Improving Your Image

How to Manage Radiology Services More Effectively

AUDIT COMMISSION
The Audit Commission

... promotes proper stewardship of public finances and helps those responsible for public services to achieve economy, efficiency and effectiveness.
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Preface

The Audit Commission is responsible for the external audit of NHS trusts and other health service bodies in England and Wales. Its auditors are required to examine not only financial regularity but also arrangements for securing economy, efficiency and effectiveness.

Since 1990 when the Commission was given responsibility for auditing NHS expenditure, it has published reports on many areas of health service provision. This latest report deals with radiology services. During this year the Commission’s auditors will be following its conclusions through in individual NHS trusts, making recommendations as to how more efficient, higher quality radiological services could be delivered to other departments, to the ultimate benefit of patients themselves.

The report is based on detailed study of radiology services at nine different hospitals that were visited during 1993/94. The findings were confirmed and developed during pilot audits at eight further NHS trusts.

This study was carried out by Geoffrey Rendle and David Bird, under the direction of Dr Jonathan Boyce and Dr Jocelyn Cornwell. Other team members were Jean Harvey, Dr Richard Mason, Maire O’Sullivan, Chris Raspin and John Russell. The team received guidance from a group of expert advisors, whose names are listed in Appendix 3 together with those of the hospitals visited. The Audit Commission is very grateful to them all for their help. Responsibility for the contents and conclusions lies solely with the Audit Commission.
Introduction

1. There are a number of reasons why NHS managers and professionals should give careful attention to the management of radiology services:
   - Radiology contributes not only to the effectiveness of almost every other specialty in the hospital, but also to the quality of general practice in the surrounding area. Indeed, the fact that GPs have direct dealings with radiology departments makes them important ‘shop-windows’ for hospital marketing activities.
   - The potential hazards from ionising radiation require its use to be strictly regulated to ensure it is administered at as low a level as reasonably practicable.
   - The services are costly to provide, in terms of both a hospital’s revenue budget and its capital asset base.
   - Many different types of patient pass through the radiology department. The quality of service they receive and the environment in which it is delivered contribute to their overall impression of the NHS and the care that they receive.
   - Delivering a high quality service demands a combination of professional expertise with effective management and communication skills – both within the department and in contact with service users.
   - There is increasing pressure for parts of the service to be decentralised and located either in other hospital departments or in the community. This, as well as technological and clinical change, means that strategic thinking and investment are more important than ever in managing these services.

An action list is provided at the end of this report, together with estimates of the financial savings achievable, as a summary of the importance of these areas.

2. Radiology contributes to the effectiveness of medical services at three stages:
   - establishing the diagnosis;
   - as part of the treatment itself, when x-ray images can guide the progress of minimally invasive techniques such as angioplasty, which can reduce trauma to patients and shorten their stay in hospital; and
   - monitoring patients’ progress, for example, post-operatively and in response to radiotherapy and chemotherapy.

Radiologists specialise in keeping abreast of the wide range of techniques and procedures; thus they have a proactive role, offering consultation and advice to their clinical colleagues. So departments must not be seen as merely carrying out procedures and providing clinical reports on them ‘on demand’.

3. Health risks are attached to the use of ionising radiation, from conventional x-ray equipment, computed tomography (CT) scanning, and radiopharmaceuticals in nuclear medicine examinations. These hazards have to
be balanced against the clinical benefits. The statutory framework of regulations and inspection established for this purpose defines the ‘core of knowledge’ required of any person directing a medical exposure, to ensure that each patient’s radiation dose is ‘as low as reasonably practicable’. The open-ended nature of this latter requirement means that no department can rest on its laurels for long. Departments must keep their practice and procedures under constant review, for three reasons:

- Medical exposures constitute 92 per cent of the population’s collective exposure to man-made radiation – and about 12 per cent of the total radiation dose (Ref. 1).
- Fourfold variations in dose to patients have been shown to exist, apparently due to the technique used in the hospital concerned (Ref. 2).
- A few procedures require particularly high doses of radiation – for example, a CT scan of the chest or abdomen is equivalent to around four years’ worth of natural background radiation (Ref. 3).

4. Radiology departments spend heavily on both capital and revenue (Exhibit 1). The value of the assets may equal or exceed the annual revenue expenditure, making them almost the most capital-intensive of any hospital department. There is great diversity within each category of expenditure:

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Exhibit 1

**Departmental expenditure**

Radiology departments spend heavily on both capital and revenue.

Note: These figures are typical of a general hospital not possessing an MRI scanner.

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diagnostic equipment ranges from conventional x-ray sets, to state-of-the-art scanners for CT and magnetic resonance imaging (MRI);

- the staff include radiologists (mostly at consultant grade), radiographers, receptionists and office staff, nurses, helpers and porters;
- consumables range from large quantities of films and chemicals, to contrast media and small numbers of expensive catheters.

