particularly to junior medical staff in making a diagnosis. The fact that the presence or absence of a red dot on a film is not recognised as a definitive report could reduce how the status of the training is perceived. Red dot was the activity with the least number of accredited courses at only 10%.

The adoption and diffusion of reporting by radiographers was a phenomenon of the 1990s with the exception of ultrasound which has its origins in the late 1970s and early 1980s (see chapter 3). Ultrasound, probably due its complexity, had the largest number of trusts sending its staff on taught courses and with the greatest number of postgraduate programmes declared. The key facts to be noted about training for ultrasound reporting is that 82% of managers indicated that radiographers are taught at externally provided courses with only 18% of trusts using exclusively in-house training. Fifty-six percent of managers indicated that radiographers undertook postgraduate training, 17 managers reported that training was to masters' level but

the majority in this category were supported to postgraduate diploma level which has become recognised as the qualification for practice. Given the long establishment of ultrasound reporting it could reasonably be expected that training has become fairly well-established and evaluated; this could be evident by the smaller range reported in the duration of training. In addition, there has long been a record of accreditation of ultrasound training, firstly by the College of Radiographers in its Diploma in Medical Ultrasound, which was superseded by the move to postgraduate education in the early 1990s when higher education institutions became involved in radiographer education.

Of the other forms of reporting, axial skeleton and appendicular skeleton were the fields that have gathered momentum since the mid-1990s. Given the long history of the conflict between radiographers and radiologists on reporting and at a period when the debate on skill mix and the concerns expressed by the Royal College of Radiologists were at their height, the great majority of training appeared to be organised at postgraduate level, accredited and provided by a university.

Overall, the study has provided a 'snapshot' on the nature and scope of training for extended role tasks. It is evident and reassuring that importance is being given to training although there was a wide variation to each of the responses to the questions with the exception of training for ultrasound reporting which is well established.

However, the numbers of centres providing in-house non-accredited courses is a cause for some concern, especially where there is direct patient intervention such as with intravenous injections and barium enemas where 73 and 17 trusts respectively supported non-accredited training. While it is not possible to reach any conclusions about the standards and effectiveness of training the most important issue for the patient, radiographer and employer is whether courses develop competent individuals who are prepared for practice. Accreditation is the basis for determining this and, while the study does not provide information as to whether, or not, individuals are competent, the fact that training is unaccredited means that there is no certainty they are competent.

6.5 Limitations of the Studies and Implications

The three studies provided useful information on the state and nature of radiographic education in the UK.

Study 1 provided information on new graduates' experiences of their first post at six months following-qualification. Given the nature of the overall research and its

breadth, convenience sampling was believed to be justified but it was also a limitation in that it was conducted with graduates from just one university, albeit with three successive cohorts. While the study explored the preparedness for practice of the three successive cohorts the results could not be generalised as being typical of the experiences of radiography graduates from other universities. A larger sample from a range of universities would have enabled greater confidence regarding these findings. One aspect of the analysis that particularly suffered from the relatively small sample size was the post-hoc analyses of gender bias on the question whether skills and attributes were used to full potential. This is an area that would particularly benefit from further follow-up with a larger and more heterogeneous sample.

The majority of graduates found employment in London and the south east which was not unexpected, London showed the lowest rate of extended role adoption, and also suffered from higher vacancy levels than elsewhere. Thus graduates' experiences in London may well be different from graduates' experiences in other regions.

The implication here is that London, in particular, which showed the lowest rate of extended role adoption and has suffered from higher vacancy levels than elsewhere could mean that graduates' experiences may well be different from other regions. Again, a sample consisting of graduates from universities outside of London and the south east may well have provided a different picture. Nevertheless, the experiences were real for those graduates practising in London and the south east.

A limitation relating to Study 2 is the timing and cross-sectional 'snapshot' design of the documentary analysis, especially of those documents which were at the end of their working life. If programmes were in the process of being amended to reflect changes in practice then this information would have not been captured at the time of the analysis as they would not have been included in the programme document. However, this was overcome in the case of four universities where the analysis was delayed until new documentation was available.

Study 3 explored the type and nature of training provided by employers for radiographers preparing for new roles. It is believed that this was the first study of this nature to have been conducted nationally. The 68% response rate to the questionnaire was good for a postal survey (Hicks 2004). The questionnaire design was straightforward and was adequate for purpose. The fact that the questionnaire was of a fairly simplistic design was thought to be a factor that contributed to the relatively high response rate. A difficulty, however, was that not all managers

provided complete information for each activity. For example, there were a number of questionnaire responses where the manager indicated the type of training, but offered no further information on duration, the provider or whether it was accredited or not. It perhaps could have been the case that some were unsure of the correct information, especially if the completion of the questionnaire had been delegated to a junior manager.

While the questionnaire sought information on the type of training there were no questions about the level and methods of assessment and hence outcomes. Therefore, it was not possible to reach any definitive conclusion about the standards and effectiveness of training. Although, there can be a reasonable assumption that appropriate standards are reached for those courses accredited by the Professional Body and for those courses validated by a university at postgraduate level possibly in conjunction with the Professional Body.

A repeat study with some modifications and additions to the questions, particularly regarding the course level and assessment, would strengthen the data and therefore the knowledge base of work in this area. Further work should also focus on whether employers recognise extended role skills as being transferable from one trust to another and, if not, what would be the criteria they would accept to allow a radiographer to continue to practise a particular skill at their new employment. In addition the rationale for supporting non-accredited training should be investigated fully.

6.6 Summary

The three studies reported in this chapter provided valuable information on the relationships between developing practice and the extent to which it has been supported and underpinned by education and training provision.

The aims of pre-registration education and training are numerous and apart from facilitating personal and intellectual development it has to deliver vocational outcomes. Firstly, to develop the knowledge and skills to prepare students for practice, for their first post in particular but secondly to provide the basis for career progression and life long learning. In Study 1, graduates were given the opportunity to reflect on their experiences of their introduction to practice after a period of approximately six months following graduation. This was judged to be a sufficient period for graduates to settle into the post allowing for induction and assimilation into the trusts working practices.

Study 1 found the extent to which students were prepared for their first post in terms of tasks or techniques to be undertaken was variable. Nearly half of the respondents indicated that there were tasks they could not undertake because they were not addressed in their pre-registration education. The corollary of this was that more than half of the graduates were unable to identify any tasks they could not perform. The conclusion here is that the requirements of individual trusts are also varied for new graduates. However, it was the opinion of some of the managers interviewed (Chapter 4) that a greater emphasis needs to be placed upon practical and clinical education; this would concur with the view of some of the students who reported areas of deficiencies that included theatre and trauma radiography. Although managers were not included in Study 1 the findings from the sample reported in Chapter 4 agreed with those of Williams and Berry (1997) who found a wide variation in understanding of what to expect from a newly qualified radiographer. In addition to those who felt that they could not perform some tasks there was a large majority who believed that there were of areas in which they would have liked more extensive training. These invariably were theatre radiography, trauma radiography and dental radiography two of which were mentioned above. There is a clear indication for education providers to take note of these areas and to engage with clinicians when reviewing programmes.

The time allocated for education and training in the specialist modalities in undergraduate curricula has to be questioned; this view is not only supported by the findings from Study 1 but by the views of managers on education expressed in Chapter 4. The study by Price, High and Miller (1997) reported the views of clinicians who believed that training for such modalities should be provided as postgraduate options. Study 2 also revealed some support albeit from two institutions where time was judged as being better allocated to developing transferable skills which would support career progression after graduation.

Clinical departments recognised their responsibility to support CPD with the numbers of graduates with formal development plans increasing over the period of Study1. Graduates themselves were identifying extended role tasks for development which is recognition that the shift in practice is gaining a high profile with new graduates. Study 3 provided data as to the extent to which training for extended roles and new ways of working was occurring nationally. It is evident that support is provided extensively but with considerable variation in the type of training, duration, the education and training provider and whether it is accredited or not. The national picture overall does seem to support the ‘chaotic’ situation that was found in nursing

reported by Wright (1995). Of major concern is absence of external accreditation for much of the activity which gave rise to further questions on the standards being achieved in practice. It is insufficient to conclude that as training is supported by a trust it is therefore adequate, if that was the case the question of skill recognition and transferability to other trusts would not be an issue. Two areas, however, reporting and ultrasound training are exceptions in that the majority of training is accredited and, at master's level. Nevertheless, there is the case for further work to be undertaken in this area around standards achieved and performance.

The review of curricula found that the majority were cognisant of the drivers of change, i.e. developing technology, Government and NHS reforms which were facilitating skill mix changes in practice; however, not all recognised each of the drivers. On the parameters investigated there were developments evident from the first wave of degree documents identified in the study by Price, High and Miller (1997). The view of Moses and Mosteller (1985) is supported as far as undergraduate curricula and confirms that education does follow the practice lead. Whether or not this is always the correct approach is debateable. For example, if a new practice development with national implications is being planned then the training should always precede delivery not as evidenced by Study 3 where the overall impression is one of trusts 'scrambling' to facilitate training to meet the ad hoc practice developments.

In conclusion, the three studies reported in this chapter investigated the extent to which education and training was supporting new ways of working. There was evidence to show that curricula developments at undergraduate level have been influenced by the impact of new technologies and the consequential developments in practice. At post registration level continuing training was taking place but with much variation. The level of unaccredited training was a concern as it implies a lack of consistency in the application of standards across the UK.