5. There is also great diversity in the work carried out. Some procedures, such as chest x-rays and routine ultrasound, are performed for large numbers of patients using equipment of conventional design. Others, such as interventional work or complex body scans, may involve a team of staff using high-technology equipment on just a few patients per session. Both the high volume work and the less frequent but individually costly procedures contribute substantially to the high costs of radiology (Exhibit 2).

6. Patients come to the radiology department from almost every part of the health service (Exhibit 3). Accident and emergency (A&E) departments and general practitioners request large numbers of examinations, but contribute proportionately less to the overall workload because these are usually basic investigations. Other departments, notably general surgery, are heavy users of the service because of the relatively complex mix as well as the number of investigations they request.

7. A radiology service may reach the highest standards of clinical and technical excellence, but if the organisation and management of the service are not equally as good its effectiveness will be blunted. In many departments it is common to find delays of 24 hours or more before reports are issued to the referring clinicians. Departments, however, that succeed in issuing reports along with the films, contribute to timely diagnosis and treatment and minimise delay and possible anxiety for the patient. In achieving this higher quality of service, the way staff work together is crucial. The twin themes of effective management and communications and teamwork therefore underpin the recommendations of this report.

- The nature of radiological work in some respects lends itself to managerial good practice. Controlling the budget, describing and measuring the work, and defining consultants’ responsibilities and job plans are easier than in many departments. Yet organising and motivating staff as diverse as porters, receptionists, radiographers and consultants to achieve overall goals, is no simple task. It is commonly a consultant radiologist who is responsible for managing the department and representing it within the hospital; but in practice many directors have little time, and sometimes little inclination, for managerial activities – especially those like business planning that have arisen since the NHS reforms. Finding the right balance between managerial and clinical commitments is not easy. In practice, the support of a business manager, often promoted through the radiographer grades, may be crucial yet neither radiologist nor radiographer will necessarily have taken up the opportunities that now exist for training in management.

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**Exhibit 2**

**What the money buys**

Both the high volume work and the less frequent but individually costly procedures contribute substantially to the high costs of radiology.

Note: ‘Cheap’ and ‘expensive’ procedures are those costing respectively below and above £50 each in a typical department. ‘Frequent’ and ‘rare’ procedures are those where respectively more than 1000 and less than 1000 cases are done per year in a typical department.

8% Cheap and rare e.g. x-ray of facial bones
6% Expensive and frequent e.g. CT of head
32% Expensive and rare e.g. angioplasty
54% Cheap and frequent e.g. obstetric ultrasound

Source: Audit Commission cost diagnostic.

The contribution of other professionals such as physicists and engineers lies outside the scope of this report.
Good communications and teamwork are vital for all the diverse groups of staff involved with radiology. Staff in the department need to liaise not only with each other, but also with ward nurses, hospital clinicians, GPs, engineers and suppliers. And finding out about patients’ needs, and responding to them, should be paramount.

Radiology departments are not the only providers of radiology services in hospitals. Consultants in other specialties, particularly obstetrics and cardiology, commonly possess ultrasound – and perhaps other imaging equipment. Increasingly, too, there is pressure for basic services to be provided in GP surgeries. This report concentrates on radiology departments because they provide the bulk of the imaging services to clinicians. But its recommendations on how to make better business cases for new equipment and other investments apply to all providers of radiology, wherever located.

Considerable managerial ability and communication skills are a prerequisite if full advantage is to be taken of the opportunities now facing radiology. The growth in the workload – a steady 5 per cent per year over the last 25 years, far outstripping increases in staffing – adds to the challenge. The aim of this report is to help departments respond. Its first four chapters...
examine the main problems currently facing radiology and show how some departments are addressing them successfully:

- managing the workload, reducing inappropriate referrals and concentrating on the priorities (Chapter 1);
- delivering a better quality of service in face of the growing demand (Chapter 2);
- becoming more efficient, so as to absorb extra work at minimum cost (Chapter 3); and
- ensuring the asset base is appropriate for future expansion in response to clinical need (Chapter 4).

Exhibit 4
Problems and solutions

Good practice sometimes addresses more than one problem at a time.
10. There is some overlap between the chapters, since good practice sometimes addresses more than one problem at a time (Exhibit 4). In particular, quality and efficiency should not be seen as separate or competing goals. Some measures, such as immediate (‘hot’) reporting, are capable of improving quality and efficiency together.

11. The fifth and final chapter looks at longer-term challenges. In this 100th anniversary year it may be useful to remember that Röntgen’s discovery of x-rays was applied in hospitals in many countries before the hazards of ionising radiation were fully appreciated. The final chapter sets out the questions that today’s managers need answers to before they can move forward into radiology’s second century with confidence.

‘Good communication and teamwork are vital’
Demand for radiology continues to grow, and so any unnecessary work must be minimised.

As many as 20 per cent of x-ray procedures contribute almost nothing to the management of the patient’s condition.