Education provision overall lacks continuity but the opportunity exists with the introduction of the four-tier structure for a cohesive approach that recognise explicitly the needs of those practising in each tier.

CHAPTER 7

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

7.1 Background

The research investigated the impact of technology on radiographic practice and upon the education and training to support new ways of working. The 'hardware' expansion and consequent increased range of imaging has resulted in a greater service demand for radiology. As a further consequence there have been far reaching effects on role requirements and educational needs of radiographers.

The research mapped changes taking place to the scope of radiography practice. Important information on the changing nature of the role of radiographers and the ability of the profession of radiography to cope with technological innovation has been presented. The research mapped the redefinition of roles and the emergence of a practice model linked with an education and training framework in response to significant drivers for change.

The thesis has presented a literature review (Chapter 1) that considered the context of diagnostic radiography and imaging. The review identified a range of factors impacting on imaging practice and the way it has responded. Chapter 2 presented initial data on the impact of technology which was drawn together from interviews with clinicians and industry representatives. Data on the adoption and diffusion of extended roles throughout the UK was obtained from three separate surveys of radiography managers at NHS acute trusts. This research was presented in Chapters 3 and 5. A further round of interviews with imaging department managers allowed an exploration of factors that encouraged or resisted change was reported in Chapter 4. The role of education and training was investigated (Chapter 6) by three studies. First, a survey of new graduates on their preparedness for practice, second, an analysis of undergraduate curricula documents; and third, a survey of radiography managers on the nature and scope of the preparation of radiographers for new ways of working. This final chapter presents a summary of the research, its conclusions and recommendations.

7.2 Drivers of change

The primary driver of change has been increased capability and capacity of imaging modalities notably, CT, MRI, nuclear medicine and ultrasound. From 1995 to 2004 the number of imaging examinations increased by 17 % overall (Chapter 1, Table 1.1) with MRI, ultrasound, nuclear medicine and CT activity increasing by 147%, 47%, 25% and 17% respectively. The research (Chapter 2), investigated the views of radiologists, radiography managers and company representatives on the impact of these changes to the available technology and the consequences for imaging practice. The increased capability of imaging and the growth of interventional radiology was making additional demands on radiologists and widening the scope of radiology practice. There was no evidence that the numbers of radiologists were increasing to cope with the increasing numbers of imaging examinations. A consequence of skill shortages in radiology provided the drive and opportunity for radiographers to extend the scope of their practice as many departments began to champion new skill mix profiles. At local level, the research (Chapter 4) found that radiologists were the key drivers in enabling radiographer role extension.

There were examples of the adoption of role extension in radiography in the early 1990s and in many trusts tasks were well diffused by the time Government responded to promote such developments. Nevertheless, successive Governments have been drivers for change and have responded to the increasing demands on imaging and have themselves been drivers of change, especially, in stimulating organisational development to support new ways of working. There have been a number of key Government publications that support modernisation of the health service. These include:

- *The New NHS - Modern·Dependable* (1997)
- *A Health Service for All Talents – Developing the NHS Workforce* (Department of Health, 2000)
- *The NHS Plan* (Department of Health, 2000)
- *Meeting the Challenge: A Strategy for the Allied Health Professions* (Department of Health, 2000)
- *Radiography Skills Mix* (Department of Health Learning and Personnel Development Division, 2003).

All had a common theme of modernising health services. The documents published in 2000 were critical of traditional demarcations between staff, which they claimed

had held services back. The Government's view was that the provision of health services should depend on the ability of the staff to deliver the service, not their job title and this could be interpreted as a clear signal in support of radiographer role extension.

However, professional bodies, in particular, the College of Radiographers and the Royal College of Radiologists, have *responded* to changes in practice rather than leading change. In some instances the negative approach taken to skill mix and role extension by the Royal College has meant that it has been a barrier to change rather than a protagonist for it. This is in contrast with the actions of some individual radiologists who have been the real innovators and prime drivers for change in the adoption of extended roles by radiographers to cope with increasing workloads at the local level.

7.3 Practice shifts in diagnostic radiography

The research demonstrated and mapped the adoption and diffusion of extended roles across the UK over a six year period. The changes are of two kinds, firstly, changes in the procedures carried out by radiographers, and secondly in the reporting of the findings of those procedures. The main areas of role extension in procedures were: intravenous injections; radiographer performed barium enemas; abnormality detection (red-dot systems); image interpretation i.e. reporting of images from skeletal radiography; ultrasound; barium enemas; nuclear medicine; and mammography.

IV injections, barium enemas, red-dot systems and ultrasound reporting were shown to have been adopted by the majority of trusts. There were also some isolated examples of trusts where radiographers were performing angiography, barium meals, cystography and sialography. The number of trusts where radiographers report images has increased over the period but the role extension in reporting is substantially less than for radiographic procedures.

The research also found that not only were there regional differences in role adoption but also differences between trusts in the same region. There was also some evidence that the adoption of certain roles (barium enemas and red-dot) was less prevalent in trusts classed as teaching trusts as opposed to those classified as non-teaching. This supported the view that the need to train radiology trainees was given preference over radiographer role extension. The evidence, overall, for all tasks, indicated that adoption and diffusion of extended roles was taking place in an ad hoc manner. However, the re-assignment of some tasks previously considered to be

medical has increased the scope of radiography practice. The research has shown that there has been a paradigm shift in radiographic practice which commenced in the earlier part of the 1990s.

7.4 Integration of extended roles in work practices

The research investigated factors that encouraged and resisted the development of extended roles in trusts. Increasing workloads and radiologist involvement in interventional work were the main reasons for radiographer role extension. Despite the barriers, some of which seemed to be protecting radiology role boundaries, all of the trusts investigated in the work reported in Chapter 4 had introduced extended role tasks to some extent.

An important fact to emerge from the research was that role extension was dependent upon the support of at least one radiologist at a local trust. Ironically, while some radiologists were the protagonists for radiographer role extension, others were also the biggest barrier. However, most radiologists seemed to have supported role extension from a position of pragmatism in that work load targets had to be met. There was evidence to show that once radiographers were seen to perform a task to the standard required, radiologists developed a greater respect for radiographers and relationships with radiologists improved as did morale and team working. Once performing a new role to the required standard, a radiographer could become a useful teaching resource for trainee radiologists.

Role extension also required radiographers to be willing to adopt new roles. However, evidence provided in Chapter 4 indicated that there was some resistance by older radiographers who were unwilling to take on responsibilities that were seen to be medical. This was offset by a new generation of graduate radiographers who were enthusiastic about taking on new roles. This was often sufficient to encourage, older and more experienced staff to reconsider their position.

Prior to the publication of the NHS Plan (2000) there was no evidence provided by managers that role extension had come about through any planned re-profiling or re-engineering from either national or regional initiatives. It has been largely ad hoc in nature, although, there was a similarity in the roles deemed suitable for extension. The ad hoc nature is reinforced by the examples of trusts adopting new roles which lacked precedent elsewhere. This was indicative of radiologist enthusiasm and a need to deal with a particular workload demand (Chapter 4). These situations lend additional weight to the conclusion that the nature and the extent of role extension was dictated by local demand. Alterations in responsibilities are, therefore, typically

by dint of local protocol, and any training needs arising from such developments are again resolved locally rather than by any planned, coherent, national or regional strategy.

A shortage of radiographers at some trusts was preventing or slowing down developments in role extension because priority had to be given to meeting the radiographic workload. Staff shortages also led to a lack of succession training at some trusts. This situation could be storing problems for the future as there will not be a sufficient number of trained staff to meet workload demands in times of sickness, holidays or if trained individuals leave a trust. There was a clear indication given by managers in Chapter 4 that the introduction of a sub professional grade of worker to undertake basic radiography would help alleviate radiographer shortages and allow professional staff to concentrate on advanced work.

A lack of additional resourcing was identified as a problem and was essentially linked to many of the issues mentioned. It was clear, however, that where radiographers extend their roles they need training which is both adequately deep and specific with sufficient time to develop the skills required to undertake the given task to the required standard.

7.5 Support for new ways of working

The research found that managers were experiencing difficulties in managing workload demands. As well as a shortage of radiologists, some trusts were experiencing difficulty in recruiting radiographers. This was threatening service delivery, as while radiographers were undertaking some of the tasks traditionally practised by radiologists, additional pressure was arising because of reduced staff to undertake radiography. It was apparent that little was being done to fill the void left by radiographers who were undertaking new roles.

The emergence of the four-tier practice model was identified as an innovative solution to address the widening scope of radiographic practice and the staffing difficulties. The model introduces a new grade of sub-professional worker, an assistant practitioner, to undertake basic radiography with the creation of new roles of advanced practitioner and consultant practitioner; the practitioner level remaining as gate for professional entry[5].

[5] In practice, the model is likely to be subsumed within the extended Agenda for Change Bandings (cf Chapter 1).

Some managers believed that the introduction of an assistant level to relieve radiographers from undertaking 'routine' radiographic tasks was not welcomed by all radiographers. However, it was seen as essential by managers if new ways of working were to be sustained. Some managers had been against the concept of assistant practitioners but had changed their position after recognising the advantage of supporting radiographers working at an advanced level and above.