Guidelines on requesting have been published for both hospital doctors and GPs.

Changing doctors’ referral practice is not easy; radiologists will have to monitor, discuss and continually review patterns of requests.

Service level agreements can help clarify what departments aim to provide.

Cross-charging other hospital departments could provide an incentive to reduce inappropriate requests.
Rising demand

12. Both the volume and complexity of the work handled by radiology departments have increased from year to year. But workload increases have not usually been accompanied by extra funding, except sometimes when hospitals have introduced a completely new service such as CT or MRI scanning. Referral rates to radiology, however, vary greatly from hospital to hospital. There are considerable differences in, for example:
- A&E examinations per attendance at A&E; and
- examinations from each hospital specialty in relation to that specialty’s workload measured as finished consultant episodes (FCE) in that specialty.

The amount of work undertaken out of hours also varies between departments.

13. Some classes of investigation appear to have little or no clinical value. X-rays of the thoracic and lumbar spine, for example, seldom show clinically significant findings except in cases of trauma or persistent pain. In 1990 the National Radiological Protection Board (NRPB) estimated (Ref. 2) that at least 20 per cent of x-ray examinations carried out in the UK were clinically unhelpful, in the sense that they were unlikely to yield useful information for patient management. The Royal College of Radiologists (RCR) has reacted to this problem by publishing clear and convenient guidelines for doctors in its booklet, Making the Best Use of a Department of Clinical Radiology (Ref. 3).

Judged against these guidelines, many GP and hospital requests for x-rays may still be inappropriate. Prior to dissemination of the booklet:
- One hospital (Ref. 4) found that at least 75 per cent of pre-operative chest x-rays had never been reviewed by the clinicians who requested them. This was evident because the department had delivered the film packets stapled up (normally they would have been left open) and the staples had never been disturbed.
- A study (Ref. 5) in one department found that 35 per cent of GP requests were counter to the guidelines. The difficulties are illustrated by the example of sinus x-ray films (see Box 1, overleaf).

14. As the RCR itself has pointed out, altering clinical practice is not easy. Referring clinicians have concerns of their own and these need to be addressed:
- GPs may feel that a basic x-ray is worthwhile simply to reassure a worried patient that ‘something is being done’ – in effect, offering a ‘technological placebo’;
- in the hospitals junior doctors may, understandably, request examinations in the absence of the consultant ‘to be on the safe side’;
- failure to request an appropriate x-ray may be regarded as legally negligent (see, for example, Ref. 7) placing upwards pressure on the number of requests. On the other hand, few, if any, patients have yet brought an injuries claim relating to ionising radiation in diagnostic doses, other than in the course of pregnancy.

Both radiographers (Ref. 8) and radiologists recognise, in principle, a responsibility to query apparently inappropriate referrals, but in practice it is
often quicker to carry out the request than persuade the referring clinician to alter it. Moreover, in cases where the patient arrives for an examination without an appointment, it is difficult to explain to the patient that the examination is not required after all.

15. There are two complementary approaches to agreeing the appropriate workload for the department:
   ◆ using professional skills to persuade users to make use of referral guidelines; and
   ◆ adopting a business-like procedure of negotiating service level agreements (SLAs) on the volume and type of work.

SLAs may become the basis for cross-charging within the hospital, contributing further to effective workload management.

16. The main purpose of referral guidelines is to ensure that best use is made of the radiology department. Applying them may stimulate demand for appropriate requests which had previously been overlooked. But substantial reductions in x-ray workload may also result without any detriment to patient management. In one multi-centre study (Ref. 9), when hospital clinicians used RCR guidelines to review their radiological requesting practice, the numbers of requests dropped across a wide range of examinations (Table 1, page 15). Other hospitals would derive similar benefits from eliminating more of these questionable referrals; both the pressure of work on departments and the radiation dose to the population at large would be reduced.

17. Clinicians’ referral practice can be influenced at various stages: through active promulgation of guidelines, by checking individual requests either in advance or at the time, and through retrospective review.

**Active promulgation of guidelines**

18. RCR guidelines have been commended to purchasers by the NHS Executive (Ref. 10) and all departments should by now have issued referral guidance to hospital clinicians and GPs. Doctors in Wales have each been sent a copy of the guidelines, with a commendation by the Chief Medical Officer. Any local modifications need to be agreed and publicised as a matter of
priority. Directors of radiology should ensure they have secured support for the guidelines from their own staff, from hospital management, and from service purchasers. They will also need to consider the best way to influence medical colleagues: with new junior doctors, especially in A&E, and some GPs, among those in particular need of advice. Most directors of radiology visited addressed the topic of appropriate imaging within the induction programme for new senior house officers (SHOs). But the effect of this introductory training may not be sustained throughout their six-month placement. One study of skull radiography (Ref. 11) showed that after an initial fall of 37 per cent, referral rates had almost returned to pre-guideline levels six months after they were first introduced. Departments should monitor referral rates such as these at regular intervals.