The third national survey of extended roles (Chapter 5) found that a number of NHS Trusts were making some progress in implementing the four tier model. The evidence, however, was that the focus was on the introduction of assistant practitioners and advanced practitioners (in addition to the practitioner tier). Little progress was being made at consultant radiographer level but the introduction of the four tier structure lends weight to the argument for a more highly educated professional workforce with a high level of human decision making skill. The research identified that the range of work being undertaken by assistant practitioners (largely skeletal radiography) was consistent with the views of managers that were presented in Chapter 4 and was providing the opportunity for workers in the professional tiers to focus on more specialised activities requiring a greater level of expertise.

The key strength of the four-tier model is its clinical focus and the opportunity it provides for professional staff to advance their careers and remain within the clinical sphere. For the first time a career structure is available that values clinical expertise and means that staff can aspire to consultant level. It is suggested that benefits should accrue from the emphasis on clinical expertise, and, therefore, it is further suggested there will be improved clinical outcomes for patients, as well as improved retention of key clinical staff. However, as reported in Chapter 5, there was evidence that only a small number of NHS trusts were adopting the four-tier model and with seemingly little emphasis on establishing consultant level posts. Furthermore, the evidence pointed to implementation of the four-tier model on an ad hoc basis. There could be a number of reasons for this, including; lack of resourcing at a local level; a lack of clarity as to what each tier really represents in terms of delivering diagnostic imaging services; a 'wait and see' approach depending upon full implementation of *'Agenda for Change'*; and an insufficient number of radiographers with the expertise to move to consultant level. Surely, therefore, there is a need for a national approach to implementation linked with evaluation and dissemination of the outcomes in order that strengths can be consolidated and weaknesses overcome.

7.6 The role of education in supporting practice and new ways of working

This aspect of the research reported in Chapter 5 investigated how education and training was supporting practice developments. Views of both radiography managers and recent graduates were obtained. The actual curricula of awarding institutions leading to radiographer qualifications were also explored.

NHS trusts recognised that education and training plays a vital role in supporting the development of undergraduates and also in supporting qualified staff preparing to extend their roles. The role of undergraduate education is doubly important to prepare students not only for their first post but in providing the skills to develop beyond their first qualification, but, equally access to post registration education and training is fundamental in supporting development of new skills and attributes for new ways of working.

7.6.1 Preparation for initial practice

The research revealed that just under half of the new graduates surveyed indicated that there were tasks they could not undertake because they had not been addressed in their pre-registration education. Furthermore, there were radiographers who indicated that there were clinical tasks for which they would have liked to have received more extensive training. Anxiety was expressed about the lack of opportunity in some departments by new graduates who considered that all of their work relevant skills and attributes were not being used to their full potential. It was reported that in some trusts there was a hierarchical distinction between seniors and juniors which meant that there was no expectation that new staff would undertake specialised tasks. In preparing undergraduates for practice there was little evidence of respondents moving to the specialist modalities immediately following qualification. Therefore, the emphasis on preparing gradates to work in specialised modalities needs to be reconsidered.

There was some evidence of gender differences associated in opportunities to utilise the full range of skills. However, the number of students, overall, was small and to investigate this further a further study would need to be undertaken involving a larger number of students and the managers of the departments where they are practising.

It became clear that there were differences in departments regarding their expectations of new graduates. This is in agreement with other work that found a wide variation in what was expected from newly qualified radiographers. The differences would account for frustration by some graduates who felt that they had particular skills that were not utilised or deemed not relevant for a first post. If the

implementation of the four-tier structure is to be universal then managers need to communicate their needs to educators as to the requirements of the practitioner grade in particular.

The engagement with CPD and the support offered by managers to new graduates was evidence that the longer term needs of career development were being addressed by managers and graduates.

7.6.2 Curricula Review

Pre-registration radiography education had changed from being centrally organised by the College of Radiographers, to degree based education offered by universities. The transfer of responsibility of delivery was partially on the grounds that curricula would be dynamic, flexible and meet the changing needs of practice. The review of second and third iterations of degree documents provided an overview of how curricula were responding to, versus driving, practice requirements.

Nine institutions made direct reference to Government and NHS reforms as drivers of change and also made a link between modernisation with advances in technology. The need for curricula to respond to developments in technology (hardware) was directly or indirectly mentioned in 19 out of the twenty four documents and role development (software) was identified as a major theme in 17 documents. Fourteen documents made direct reference to specific aspects of role extension; of these seven referred to IV injections; three to gastro-intestinal examinations and thirteen to image interpretation. The research found that students were being instructed in how to undertake IV injections but only in one document was it suggested that graduates would be competent to inject on graduation.

A number of documents included the need to provide experience of specialised modalities; a position not agreed with by all of the new graduates surveyed or by all of the HEIs. The evidence from new graduates pointed to greater emphasis being placed on further development of clinical skills and to producing graduates who are adaptable and prepared for lifelong learning. The HEIs taking a stance against students spending time in specialised areas could see greater benefit if the focus of education, especially in the final year of a programme, was on practice principles and developing transferable skills which would better enable graduates to deal with new clinical situations or new technology in practice.

Therefore, pre-registration curricula, while needing to acknowledge developments and advances, must not do so not at the expense of initial competency. Curriculum development must identify desirable and appropriate outcomes that have the support

of clinicians and educators but, equally, does not make demands that are unachievable.

7.6.3 Preparing for extended roles

The research found that most trusts used some form of training to prepare radiographers for the tasks involved in extended roles. However, much of the training was unaccredited. There were also wide variations in the types of training preferred for different activities. In-house training was the most frequently employed for IV injections and red dot but for more complex procedures and those involving higher-level decision-making skills there was a tendency to turn to external providers with courses being accredited by an HEI or a professional body.

There was considerable variation in the duration of training in preparation for each role. IV training ranged from half-a-day to six months, and barium enema training ranged from one to twelve months. While there was variation in the duration of reporting courses the times provided were consistent with those required for postgraduate study. Different lengths of time devoted to training must almost certainly translate into differences both in the extent and depth of coverage and opportunities to practice the skill. While the College of Radiographers provides a national accreditation scheme for intravenous injections only 28% of trusts used this facility. The lack of accreditation is an issue for radiographers where transferability of a skill is not recognised by a new employer, or potentially, in a case where competence to practise is being challenged. It is difficult to see how employers can be compelled to support accredited training especially if cost is an issue but they do have to underwrite the risk of not doing so within the context of their clinical governance policies.

Questions have to be raised about the quality and standards of training with such variation in duration observed for some tasks and where much of the provision is without accreditation. If the assumption is made that appropriate standards are reached for those courses accredited by a professional body and / or university then the numbers of centres providing in-house non-accredited courses is a cause for some concern. Accreditation is the basis, normally, by which judgment can be made about competency. It was not possible to reach any conclusions about the standards and effectiveness of unaccredited training in developing competent individuals, but the fact that training was unaccredited means that there is no certainty that staff were competent. A repeat study with modifications and additions to the questions, particularly regarding the level of training and assessment, would strengthen the

data. Further work should also focus on the transferability of extended role skills between trusts and the rationale for supporting non-accredited training.

The three studies on education provided data on the extent to which education and training was supporting new ways of working. There was evidence to show that curricula developments at undergraduate level have been influenced by the impact of new technologies and by consequent developments in practice. A number of HEIs, however, had placed a focus on the development of transferable skills and had included topics in anticipation that particular roles would be embedded within practice by the time the cohorts graduated. At post registration level continuing training was taking place but with much variation. The level of unaccredited training was a concern as it implied a lack of consistency in the application of standards across the UK and overall it appears muddled. At the undergraduate level there was some evidence that education was providing a lead in some areas but it was not clear as to what extent this was happening at post registration level. However, this would appear to be a sensible strategy if practice developments, especially, with regional or national implications are being planned, then staff need to be trained in anticipation of the identified need.

7.7 Taking practice forward

There is no doubt that an approach to service delivery with a model which sets clinical practice at its core is long overdue. Real strengths and opportunities exist within the four tier model, but it may not be possible to realise these if potential weaknesses are not addressed. Firstly, there has to be clarification of the requirements of each tier of practice, notably, at advanced practitioner level. Furthermore, if the model is to be fully compatible with the 'skills escalator' approach, it needs to take account of support workers who perform at a level below that of assistant practitioners. Secondly, the relationship between the radiography consultant tier with that of a medical consultant needs to be clarified. Thirdly, an education framework would need to be developed that mirrors the tiers. Further research will be needed to identify prerequisites for entry into the assistant, advanced and consultant practitioner roles in the same way that a pre-determined level of education leads to eligibility for HPC registration.

Regarding education and development, learning outcomes (and qualifications) should be defined for progression to each tier. Demands should be made on both service and education centres to agree a coherent education framework to support progression through the tiers. This approach should facilitate the development of

individuals who enter either as students undertaking a BSc (Hons) degree or as trainee assistant practitioners. This arrangement would lead to a two tier entry to radiography as suggested by some managers. However, under current regulatory arrangements it is unlikely that there will be a 'fast-track' to advanced practice via a BSc (Hons) as registrants will have to have met the HPC *Standards of Proficiency* to obtain registration. However, following admission to the register, and provided there are sufficient personnel to cover routine work i.e. assistants, there is no reason why a career plan could not be implemented to follow a particular route to a specialist area of practice. The educational framework will have to be explicit about progression and career development from, potentially, support worker (an additional level below assistant) through to consultant practitioner. Therefore, there has to be a re-evaluation of what has to be learned before entry at each level and what is best learned following a particular qualification or award in order to progress to the next tier.

The identification and formalisation of new roles with a supporting education and training framework should enable managers to identity, as early as possible, those members of staff workers with the potential to progress up the tiers. This would be based on an individual's ability and potential rather than on time served.

Such an approach would ensure integration of the four tier model as a whole. There appear to be several local initiatives, especially related to the development of assistant practitioners that have been introduced in an attempt to solve staffing issues in clinical departments. However, similar pressures to implement the radiographer consultant tier were not apparent. This one-dimensional approach of 'cherry picking' the tiers has the appearance of being short-termist and is unlikely to lead to an effective longer term solution. It is recommended that trusts planning to introduce assistant practitioners to undertake imaging examinations or carry out radiotherapy should, simultaneously, plan the introduction of consultant radiographer posts.

The somewhat muddled national picture of post registration level education and training is a matter for urgent consideration. The lack of accreditation and transferability is inconsistent with a 'skills escalator' approach. When planning career advancement, radiographers and other workers need to be confident that training outcomes will be recognised beyond their immediate employer. This implies the need for accreditation by a recognised and authoritative body. This approach should be consistent with the skills escalator. This situation provides an opportunity for the College of Radiographers to take the lead and to work with providers of education

and of health care to develop and introduce a system of that all stakeholders (including radiographers) can access to assure national recognition achievement. The absence of transparent national standards has led to confusion.

Agenda for Change was introduced while the research was ongoing and it will mean that managers will need to consider carefully the skills profile of their staff. Staff development will need to be linked to the skills escalator approach in order to achieve and maintain the appropriate skills mix. However, the research showed (Chapter 4) that while managers, in general, supported the new tiered approach to practice they had done little in the way of planning to prepare for the changes that this policy shift would mean for their departments. Despite the Department of Health intentions, the evidence indicated that changes to skill requirements for radiographers were proceeding in an ad hoc fashion. The conclusion, therefore, must be that imaging departments will be poorly prepared for change and will need to consider skill profile issues very carefully given the lack of coherent planning taking place.

Set against this, though, the evidence (Chapters 4 and 6) suggests that were imaging managers to implement planned development in extended role activities, there would be a sufficient number of new graduates who would welcome these development opportunities.

7.8 Conclusions

There are a number of key conclusions that are derived from the research and are presented below:

- The continuing expansion of imaging technology has had far reaching effects on role requirements in radiography. The direct consequence of the increasing technological diffusion has been the change in the total array of tasks undertaken both in quantity and in nature.
- There has been a paradigm shift in radiographic practice which commenced in the earlier part of the last decade (1990s). The re-assignment of some tasks previously considered to be medical has increased the scope of radiography practice.
- Radiographers have contributed to relieving the burden of the radiological workload and role extension has become the norm in the UK.
- The adoption and diffusion of extended roles has been on an ad hoc basis and has been primarily dependent upon the support of radiologists.

- While radiologists have been the key protagonists for role extension, they have also constituted the greatest barriers.
- While undergraduate education must have a greater focus on the development of clinical skills appropriate to first posts it must also develop students' skills in preparation for lifelong learning.
- The ad hoc pattern of adoption and diffusion of extended roles makes the development of education and training haphazard, leading both to difficulties in co-ordination and to questions regarding parity of the student experience and preparation.
- The four tier structure offers a new career pathway for radiographers and could provide a solution to managing workload issues, there has been no systematic attempt to implement the structure, and at present education and training providers have not responded to the requirements of the new structure.
- There are imaging departments that are poorly prepared to introduce a skills escalator approach to practice and will need to consider skill profile issues carefully given the lack of a coherent planning taking place.

7.9 Key Recommendations

The conclusions lead to a number of key recommendations, both for further research and for action by the College of Radiographers, the Royal College of Radiologists and the NHS, at national, regional and local trust level.

- A longitudinal study should be instituted to follow the progress of newly qualified radiographers over at least a two year period from qualification in order to identify any areas of real difficulty.
- Further work is needed to continue to map adoption and diffusion of roles and to investigate the implementation of the four tier structure, in particular to identify development and support mechanisms needed for full implementation.
- A further study on the nature and scope of training provided by employers for radiographers in preparation for new roles with some modifications and additions to the questions, particularly regarding the course level and assessment, would strengthen the data and therefore the knowledge base of work in this area. Further work should also focus on what is necessary in

order for employers to recognise extended role skills as being transferable from one trust to another.

- There is a need to review initial education and training to ensure that students are given the opportunity to gain greater experience in aspects of specialist clinical practice in which they have reported lacking appropriate experience upon graduation, such as theatre and dental radiography.
- There is a question mark over the value of non-accredited training. Employer rationales for funding such training should be further examined, and there needs to be a national debate regarding whether training aimed at supporting new roles should be accredited to give national recognition and hence transferability from one employer to another.
- The College of Radiographers should take a leading role and collaborate with the Royal College of Radiologists and with providers of education and health care to introduce a transparent educational framework linked to clear accreditation processes that ensure consistency of standards across the UK.

7.10 Final Comment

Education provision in radiography lacks continuity between levels but the opportunity exists to introduce an education model that mirrors the four-tier structure. This would bring consistency and cohesion between the levels of education that would recognise explicitly the needs of those practising in each tier.

The acceptance of the four tier approach will do more to offset the shortage of radiologists than will the ad hoc arrangements that have been in operation for more than a decade. The increase in the scope of radiographic practice has led to a redefinition of practice that includes roles once thought to be in the domain of medical practitioners. As a consequence of this, the use of the term ‘extended role’ will become redundant. The limitations on the scope of practice will be determined by employers in conjunction with radiographers based on the needs of patients and not on the needs of individual radiologists. The four tier structure and Agenda for Change provides the opportunity to consolidate and formally recognise a situation that has been drifted into over the past fifteen years.

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Appendix 1

PUBLICATIONS/PRESENTATIONS

RELATED TO RESEARCH

Peer Reviewed Publications

Price, RC. Le Masurier, SB (2006) Longitudinal changes in extended roles in radiography: A new perspective• ARTICLE *In Press, Available online 10 March 2006.*

Price, RC. (2005) Response to Letter to the Editor by Brian Tidey *Radiography* 11: 305-306.

Price, RC. (2005) Critical factors influencing the changing scope of practice; the defining periods. Imaging and Oncology. London: The Society and College of Radiographers 6-11. ISBN 1871101263.

Vosper, MR. Price, RC. Ashmore, LA. (2005) Careers and destinations of radiography students from the University of Hertfordshire. *Radiography* 11: 79-88.

Paterson, A. Price, RC. Thomas, A. Nuttall, L. (2004) Reporting by radiographers: a policy and practice guide. *Radiography* 10 205-212.

Paterson, A. Price, RC. (2002) The Four Tier Structure. Proceedings of the UK Radiological Congress 2002. London: The British Institute of Radiology 12-3, ISBN 0-905749499.

Lovegrove, MJ. Price, RC. (2002) Recruitment, training and retention of healthcare professionals in clinical ultrasound. *Radiography* 8: 211-214.

Price, RC. Miller, LR. Mellor, F. (2002) Longitudinal changes in extended roles in radiography, *Radiography* 8: 223-234.

Price, RC. Paterson, AM. (2002) Consultant Practitioners in Radiography – A discussion paper. *Radiography* 8: 97-106.

Price, RC. (2002) Developing technology and its impact: investigating change in radiographic practice. In *'Research: Generation Change in the Clinical Setting' International Society of Radiographers and Radiological Technicians (ISRRT) 11th Teacher's Seminar Thailand*. Conference Proceedings 22-30. ISBN 0-9689186-1-1.

Price, RC. (2001) Radiographer Reporting: Origins, Demise, and Revival of Plain Film Reporting. *Radiography* 7: 105-117.

Price, RC. (2000) Radiographers and Reporting – The Early Years. *The Journal of the Radiology History and Heritage Charitiable Trust.* 14: 16-29.

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Price, RC. Le Masurier, S, High, J. Miller, L. (1999) Changing times: a national survey of extended roles in diagnostic radiography. *Radiology 1999 - Imaging Science and Oncology. Programme and Abstracts, Supplement to Volume 72 of the British Journal of Radiology* 7.

Le Masurier, S. High, J, Miller, L. Price, RC. (1999) A national survey of extended roles in therapeutic radiography. *Radiology 1999 - Imaging Science and Oncology. Programme and Abstracts, Supplement to Volume 72 of the British Journal of Radiology* 7.

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Price, RC. High, J. Miller, L. (1997) Developing practice in radiography; its impact on the curriculum. Abstract - *British Journal of Radiology Supplement to Vol. 70*: 9.

Taket, A. Lovegrove, MJ. Price, RC. (2003) Modernising the clinical ultrasound service. London: South Bank University. ISBN 1-903744-05-9.

Paterson, A. Price, RC. (2002) A tiered approach to practice: Where is the debate? *rad magazine* 29:324;32.

Price, RC. Prime, N. *Reading Radiological Images - Whose Image is it any way?* Hospital Healthcare Europe 1999/2000. Camden Publishing Limited. DI 20-DI 21.

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Conference Presentations

Price, RC. (2004) Longitudinal Changes in Extended Roles in Radiography. 23rd International Congress of Radiology, Montreal Canada, 26th June [Invited key note speaker].

Paterson, A. Price, RC. (2002) The Four Tier Structure. *Proceedings of the UK Radiological Congress.* Programme and Supplements.