Checking individual requests

19. Discussions about the appropriateness of individual requests can take place either when they are received, or at a retrospective review. Discussions with the referring clinician about individual requests for high-cost (or high-dosage) examinations should take place immediately the request is received – especially if an appointment has to be arranged for the patient. The time taken to do this for low-cost procedures may be prohibitive, and here it is probably more useful to review the pattern of referrals retrospectively. Current practice in these areas is patchy. Although several radiologists stated that they vet certain requests in advance – and radiographers that they query inappropriate requests at the time – the study team found little evidence as to the extent or effectiveness of these activities. Radiologists and radiographers should consider keeping a systematic log of the inappropriate requests that they encounter, and reviewing within the audit programme the action taken.

Retrospective review

20. At one site visited radiologists routinely review the radiology requests made overnight in A&E by junior doctors (Case study 1).

It is not known what effect this practice has on referral rates. However, a study of haematology requests made by accident & emergency SHOs (Ref. 12) concluded that a combination of education and feedback data on referring levels was not enough to reduce unnecessary tests, but combining the feedback

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<td>United Leeds Teaching Hospitals NHS Trust.</td>
<td>Accident and emergency films taken overnight at the General Infirmary at Leeds are examined by the casualty officer, who records an interpretation in the patient’s notes. The following morning those films deemed ‘normal’ or ‘no significant abnormality’ are reviewed by the radiologist on duty, who either stamps them as ‘agreed’, or places them on the agenda for review with the casualty officer. (Abnormal films resulting in action will have been reviewed by more senior staff from the A&amp;E department or orthopaedics.) This good practice has two advantages: it assists in the training of the casualty officer, and provides the patient with an almost immediate expert opinion. Furthermore, in the opinion of the radiologist involved, it demands no more of his time than full reporting.</td>
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of results together with comparisons between the referral practices of fellow SHOs reduced total requests by 30 per cent.

21. GPs are sometimes characterised as hard to influence. Meetings held at the hospital may fail to attract those GPs who make the most questionable requests. Nevertheless, review procedures focused on particular GPs can give a department valuable breathing space by interrupting the growth in demand (Case study 2 and Exhibit 5).

22. Published studies from a few hospitals, which have systematically promoted the guidelines and monitored the effect on referrals, have shown reductions of up to 30 per cent in certain examinations (Table 1); the practice of both hospital clinicians and GPs has been improved as a result. However, these studies are based on departments which have promulgated the guidelines energetically, by discussing referral rates at meetings with hospital clinicians and visiting the larger practices to obtain GPs' approval. This level of commitment is not typical; only a few departments visited had formally

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**Case study 2**

**Influencing GP referrals**

King's Lynn & Wisbech Hospitals NHS Trust.

GPs in King's Lynn who refer to the Queen Elizabeth (QE) Hospital, have been issued with referral guidelines and monitored against them since 1978. Wisbech GPs, serving 18 per cent of the district population, often prefer to use the small local hospital. This hospital offered unrestricted open access and was administered separately until it was amalgamated with the QE service in 1987. At that time radiologists from the QE arranged an open evening with the Wisbech GPs to promulgate the guidelines and began monitoring Wisbech requests.

The volume of GP requests fell immediately (Exhibit 5). But because the number soon showed a tendency to rise again, QE radiologists instituted twice yearly meetings at the local hospital to which the local GPs are invited (and readily attend). The further growth since 1991 is partly due to the opening of an ultrasound service.
reviewed compliance with the guidelines with referring clinicians. Purchasers and radiology departments should both ensure that compliance with at least one or two guidelines is covered in the medical audit programme each year. If the reduction in workload shown in Table 1 were reproduced throughout England and Wales, a total of £24m a year could be saved (estimated using the cost diagnostic described in Appendix 2):

- £3m a year in film and chemicals immediately;
- £12m a year in staff costs; and
- £9m a year if full unit costs, including equipment and hospital overheads, were recovered.

**Talking to patients**

23. Finally, it might be helpful if patients were made aware that x-rays have little value in certain circumstances. It would be possible to produce information leaflets to tell patients why x-rays may be inappropriate for their care; but it is important not to increase concern about radiation felt by some patients for whom radiography is appropriate. GPs and hospital clinicians are probably best placed to explain the situation personally to patients. There is an analogy with the Commission’s conclusions on GP prescribing (Ref. 14), which noted:

‘Patients consult for many different reasons - some are looking for reassurance rather than for treatment... Some GPs have found that the ‘worried well’ are equally satisfied with positive advice, coupled with an assurance that they are not wasting the doctor’s time. In addition to good interpersonal skills, this approach requires time. On average, GPs who allow ten minutes or more for each consultation prescribe less antibiotics.’

**Service level agreements**

24. Radiologists and referring clinicians both need to be clear about the service to be provided:

- radiologists, because pressure of work at present often leaves them with no option but to provide a less than ‘ideal’ service, not reporting all films, for example; and

**Table 1**

<table>
<thead>
<tr>
<th>X-ray examination</th>
<th>Reduction in in-patient referrals</th>
<th>Reduction in out-patient referrals</th>
<th>Reduction in GP referrals</th>
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<tr>
<td>Chest</td>
<td>-6%</td>
<td>-13%</td>
<td>-9%</td>
</tr>
<tr>
<td>Skull</td>
<td>-29%</td>
<td>-21%</td>
<td>-30%</td>
</tr>
<tr>
<td>Spine</td>
<td>-10%</td>
<td>-13%</td>
<td>-17%</td>
</tr>
<tr>
<td>Barium</td>
<td>-7%</td>
<td>-7%</td>
<td>-7%</td>
</tr>
<tr>
<td>Excretion urography</td>
<td>-9%</td>
<td>-17%</td>
<td>-9%</td>
</tr>
<tr>
<td>Limbs and joints</td>
<td>-5%</td>
<td>-4%</td>
<td>-13%</td>
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Source: British Medical Journal (Refs 9 and 13).
25. Service level agreements (SLAs) may be helpful in such situations (Ref. 15). Many features of radiology SLAs already exist for direct-access GP services, in the form of NHS contracts with district health authorities (DHAs) and fundholding practices. But these represent only a small proportion of departmental income, the bulk of which is funded out of contracts for ‘front-line’ specialties such as general surgery or medicine. There is no reason why hospital clinicians should not be treated comparably with GP fundholders and other GPs. Thus, each referring specialty or business unit could benefit from an internal SLA with radiology, setting out:

- the volume of requests expected to be met;
- the type of work to be carried out; and
- the quality standards to be met.

26. SLAs can record how the service is to be charged for and may become a step towards cross-charging between departments. SLAs may identify simple mechanisms for amending the agreement and resolving disagreements. But the main purpose of radiology SLAs should be to record the outcome of genuine discussion as to the most appropriate service levels and to resolve any uncertainties or differences of opinion, not merely to restate what has hitherto been accepted practice.
The volume of requests

27. The volume of requests expected to be met from each specialty cannot be assumed to be the same from year to year. Changes may be anticipated in radiological practice – for instance, replacement of IVUs by ultrasound – and in the likely demand that will follow the appointment of a new consultant. Constructive discussions with the other departments can result in meaningful agreement on the volume of work (Case study 3).

The type of work

28. In specifying the type of work, the range of images to be reported is particularly important. It may be reasonable to decide that some classes of image will not be routinely interpreted by the radiologists themselves, such as films that reach the department after spending weeks with the in-patient records on a ward, or those for fracture clinics, where the clinicians are particularly familiar with the relatively small range of indications being looked for. The practice of ‘red spotting’ (whereby radiographers direct the attention of medical staff to those images which appear abnormal) is particularly useful if not all films will be seen promptly by a radiologist. A survey of referring clinicians carried out for this study (see Appendix 1) showed that doctors in different specialties place very different priorities on having all images reported by a radiologist: for example, comprehensive reporting was regarded as ‘crucial’ by nine per cent of orthopaedic surgeons, compared with 61 per cent of neurologists. Where radiologists make an agreement not to report all images routinely, trust management must ensure that the referring consultant takes responsibility for placing an interpretation of the image into the patient’s notes.

29. In some cases it may be appropriate for radiologists to agree that certain work be carried out by colleagues in other specialties. In one teaching hospital (Ref. 16), for example, a radiologist instructed surgical registrars in the use of abdominal ultrasound, enabling them to answer a limited range of questions as an integral part of examining a patient. Their scanning proved a useful tool for handling surgical emergencies and the study demonstrated possible clinical benefits and savings on hospital ‘hotel’ costs. One possible problem to be

At King’s Lynn & Wisbech Hospitals the long-standing practice is for the radiology department to negotiate an ‘allocated’ number of examinations each year with each specialty and GP practice. These allocations are set so that the total workload can be covered within the department’s resources. Usage is monitored monthly and discussions take place with any specialty or practice whose requests exceed the expected demand. The aim of these discussions is to identify the explanation for the increase and to identify extra funding if the extra work is appropriate.

For example, discussions of this kind recently took place with the general surgeons. An audit of their out-of-hours requests for plain abdominal films demonstrated that they could make better use of the requesting guidelines and prompted them to reduce the number of unnecessary requests.
considered in any agreement of this sort would be the possibility that ultrasound equipment located outside the radiology department might not be fully utilised, giving the hospital poorer overall access to ultrasound investigations.

**Service standards**

30. The Commission's survey of clinicians shows that medical staff in different specialties differ in the value they place on various aspects of service (Exhibit 6). For orthopaedic surgeons it is the availability of old films that is particularly crucial, for paediatricians it is the speed with which urgent in-patient examinations can be arranged, and for A&E consultants it is a comprehensive, quick-turnaround reporting service. Departments need to agree with individual users the standards and improvements that are most important to them, and to monitor those standards.