Price, RC. (2002) The impact of new technologies - changes in practice. ISSRT World Congress Amsray. RAI Congress Centre, Euraplein, Amsterdam, The Netherlands, 22nd September 2002.

Price, RC. (2000) Developing technology and its impact: investigating change in radiographic practice. International Society of Radiographers and Radiological Technicians (ISRRT) 11th Teacher's Seminar Thailand 22nd August.

Price, RC. (1999) Changing times: a national survey of extended roles in diagnostic radiography. United Kingdom Radiological Conference 1999 - Imaging Science and Oncology Programme.

Poster presentations

High, J. Miller, L. Price, RC. (1998) Roles, Relationships and Responsibilities in Radiographic Services, Poster presentation - Multiprofessional Issues in Health and Social Care: the impact on education and workforce planning, conference May 6 1998.

Le Masurier, SB. Price, RC. (1999) A holistic picture of the barium enema examination Poster presentation. *Radiology 1999 - Imaging Science and Oncology. Programme and Abstracts, Supplement to Volume 72 of the British Journal of Radiology* 66.

Appendix 2

THE GROWTH OF ROLE EXTENSION

APPENDIX 2

The growth of role extension

This Appendix provides a short review of the development and growth of role extension in radiography practice.

IV Injections

Of those areas of role extension in radiography Paterson (1995) found that the administration of IV injections was the most widely diffused activity and had been adopted in all specialties. The activity meets the criterion of receiving support from a Professional Body (DHSS 1977), who issued advice on adoption of this task in 1996 (College of Radiographers 1996b).

The benefits of radiographer performing IV injections were reported by Nutall (1996) who suggested a reduction in waiting times of up to 30 minutes per patient with improved continuity of patient care plus a reduction in the radiologists' workload. A secondary benefit was put forward by Thomas (1998) who reported that there was increased morale amongst radiographers. Loughran's (1993) view was that radiographers readily acquire skills required to perform IV injections and this practical skill was a good starting point for role extension.

While for the main part radiographers have been trained to inject non-ionic contrast media they also able to inject antispasmodics such as Buscopan during barium examinations. In a study of 96 radiographers (Bewell and Chapman, 1996) it was discovered that 85% had received training on how to give intravenous injections as part of their barium enema course and 80% of the sample also stated that they injected antispasmodics on a regular basis. As extended roles, by definition, will have previously been outside the scope of radiographic practice it follows that training will almost certainly be undertaken following initial registration. In order to facilitate wider recognition and transferability of the skill, the College of Radiographers began a scheme to accredit courses and issuing certificates of competence. In time, however, as the skill diffuses throughout the profession the question of whether training should be integrated within pre-registration courses arises. In the study by Price, High and Miller (1997) a question asked whether newly qualified radiographers should be able to give in IV injections; the question implying that training would take place prior to qualification. Of the sample 54% were against with 20% undecided. There is no evidence to indicate whether this position as changed but Keenan (2001) stated that those radiographers' giving intravenous injections have

"become fundamental to the operational management of diagnostic imaging departments." By 2000 most NHS trusts had radiographers administering IV injections (Price et al 2002). The crude division of 'normal' from 'abnormal' radiographs was expanded to encompass a formal reporting system by Loughran (1996) who stated that radiographers formally reported 40% of accident radiographs at his hospital.

Barium enemas

The idea of radiographer-performed enemas was initially described within North America with Somers et al (1981) and Miller and Maglinate (1982) evaluating 'technologist' performed procedures. Initially, in the UK there was some controversy over radiographer performed barium enemas, with change not readily being accepted by everyone. Simpkins (1992) suggested that patients would prefer a doctor to complete the procedure and it was an examination where early diagnosis of colonic neoplasms was at the forefront of radiological challenges. Simpkins (ibid) sated that radiologists should be redoubling their efforts to improve the standard of work and not to hand over responsibilities to radiographers. A different perspective was provided by Chapman (1992) who provided evidence to show that not only was their no difference in the quality of examinations between radiographers and radiologists but that there was a higher detection rate for polyps and carcinomas by the former. Regardless of the views of Simpkins, developments were proceeding in this field and were being driven by the shortage of radiologists and the fact that barium enemas accounted for 250,000 examinations a year (Mannion et al 1995).

Radiographer performed barium enemas also received the support of the College of Radiographers who accredited a training programme as early as 1993 which produced radiographers with good safety records and reporting skills (Bewell and Chapman 1996). Mannion et al (1995) and Page (1998) also demonstrated radiographers' success in undertaking barium enemas. Bewell and Chapman (1996) noted that, once trained, the complication rate from radiographer performed enemas was of the same order as that of a radiologist performed procedure. Radiographers only performed less efficiently than radiologists in the quantity of films taken, (Lee 1998) but this changed over time as knowledge and confidence increased. From the same centre as Bewell, Culpan (1999) audited patients with known colorectal cancer and discovered that the sensitivity (a measure of the ability to recognise disease when it is present) of radiographers was higher than that of radiologists.

The diffusion rate of this field of role extension was unknown within any great degree of accuracy but it was claimed that radiographers were continuing to push this extended role forward in more and more hospitals (Mathers, 1996). Mckenzie et al (1998) also suggested that barium enemas were becoming common practice within many trusts and of the100 departments surveyed, 49 were utilizing radiographer performed barium enemas and, although this was a smaller sample than Paterson's survey, it represented a large increase over the 14% in that study. Law et al (1999) claimed that radiographer performed barium enemas provide an excellent quality examination with results comparing favourably with published data for radiologists. Hogg and Nightingale (2003) reported that radiographer performed barium meals have been shown to be an efficient, cost effective and safe role for delegation. They also charted the development of enema practice over a 10 year period from radiographers practising performing examinations with regular referral to a radiologists to the situation where 'independent practitioners' work within a relaxed protocol with little reference to radiologists. The evidence was supporting that this field of role extension was improving the quality and provision of services within the radiology department.

Image Interpretation

Paterson's study showed that reporting was being undertaken by radiographers in three areas: plain film, obstetric ultrasound and general ultrasound. She also included the *'red dot system'* in the reporting category, and, while this can be classified as a role development it hardly qualifies as a role extension in radiography as it was not a task traditionally undertaken by another professional. The initial ideas for the 'red dot' system can be traced to Swinburne (1971) who suggested that senior radiographers could triage films into "normal" and "abnormal" categories, but it was Berman et al (1985) and Cheyne et al (1987) who put the system into practice. They believed that radiographers could play an important role in identifying abnormal films within the accident and emergency setting.

This 'red dot' system had become a relatively common place by the time of as shown by Paterson's (1994) survey. From her sample she reported that 50% of accident and emergency departments were participating in the red dot system. By 1999 some 85% of accident and emergency departments were using such a system (McConnell and Webster 2000). Similar proportions were found by Price, Miller and Mellor (2002) who reported that 141 trusts (82%) out of a sample of 172 utilised the red dot system.

Paterson indicated that there had been progression from providing verbal opinions through to the 'red dot' system and then onto providing written reports within sub-specialties.

With the shortage of radiologists and the need for radiological examinations to be reported and despite the opposition to reporting by a substantial number of radiologists The Royal College of Radiologists (1995) published a document on reporting. This document recognized the need to delegate some aspects of reporting to non-medically qualified staff within certain guidelines. The guidelines included adequate training and confidence by both radiologists and the radiographers in the radiographers' ability. Clearly, the Royal College viewed reporting by radiographers as a delegated task within the guidelines set out by the General Medical Council (1995). Brindle was concerned with the risk of radiographers acting as independent practitioners outside of the radiology department which could lead to the disintegration of the *'well organized U.K. radiological service.'* This view did not deter the College of Radiographers from supporting this field of extension (1997c) which resulted in the strong statement that *"reporting by radiographers is not an option for the future, it is a requirement."*

The crude division of 'normal' from 'abnormal' radiographs was expanded to encompass a formal reporting system by Loughran (1996) who stated that radiographers formally reported 40% of accident radiographs at his hospital. Robinson (1996) showed that suitably trained radiographers could provide full text reports on plain film examinations with indistinguishable sensitivity and specificity compared to those achieved by radiologists and Irving (1996) also a radiologist conceded that reporting was no longer the sacred preserve of radiologists. This was a retreat from the hard line views on the belief that all radiographs should be reported on by a trained radiologist (Craig 1989, Rose and Gallivan 1991). Loughran (1994 stated that role extension" may help improve the service, to the benefit of the patient, and also exploit a potential talent lying dormant in probably almost every radiology department in the country".

At the end of the 20th century and at the beginning of the 21st century the case for radiographer reporting, especially on plain films was becoming well documented. (Brayley, 2000). Evidence also demonstrated that, where radiographers reported there was a significant reduction in problems; the volume of reporting increased and reports were timelier (Piper, Paterson and Godfrey, 1999). The literature was addressing a range of matters such as standards of performance (Brealey

and Scally 2001, Brearley, Scally and Thomas et al, 2002) and research questions in clinical reporting were being identified (Manning 2000). While there was a developing consensus that radiographer reporting was successful (Brealey, King and Warnock, 2002) the involvement in conventional radiography and some speciality areas were diminishing. The consensus among radiologists in their study was that radiographer reporting had little to alleviate their workload. They also suggested that radiologists reporting skills could be diminished with little benefit to other areas of work.

The radiographers' role in ultrasound is well established and Witcombe and Radford (1986) were among the first to recognize the potential in this field. Development was supported by the College of Radiographers who developed a post registration qualification, the Diploma of Medical Ultrasound, in 1986. Berman (1990) called for acknowledgement of the skills sonographers had acquired and Shirley et al (1992) reported good sensitivity and specificity of radiographers in detecting fetal anomalies. While the role of radiographers or ultrasonographers developed in the obstetric field there was pressure to extend their work in general ultrasound. Weston, Moorse & Slack (1994) noted that errors were made by both radiographers and radiologists and concluded that the existing radiographer based general ultrasound service provided an adequate level of accuracy. Bates et al (1994) suggested that trained sonographers are capable of performing and reporting non-obstetric ultrasound and their roles should be extended further to envelope this. Tessler (1996), however, found a large disagreement between the performance of radiographers and radiologists but this research contained a wider range of examinations such as breast, carotid arteries and small parts not routinely included in radiographer training. However, Paterson (1995) noted that small numbers of hospitals were using radiographers to carry out the less routine procedures such as vascular and cardiac studies. Discrepancies found by Tessler were presumably influenced strongly by the training deficits of radiographers as was the case in Renwick's study (1991). Leslie et al (2000) supported Bates and have since found that there was no statistically significant difference in the accuracy of radiographers and radiologists in interpreting routine abdominal sonography. This is important as the demand for ultrasound has increased dramatically over the last decade due to its relatively inexpensive, quick and safe nature. Also the implementation of the guidelines for the utilization of ionizing radiation only further increased the need for ultrasound provision. Perhaps in the next 10 years there will be a shift

completely from radiologist performed ultrasound to a purely radiographer based service where radiologists will undertake the interventional studies.

Paterson's study did not reveal any hospitals where radiographers were reporting on chest images but Flehinger et al (1978) in the USA believed that specially trained radiologic technologists could reliably screen chest radiographs for cancer. Collins (1996) also reported that selected radiographers could assess chest radiographs after tuition. Very little development or research work has been undertaken in this field with the exception of Sonnex (2001) who reported on the role of preliminary interpretation of chest radiographs in the management of acute medical problems within a cardiothoracic centre.

Training programmes dating back to the 70's have demonstrated that radiographers can be taught to read mammograms (Alcorn et al 1971, Dowdy et al 1970 and Basset 1995). Over the past decade there has been increasing interest in the training radiographers as film readers for screening mammograms following the inception of the national breast screening programme (Robertson 1995 and Muir 1986). Pauli et al (1996) concluded that double reading by both a radiographer and radiologist resulted in similar increases in sensitivity previously noted by radiologist double reporting. Studies have shown a high level of agreement between radiographers and radiologists in the assessment of screening mammograms with similar levels of sensitivity but lower specificity (Haiart and Henderson 1991). This study reported that radiologists were 2.6 times faster than radiographers but the research was conducted after radiographers had received only 6 months training and no mention was made to the length of time the radiologists had been practising. Pauli (1996) noted that the acquired skills, if practised, are maintained over a substantial period of time and following training in breast reporting radiographers specificity increased from 68% to 80%, a significant improvement. Bassett (1995), in the USA, also concluded that training improved radiographers' ability and showed sensitivity increases from 78% to 90% post training. This was compared with radiologists' sensitivity which was 89% at its highest. Research into cost and total time taken to report mammograms by radiographers was not as favourable but experience and confidence will help in reducing radiographers reporting times and make this role extension more cost effective. The difficulties in recruiting new consultant radiologists for breast cancer screening has been another factor pushing radiographers forward and was taken up by the Department of Health in their strategy for allied health professions (Department of Health 2000).

The adoption of reporting by radiographers has been controversial and has not diffused across all potential fields in imaging. Ultrasound reporting has attracted the same degree of controversy as plain film reporting but evidence shows that the latter has begun to gain a foothold but other areas remain at a formative stage. These fields include mammography, barium enemas, chest imaging, nuclear medicine, CT and MRI. The College of Radiographers (1997c) however believes that expansion of the reporting role will bring even greater benefit to the patient and the management of clinical radiology services. The College of Radiographers (1997) position on reporting was clear they stated that it is not an option for the future but a requirement.

The extent of published work on role extension for radiographers working in nuclear medicine has been limited. Hogg, et al (1997) investigated the scope of practice in nuclear medicine with a survey undertaken using a convenience sample of 50 nuclear medicine departments in England and Wales. The results showed that a number of extended roles were undertaken; 92% of respondents said they performed image data analysis and a relatively high percentage (80%) performed quality control of equipment and 74% the administration of radiopharmaceuticals. The study also noted that only a small percentage (8%) of radiographers was involved in reporting of images and 14% in laboratory work. These two areas of work were stated to be least likely undertaken because they were traditionally undertaken by other staff groups. The results also showed that the majority of respondents (70%) had less than 5 years experience of nuclear medicine. A possible implication of this finding is that the short-term nature of their experience could result in a lack of career development for radiographers in this field which has traditionally been populated by physicists and physics technicians. Thomas et al (2000) discussed radiographers giving technical reports, this incorporates a description of the tracer, a normal/abnormal statement, recommendations of further imaging and an indication of diagnosis. Technicians within nuclear medicine appear to have more formal boundaries and their development appears limited. Hayes (2002) stated that many smaller nuclear medicine departments only have one specialized nuclear medicine radiologist and the difficulty of offering a service that is reliable with only one member of staff. It could be that radiographers specializing in nuclear medicine could fill this role in preference to a less experienced radiologist. Future studies in nuclear medicine should consider how the most effective use of human resources can be utilised.

As with nuclear medicine the literature on the development of reporting within CT is limited. Craven and Blanshard (1997) concluded that experienced and trained

CT radiographers could report routine CT head scans. The study reported levels of sensitivity for the CT radiographer at 85.4% and registrars 87.5%, and specificity was 96.9% and 97.5% respectively. Craven and Blanshard's research however was not without flaws as only one radiographer was assessed against one consultant and five registrars but it nevertheless suggested the potential of utilising experienced radiographers for reporting head scans.

The potential for radiographers to extend their role within MRI reporting has not advanced although one study has been completed assessing radiographers' ability to report on images of the internal auditory meatus (Gilmore 2001). Gilmore found radiographer accuracy improved from 94% to 96.5% after training. This research was however limited to a very specific anatomical area and used only one radiographer as the sample group. As with CT there is scope to develop this role further.

APPENDIX 3

INTERVIEW QUESTIONS
FOR CHAPTER 2

Appendix 3

Developing Technology: The Impact on Imaging and Possible Consequences for the Skill Requirements of Diagnostic Radiographers.

Basis for questions

1. What has had the greatest impact on imaging over the past decade?
2. What do you see as the having the greatest impact upon imaging in the next:
   i) five years:
   ii) ten years.
3. If a modality such as MRI or CT is cited then the interviewee should be asked if h/she would be willing to provide data on trends in imaging examinations over the past decade.
4. An important issue arising from the preceding will relate to access to diagnostic imaging services and whether departments will remain as a centralised service or as a service which can be operated within the community.
5. How will department design differ from the present where examinations are undertaken by modality or anatomical area?
6. Given the reforms to the NHS, what are the pressures that you see continuing to impact on imaging departments? *(It may be useful to use the following headings as prompts.)*

   Managerial

   Clinical

   Other
7. One of the most important dynamics is skill mix. Imaging has depended upon the interactions and relationships between different groups, there has however, been fairly well defined lines of demarcation, do you see these lines being held in the next five years, ten years?
8. Has your department taken part in any skill mix studies?

   If so, what did they entail and what was the objective of the study?
9. Compared to 10 and 5 years ago what different tasks are being undertaken today by:

   radiologists;
   radiographers;

nurses;

support workers.

10. What do you understand by the radiographers extended role?
11. Are there different skills required now to what was needed say 5 and 10 years ago.
12. What skills will be required for 5 years and 10 years into the future.
13. Do you consider current education for radiologists and radiographers is appropriate for the demands of the work undertaken?
14. What will be the demands for training over the next decade?

APPENDIX 4

ADDITIONAL ANALYSIS
CHAPTER 2

Appendix 4

CONTENT ANALYSIS IMPACT OF DEVELOPING TECHNOLOGY ON THE FUTURE OF THE IMAGING DEPARTMENTS

Approach

Total of 17 semi-structured interviews (one of which was a group interview). 3 from industry, 7 from radiology, 7 from radiography. Each interview was transcribed and studied individually by both the author (Richard Price) and a research assistant (working under the supervision of the researcher) using differing techniques and without collaboration.

The purpose of this preliminary research was:
To identify all those factors which the interviewees thought were impacting upon imaging departments in the future, and to ascertain their views on the nature and ramifications of such an impact.

The text was studied using context units which delineated finite issues involving some form of changing circumstance. These issues were tabulated by means of defining the change (i.e. from what to what) and the reasons given for that change. Where common or related themes were evident, the issues were collated and links of dependency or hierarchy noted.

No attempt has been made at this point to analyze the value of any statement or opinion and therefore none should be assumed to be true. This is emphasised by the fact that so many of the statements are contradictory, some interviewees even appearing to be self-contradictory. Because of the contradictory nature of much of the information, the unreliability of the baseline information used in the reasoning processes, and the small sample size of interviewees, these results should not be considered to be indisputable. Rather they indicate areas which would benefit from more rigorous inquiry.

There was been no attempt to categorise opinions in terms of professional group, importance, or weight of opinion. Incidences supporting a point previously made were not, as a general rule, noted down again except in instances where additional examples were cited. This was due in part to time pressure, but the numbers of interviewees was too small to be statistically viable anyway, therefore only a general indication as to degree of support is given.