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**Exhibit 6**

Clinicians’ views on the importance of the service

Medical staff in different specialties differ in the value they place on various aspects of service quality.

*Note: Differences between specialties in the remaining five of the thirteen aspects of quality were not strongly significant.*
Cross-charging

31. Many trust finance departments are planning to introduce hospital-wide cross-charging. This will mean that referring departments will be charged on a cost-per-item basis for radiological services. Cross-charging has two advantages in principle over fixed budgeting: those directorates who generate the workload are made accountable for the cost incurred, and the radiology department is held fully accountable for the resources deployed to meet these requests. Some clinicians are concerned that in practice:

- transaction costs could be high (‘more jobs for the accountants’);
- information on costs and activity levels is so poor that internal charging could unfairly penalise particular departments;
- radiology departments require a minimum guaranteed funding for their core activities; and
- the whole ethos of cross-charging could undermine clinical trust and cooperation between specialties.

The experience of one hospital demonstrates that such objections can be overcome (Case study 4).

Case study 4
Cross-charging for radiology
North Hertfordshire NHS Trust.

The Lister Hospital Stevenage and associated hospitals form a 700-bed district trust which has instituted internal charging across its 15 directorates. Radiology, like other departments, has an income budget to balance its budgeted expenditure. Of this £2.4m income, 35 per cent is fixed, the remainder being variable in line with work carried out for other departments.

Monthly budget statements are issued both to radiology and to the referring departments. However, the emphasis is placed on end-of-year projections, not on individual monthly fluctuations.

The existence of internal charging has influenced a number of referring departments to audit their use of pharmacy, pathology and other support services as well as radiology. The requesting pattern of individual clinicians can be provided on request to assist this process.

Once set up, the system’s transaction costs are low. Internal charging is now almost a by-product of the work of the directorate business managers and the management accountants involved in running external contracting. Entering monthly radiological workload statements into the finance department’s computer, and converting them to debits and credits against the ledgers, takes less than half an hour each month.

The hospital regards the following factors as important in making the scheme a success:

- it has reliable information on departmental costs and on radiological activity over several years (innovations such as MRI are funded separately for the first year whilst accurate data are established);
- regular monthly monitoring avoids sub-optimal emergency decisions at the year-end;
- the high level of GP fundholding locally, with many cost-per-case contracts, helped a healthy understanding of contracts to develop; and
- because the basis of the cross-charges is open and logical, discussions can concentrate on clinical activity not on money.
Recommendations

1. **Directors of radiology should:**
   - publicise RCR referral guidelines to hospital clinicians and GPs, agreeing any local modifications as a matter of high priority;
   - ensure that a radiologist vets high-cost (or high-dose) radiological procedures in advance, in accordance with a clear local policy;
   - monitor referral rates especially for high-volume procedures and review compliance with referral guidelines as part of the clinical audit programme;
   - arrange meetings with GPs and hospital clinicians where comparative data is fed back about their referring practice;
   - discuss with referring clinicians and GPs their priorities for the development of the radiology service and negotiate service level agreements (SLAs), recording:
     - the volume of work attainable under the current resourcing of the department;
     - the type of work (e.g. which films should be reported); and
     - the quality of service (e.g. target waiting times).

2. **Finance directors should:**
   - move towards ‘internal trading’ as soon as the hospital’s information and financial systems allow this to be done accurately and economically.

3. **Purchasers should:**
   - ensure that compliance with referral guidelines is specified in contracts and reviewed effectively within the trust’s clinical audit programme.
2 A Better Quality Service

Quality of service encompasses professional, clinical and patient viewpoints.

Work within departments to improve service quality is sometimes unsystematic or not acted on.

Clinicians give generally good marks to those aspects of the service they regard as most important.

Relatively few patients report unfavourably on their time in radiology.

Communication and teamwork are vital to raising quality still further.

Departments should aim to report immediately on a wide range of basic procedures.
Dimensions of service quality

32. The increasing volume of requests and the pressures to improve throughput have led to concern that service quality standards might be at risk. The management of quality is a very complex business. High standards are needed in:

- professional and technical matters, for instance, monitoring the equipment to ensure high quality images can be obtained with the minimum practicable amount of radiation; and
- interpersonal skills, so as to deal efficiently and understandingly with patients and their carers, and with other hospital staff.

Referring clinicians, patients, and the department itself, all have their own particular views and priorities. Managers may be inclined to concentrate too heavily on those aspects that are measurable, especially when all parties have an interest in common, for example, in minimising the delay for investigations. By contrast, interpersonal service quality is highly individual and hard to measure: some patients may wish to be forewarned of all possible aspects of their examination, where others may worry unnecessarily if given detailed explanations.