Results:

CT and U/S were cited as the biggest influences of the earlier part of the past decade, but MR was seen as the major influence of latter years. For future projections, the information elicited fell into two main categories.

l) The performance of specific modalities

2) Cultural changes in the concept of the organization, based on political and administrative strategies.

3) Quality issues

In all cases the information is presented as a complement of alterative scenarios, with examples of the reasoning on which each is based.

1: Specific modalities:

All interviewees referred to modalities currently in use. There was no knowledge of research into possible new technologies.

1: 1 Plain film radiography

a) Plain film radiography will cease to exist (long term) because:-
No radiation risk to MRI and U/S
The alternatives will give more specific information
The alternatives will become as quick and cheap to perform

b) Plain film radiography will always exist because: it will always be the quickest and cheapest method of gaining certain information

1:2 Magnetic Resonance Imaging (MRI)

a) MRI will continue in rapid growth and eventually replace most other specialities because:

- no ionizing radiation, (increasingly important with heightened public awareness)
- development of real-time scanners (greater patient throughput and breath-holding techniques)
- development of compact units, (possible use in mobile or outreach services) development of units designed for small areas such as knees, ankles etc.
- Increased use with the growth of sports injury clinics.
- New techniques are being developed which will expand the range of imaging possibilities for MRI (possibly of bone imaging being viable in the future?)
- There will be no cost difference long term.

b) MRI will shortly plateau because:

CT and U/S did.

1:3 Computed Tomography (CT)

a) CT will cease to be used at all because:

Other modalities will be able to supply similar information with less radiation risk

b) CT will decline but not disappear because:-

CT can and always will give information not available from other modalities. It's particular use might be in major trauma centres.

c) CT will be a growth area because:

New developments (spiral fields etc.) promise new techniques.

1:4 Ultrasound (U/S)

a) U/S will continue to be a major growth area because:
No radiation risk. New developments (colour doppler) New applications (vascular imaging, bowel imaging, breast screening) Low capital investment Portable with no radiation protection problems Other professional groups are "training" in it's use. Expansion of role of sonographers (with protocols and supervision) will keep costs down.

b) U/S will plateau because:-
Operator intensive in time and training
Images from other modalities are more use to others.(surgeons etc.)
Patient scheduling and scanning times less constant than MRI
Cost of other modalities will decrease

1:5Nuclear Medicine

a) Nuclear Medicine will not change significantly because:

Promising developments have not materialised

It can demonstrate some processes that other modalities cannot.

b)Nuclear medicine will increase significantly because:

Development of tomography looks promising for new techniques and applications

2: Cultural changes-general

i) Overall, the interviewees presented a twin-focus model of influence on future developments. One strand was based on the technological capabilities which either currently exists or is in the development stage, and the other was based on changes which are occurring in the organisational structure of health care provision. These changes in the second case were seen to be largely, but not exclusively, financial. Although both strands were perceived as influencing future decision-making, in all instances the interviewees were of the opinion that in a situation of conflict the deciding factor would be based on financial considerations alone.

ii) The consensus of opinion was that there would be a rapid and sustained growth in the number and type of examinations performed by the imaging department overall, as new techniques for interventional work are developed.

iii) It was generally assumed by those interviewees who addressed this aspect, that a British or even European model of equipment design was largely irrelevant and that the American market would drive development.

2:1 Cultural changes - Imaging

2:1:1 Digital v analogue

a) Digital radiography will replace conventional acquisition totally because:-

Permits better use of rooms. eg. for general use and angiography instead of dedicated suites. Long term cost and radiation savings due to less exposure errors Financial savings due to reduction in level of skills required to operate digital units

Cost of current image recording materials will be prohibitive as the quantity required diminishes. Ease of unspecific requests. (e.g. "pain in chest" might be spine, soft tissue etc.)

b) Digital radiography will not replace conventional acquisition completely because: For certain applications the latter will always be the cheapest and simplest method of gaining and recording a lot of information.

2 1 2 PACS

a) Comprehensive PACS systems will be adopted because:

- there will be fewer, but bigger DGHs, which will have more funds.
- financial saving/revenue due to one expert being able to serve many operators
- necessity of shared expertise as too few are being trained
- the technology is now sufficiently sophisticated

b) Comprehensive PACS systems will not be adopted within ten years because:- funding will not be available, technical difficulties will not be resolved

2:2 Cultural changes - policy issues

2:2: 1

a) High-tech imaging services will devolve from large central units into smaller more remote units because:

Perceived to be inevitable because driven by political policies (e.g. patient focus)
Demand by GP's and public (convenience and control)
Opportunity for profit-making (possibly short-term only)
Technology made viable by miniaturisation
GP referrals now viable due to tighter protocols, vocational training of younger GP's (they know which examinations to request)
Change in GP's work patterns (minor ops. breast screening)
b) High-tech imaging services will remain in large central units, in the long term, because:

Radiation protection problems
Cheaper due to flexible use of staff, unit costs etc. availability of expertise for supervision etc.
Fund-holders will ultimately have less money therefore demands and priorities will change.
Investment costs too high for buildings and modifications, etc. No great advantage to patient except in very remote areas. Existing GP workload substantial, no slack for minor ops,.

The true cost of devolution will ultimately prove too great. (see quality Issues, section 3)

2:2:2
a) The nature of radiography will change such that greater skills are needed because:
Digital technology requires a greater degree of operator expertise than does conventional film/screen technology.

Too few radiologists for vastly increased work load (new interventional techniques) so radiographers will take on new responsibilities.
Commercial forces. (Radiographers are cheaper in terms of employment and training) As units devolve into the community, access to expert opinion will decrease, so the level of personal responsibility will increase.

Advanced degree of computer literacy is essential Supervision/teaching of imaging technicians.
New tasks required as quality management. (Equipment tests etc.)

b) The nature of radiography will change such that lesser skills are needed because:
Digital technology requires a lesser degree of operator expertise than conventional film/screen technology.

Sophistication of technology in special modalities requires less training.

2:2:3

a) The nature of radiology will change such that greater skills are required because:-

Others performing much of the "simple" scanning procedures, only complex or unusual cases will be referred
New interventional techniques are being developed which will also increase workload.

b) The nature of radiology will change such that lesser skills are required because:
Sophistication of technology. Some skills taken on by other personnel (radiographers and vascular surgeons.

2:2:4
a) Training requirements will change because:

The tasks required of various groups of personnel will change
Devolution of control will cause hospitals to become individual in nature, therefore requiring specific training rather than general training.
Financial constraints will cause reduction in Scope and numbers of training possibly more in-house courses and apprenticeship models.
Formalisation certification of training for performance of ultrasound,

b) Unanimous point. No interviewee suggested that training would not change.

3: Quality Issues

It is perhaps interesting to note that, on issues of quality, the points were raised by the interviewees themselves. i.e. not in response to specific questions. They were offered spontaneously and voluntarily and refer largely to "knock-on" effects, i.e. those future developments predicted by the interviewees to occur, based on the technical and managerial changes they had predicted. Many such effects could be

inferred from the original predictions; however this report has been restricted to those issues which were mentioned by the interviewees themselves. It should however be remembered that the original predictions are not necessarily reliable and therefore the predicted "knock-on" effects must similarly be viewed with caution.

There appears to be two main areas of concern regarding quality issues.
i) A decline in technical, professional and ethical standards is predicted.
Profit. (They can have a particular service if they want it because we can make money on it)
Anomalies in rules of cross-charging (digital procedure extra). Reduction in training will lead to a lack of professionalism.
Diversification of workplace leading to loss of control. (theatres, cardiac labs. slackening in supervision, self-motivation etc and he who pays the piper).
Expediency (MR not readily available, so do lumbar spine x-rays or CT first then assess. Insufficient time for decision-making, enforcing protocols etc.

ii. Poor financial planning and faulty decision-making is predicted.
Lack of sophisticated measuring tools for financial information. Eg. Radioloist cost is set against the number of films reported and examinations done. But what about "ad hoc" consultancy during examinations? Learning curve" situations. such as A&E.
Good quality radiographs first time. (Digital may be more technically demanding. not less).

Large conceptual issues do not work at the interface with the patient, eg. effect of patients charter

APPENDIX 5

EXTENDED ROLE SURVEY 1

QUESTIONNAIRE

EXTENDED ROLE SURVEY QUESTIONNAIRE

1 Please indicate the type of hospital in which your department is situated. Teaching ❒ Non Teaching ❒

2. Please indicate which region your hospital is located:

Wales	❒	South and West	❒
Northern Ireland	❒	West Midlands	❒
Scotland	❒	North West	❒
Anglia and Oxford	❒	Northern and Yorkshire	❒
North Thames	❒	Trent	❒
South Thames	❒		

3. Do radiographers carry out IV injections in your department? Yes ❒ No ❒

If yes, what year was this implemented? .....

4. Is there a red dot scheme running in your department? Yes ❒ No ❒

If yes, what year was this implemented.....

5. Do radiographers in your department report on radiographs in any of the following categories.

	Yes		**Year Implemented**
A & E	❒		19..
Axial skeleton	❒		19..
Appendicular skeleton	❒		19..
Chest	❒		19..
Paediatric	❒		19..
Mammography	❒		19..
Ultrasound	❒		19..
Bariums	❒		19..
Other	❒	Please specify.....	19..