33. A wide variety of approaches has been adopted by radiology departments to tackle quality improvement, from half-day audit reviews, to quality circles, and recognising the internal customer. No technique of itself guarantees that progress will be made, and it is not uncommon to find:

- an ambitious and comprehensive programme, started in a burst of enthusiasm, which has not been reviewed subsequently because of the work involved, so there is no evidence of whether progress is being achieved or not;
- medical or clinical audit being treated as an opportunity to discuss practice, but with no indication of what standards or protocols should be adopted;
- patient questionnaires whose complexity makes analysis and action difficult, or which encourage the responses the department expected or even wanted to hear;
- unfocused discussions amongst staff, with no clear framework within which to choose priorities or obtain change.

Departmental quality assurance

34. Radiology departments have a strong commitment to technical standards. They invariably undertake comprehensive programmes on radiation protection and equipment quality assurance. Film wastage analysis (‘reject analysis’) is widely carried out, although it is not always clear what action is being taken as a result. In view of the strength of these programmes, this chapter concentrates on some of the ‘softer’ issues surrounding quality.
Clinicians’ views

35. The Commission’s survey (described in Appendix 1) of hospital clinicians shows relatively high satisfaction with aspects of the service felt to be of greatest clinical importance (Exhibit 7). These are:

- the availability of radiologists and the quality of their advice;
- the quality of the image and the report; and
- the speed with which urgent examinations are arranged for in-patients.

Clinicians are more critical of the time that patients have to wait once they reach the radiology department, and of the work being done to reduce the burden of inappropriate referrals (although they judge these less crucial to their own needs). The relatively low rating given to joint clinical meetings (both their importance and their quality) is disappointing, given the importance of liaison between radiology and other specialties. But perhaps the most striking criticism is reserved for delays before they receive the reports on their patients’ examinations – a point considered below.

Exhibit 7
Hospital clinicians’ assessment of the radiology service

There is relatively high satisfaction with the aspects rated as of most importance.
Patients' views

Many aspects of quality can be assessed only by asking patients for their opinion, yet consulting patients is not easy. The Commission’s report, What Seems to Be the Matter (Ref. 17), discusses some of the problems with obtaining feedback from patients and gives examples of good practice. Patients’ viewpoints are insufficiently appreciated in many radiology departments. This is despite the fact that radiographers and radiologists are aware of, and emphasise, the importance of patient comfort and reassurance. Information is often based on questionnaires whose value is limited; they may identify specific problems, such as finding parking spaces or making one’s way to the department. Otherwise they commonly indicate high levels of patient satisfaction, but fail to register more personal concerns which individuals would express in conversations with outsiders. For this reason the Audit Commission arranged for a series of independent structured interviews to be carried out with patients largely in their own homes (Appendix 1).

Many patients who attend radiology departments arrive with anxieties about their clinical condition. Individuals may find certain examinations physically awkward, uncomfortable or painful, embarrassing or occasionally frightening. It is encouraging therefore to find that the majority of patients speak positively of each stage of the process, from when they are told they need an examination, to when they receive the results. Indeed, at the outset of the interviews, 64 per cent of patients made unprompted positive comments about having their x-ray or scan, whereas only 36 per cent commented on aspects which worried or upset them (Exhibit 8). Certain causes of satisfaction and dissatisfaction were recurrent:

- praise for the staff involved far outweighed criticism;
- concern about ‘what is wrong with me’ was balanced by relief that something was being done;
- the delays experienced by some patients were matched by others’ pleasure at the unexpected speed with which arrangements were made;
- lack of information about what would happen during the examination, and the purpose of any prior preparation, was a cause of concern for some.

These points are interrelated. Although relatively small proportions of patients felt that they had suffered unacceptably long delays or not been given adequate information, the consequence was often added anxiety and even distress (Exhibit 9). Moreover, because radiology departments see hundreds of patients per day, these problems although small in percentage terms, still affect a considerable number of individuals. Sometimes departments are failing – at least in the eyes of patients – to deal with the problems. For example, 5 per cent expressed some worry about being exposed to x-rays, but none of those interviewed felt their concern had been addressed. Some further comments are described in Box 2.

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Exhibit 8
Patients’ impressions of radiology

Unprompted, 64 per cent of patients made positive comments about having their x-ray or scan...

Source: Audit Commission survey of patients.
The objective of ‘quality’ activities in a department should be to ensure that the most important areas for improvement are identified and that results are obtained. The Department of Health has provided funding for two departments that have taken quality management far enough to obtain British Standards’ (BS5750) accreditation. Not all departments will wish to invest the time and effort needed to win this, but they can still learn from some of the practices which underpin BS5750, ensuring that:

### Achieving higher standards

#### Managing quality

39. Patients react in different ways on first being told they need an x-ray or scan, ranging from relief that something is happening (21% of our respondents), to worry, anxiety or shock (30%). Others feel happy about the exam because they have had a similar one before (23%). One in four say they are sent to the department ‘without enough explanation as to why’ (29%).