6. Do radiographers perform barium enemas in your department Yes ❒ No ❒
If yes, what year was this implemented? .....

7.Do radiographers carry out any other extended role tasks in your department?
Yes ❒ No ❒

Please specify ……

APPENDIX 6

EXTENDED ROLE SURVEY 2

QUESTIONNAIRE

RADIOGRAPHY SURVEY 2000

1. Please indicate the type of Trust in which your departments are situated. Teaching ❑ Non Teaching ❑

2. Please indicate the region in which your Trust is situated.

Eastern	❑	West Midlands	❑
London	❑	Trent	❑
South West	❑	Wales	❑
North West	❑	Northern Ireland	❑
Northern and Yorkshire	❑	Scotland	❑
South East	❑	Islands	❑

3. Do radiographers carry out IV injections in your department(s)? YES ❑ NO ❑

Please give year of implementation if after 1 July 1998. .....
Approximate number of radiographers involved in the activity .....

4. Is there a 'red' dot scheme running in your department(s)? YES ❑ NO ❑

Please give year of implementation if after 1 July 1998. .....
Approximate number of radiographers involved in the activity .....

5. Do radiographers carry out barium enemas in your department(s)? YES ❑ NO ❑

Please give year of implementation if after 1 July 1998 .....
Approximate number of radiographers involved in the activity .....

6. Do radiographers in your department(s) report examinations in the following categories?

	YES	Year if implemented after 1 July 1998	Approximate number of radiographers involved in the activity
Axial skeleton	❑	.....	.....
Appendicular skeleton	❑	.....	.....
Chest	❑	.....	.....
Paediatric	❑	.....	.....
Mammography	❑	.....	.....
Ultrasound	❑	.....	.....
Barium enemas	❑	.....	.....
Nuclear medicine	❑	.....	.....

Other please specify

.....

7. Are there any other extended role tasks that radiographers have adopted in your department(s) since 1 July 1998?

---

8. How many full-time equivalent radiographers and radiologists work in your department(s)?

9.

Radiographers ---------- Radiologists ----------

APPENDIX 7

EXTENDED ROLE SURVEY 3

QUESTIONNAIRE

RADIOGRAPHY SURVEY 2004

Please tick the relevant box.

1. Please indicate the type of Trust in which your department is situated.
   Teaching ❑ Non teaching ❑

2. Please indicate the geographical region in which your Trust is situated?

Eastern	❑	South West	❑
London	❑	Trent	❑
North West	❑	West Midlands	❑
Northern & Yorkshire	❑	Wales	❑
Thames Valley/ Northampton	❑	Northern Ireland	❑
South East	❑	Scotland	❑

3. Do radiographers carry out IV injections in your department(s)? YES ❑ NO ❑
   Please give year of implementation if after 1st July 2000 …..
   Approximate number of radiographers involved in the activity …..

4. Do radiographers carry out barium enemas in your department(s)? YES ❑ NO ❑
   Please give year of implementation if after 1st July 2000 …..
   Approximate number of radiographers involved in the activity …..

5. Do radiographers carry out barium meals in your department(s)? YES ❑ NO ❑
   Please give year of implementation if after 1st July 2000 …..
   Approximate number of radiographers involved in the activity …..

6. Is there a 'red dot' scheme running in your department (s) YES ❑ NO ❑
   Please give year of implementation if after 1st July 2000 …..
   Approximate number of radiographers involved in the activity …..

7. Do radiographers in your department(s) report examinations in the following categories

YES	**Year if implemented after 1st July 2000**	**Approximate numbe radiographers involv the activity**	**Is the report independent of a radiologist?**
Axial skeleton ❑	…….	…….	YES ❑ NO ❑
Appendicular skeleton ❑	…….	…….	YES ❑ NO ❑
Chest ❑	…….	…….	YES ❑ NO ❑
Paediatric ❑	…….	…….	YES ❑ NO ❑
Mammography ❑	…….	…….	YES ❑ NO ❑
Barium enemas ❑	…….	…….	YES ❑ NO ❑
Barium meals ❑	…….	…….	YES ❑ NO ❑
Nuclear medicine ❑	…….	…….	YES ❑ NO ❑
Ultrasound ❑	…….	…….	YES ❑ NO ❑

Question 7 continued

Other please specify

……	…….	…….	YES ❑ NO ❑
……	…….	…….	YES ❑ NO ❑
……	…….	…….	YES ❑ NO ❑

8. How many full time equivalent radiographers and radiologists are there in your departments(s)?
   Radiographers ……. Radiologists …….

9. Are there any other extended role tasks you have introduced into your department since 1st July 2000?

   ……
   ……

10 Are there any other extended role tasks you are anticipating introducing into your department in the next 12 months? Please specify

   ……
   ……

11 Do you have any of the following designations of staff in your department(s)?

Assistant practitioners	Advanced practitioners (or equivalent)	Allied Health Professional (radiographer) consultant
YES ❑ NO ❑	YES ❑ NO ❑	YES ❑ NO ❑
Number ……	Number ……	Number ……
Year started ……	Year started ……	Year started ……
Area of practice……	Modality or area of practice	Modality or area of practice
e.g. appendicular skeletal radiography	……	……..

12. If you do not have any of the above designations, have you any plans to introduce them the future?

If NO please leave blank

Assistant practitioners ❑	Adv. practitioners ❑ (or equivalent)	Consultant radiographer ❑
Number ……	Number ……	Number ……
Date to start ……	Date to start ……	Date to start ……
Modality ……	Modality or area of practice	Modality or area of practice
……	……	……
……	……	……

Thank you very much for completing this questionnaire, please return in the prepaid envelope.

APPENDIX 8

PREPARED FOR PRACTICE

QUESTIONNAIRE

UNIVERSITY OF HERTFORDSHIRE

DEPARTMENT OF RADIOGRAPHY

Questionnaire on preparation for radiographic practice.

PLEASE ENTER YOUR ANSWERS IN THE BOXES PROVIDED. IN THE CASE OF YES OR NO PLEASE ENTER A TICK (✓) AS APPROPRIATE

1. Please give your gender and age. Male ❒ Female ❒ Age [ ]

2. When did you become state registered as a radiographer? (Year and month please). [ ]

3. How many months have you been in employment as a radiographer? [ ]

4. In your first post, was there any task or tasks that you were asked to undertake and felt you were unable to do because they were not addressed in your pre-registration education and training?

[ ]

5. Are there any areas in which you would you like to have received more extensive training?

[ ]

6. Were there any topics (or individual subjects) on which you feel too much emphasis was placed during your pre-registration and training?

	YES	NO
7. Is continuing professional development (CPD) available for radiographers in your department?	❒	❒
8. Have you a personal plan for CPD?	❒	❒
If YES, was it developed in conjunction with your manager or independently	❒	❒

9. Please tick which of the following **modalities** in which have you worked and indicate what type of training, if any, you have received for this activity during your employment.

Modality		Training
Conventional radiography	❒	.....
Computed radiography	❒	.....
CT	❒	.....
MRI	❒	.....
Nuclear medicine	❒	.....
Ultrasound	❒	.....
Other modality/ies	❒	(Please identify any other modality and training received below)

Modality	Training
.....	.....
.....	.....

		YES	NO
10	Have you undertaken any training in addition to that mentioned in 9 above.	❒	❒

If YES, please indicate what it was:

11. Do you plan to undertake any education or training in the next:

	YES		YES
6 months?	❒	12 months?	❒

If YES, please indicate what you plan to undertake:

At 6 months?
At 12 months?

12. Are there any tasks or skills that you would like to see developed further in radiographers in general, or in yourself?

Radiographers in general	In yourself

13. Do you consider that all of your work relevant skills and attributes are being used currently to their full potential? **YES** ❒ **NO** ❒

If NO, can you identify those that are not being used fully and give reasons where possible?

14. Are you able to identify any additional or new skills that you believe will become essential for newly qualified radiographers over the next 5 years?

15. Please indicate where you have been employed.

United Kingdom (NHS)

Eastern	❒	South East	❒
London	❒	South West	❒
Northern & Yorkshire	❒	Trent	❒
North West	❒	West Midlands	❒
Wales	❒	Northern Ireland	❒
Scotland	❒		
United Kingdom non-NHS	❒	Ireland	❒
Other	❒		

Please indicate .....

Thank you very much for participating in this study.

Please return the completed questionnaire in the enclosed envelope to:

Richard Price
Department of Radiography
University of Hertfordshire
College Lane
Hatfield
Herts
AL10 9AB0

APPENDIX 9

TRAINING FOR EXTENDED ROLES

RADIOGRAPHY SURVEY 2000

Training for extended role tasks: In this section of the questionnaire would you please indicate the nature of the training provided for any extended role activities undertaken by radiographers.

Activity	**Type of training/course, e.g. taught course, in-house, MSc.**	**Duration e.g. 1 day a week for 6 weeks**	**Who delivers the training? e.g. hospital, university, manufacturer**	**Validated or accredited by any external organisation e.g. university, professional body.**
Intravenous injections				
'Red dot' scheme				
Conducting barium enemas				
Axial skeleton reporting				
Appendicular skeleton reporting				
Chest reporting				
Paediatric reporting				
Mammography reporting				
Ultrasound reporting				
Barium enema reporting				
Nuclear medicine reporting				
Other (Please specify)				

Thank you for your help with this survey. Please return the questionnaire in the envelope provided.