Many patients express satisfaction with different aspects of their examination. For example 47% find the waiting time in the department shorter than expected (about 12 minutes on average). However negative comments are not uncommon:

- ‘No-one greeted me on arrival’ (8% of respondents)
- ‘Staff were efficient but not particularly friendly’ (14%) or ‘insensitive’ (9%).
- ‘There was not enough seating in the waiting area’ (9%)
- ‘I was left unsure what was going to happen next in the examination’ (21%).

This last comment is important since the examination itself can be experienced as physically awkward (31%), painful (28%), or frightening (10%).

Staff examining patients often fail to introduce themselves by name (only 30% of patients said all the staff did so).

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### Exhibit 9

**Lengthy waiting times in the department**

Though proportionately few patients suffered unacceptably long delays, the consequence for them was often added anxiety.

Source: Audit Commission survey of patients.

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### Box 2

**Patients’ viewpoints**

Note: The survey was deliberately biased towards the more complex and stressful procedures.

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Staff examining patients often fail to introduce themselves by name (only 30% of patients said all the staff did so).

Source: Audit Commission survey of patients.
Standards are set against which performance is to be monitored.

Overall responsibility for managing quality improvements is placed with a named member of staff. This individual needs to work through committees within the department and to liaise with quality initiatives in the rest of the hospital.

Policies and procedures are documented, and up-to-date material is accessible to all concerned; for example, radiographic methods should be documented within the department, so that all parties can be clear on the number and type of projections. Revision to such protocols should be agreed at joint clinical meetings with the appropriate referring departments.

The views of clinicians and patients, and of the purchasers, are actively sought.

There is a systematic upward spiral approach to improving quality (Exhibit 10).

40. As in other specialties, the function of medical and clinical audit should be to review compliance with standards, not to carry out research into what those standards should be. Clinical standards should, where possible, be derived from published literature. Where no such information exists, standards should be agreed and audited in discussion with all the relevant staff in the department (radiographers participating with radiologists) and in other specialties. Comparisons with other hospitals can provide a useful guide as to what can be achieved. Some regional health authorities (RHAs) have organised extensive comparisons between hospitals in their area, allowing departments to make consistent comparisons of patient satisfaction and dosage. Although the eventual abolition of RHAs may make comparisons of

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Exhibit 10

**Systematic quality improvement**

Departments must adopt a systematic ‘upward spiral’ approach to improving quality.
this kind more difficult, the gap could be filled by arrangements for
departmental accreditation by the relevant professional bodies, especially if
accreditation schemes promote quantitative comparisons as well as qualitative
judgements. The quality of radiographic images and reporting is another area
where inter-hospital comparisons could be valuable. The issues are important,
but judgements are subjective and it might be helpful to have a formal scheme
whereby hospitals exchange images and reports, to check that quality is
consistently high, on the analogy of the pathology and national breast
screening services.

41. A number of particular good practices on quality management were seen
during fieldwork:
◆ radiographers meeting together for peer review of film quality, an
  important topic because of the value placed on it by referring clinicians;
◆ some departments participating in the N R P B’s national dose monitoring
  surveys, thus allowing strict comparison with other hospitals on a matter of
general concern;
◆ a study of delays to in-patients due to difficulty in arranging certain
  radiological examinations, which concluded that over 1,250 bed-days per
  year could have been saved if all examinations had been arranged within the
  audit standard (two working days of the request being accepted).

42. The needs of patients include clear information in advance and reassurance
on those occasions when delays or difficulties occur.
◆ Patients who have been sent from out-patient clinics and GP surgeries may
  have anxieties that the referring doctor did not address. Many departments
  have worked on producing informative material describing the procedure
  and any preparation needed, and this work should continue.
◆ It should be decided whose task it is to notice patients for whom things are
  not going smoothly. For example, it should be the job of a specified helper
  or receptionist to notice the occasional patient who has had a very long
  wait in the waiting room. Staff may benefit from training in how to deal
  with people in difficult situations. Introducing oneself by name may help to
  establish a rapport with the patient, but being able to reassure patients in
different situations requires deeper confidence and experience.

Making the most of the staff

43. All staff, whatever their grade, should be aware of their contribution to the
service being delivered. For this reason, individual performance objectives
should be set throughout the department, cascading downwards from the
objectives of the department as a whole.
◆ Objectives for radiographers might well include responsibility for small
  projects; for example, reject analysis is currently often assigned to one
  individual.
Radiologists need to work as a team. In some departments it appears that not all the radiologists are pulling their weight, causing large backlogs of unreported film, or long waiting lists for allegedly less popular examinations, which are only cleared as a result of special efforts on the part of one or two of their colleagues (Case study 5).

Good liaison arrangements will help to avoid communication failure which can result in:
- ward nurses not realising the implications of late preparation of patients for booked examinations;
- porters at lunch when the number of patients to be fetched from wards is high.

Departments rely on good communications and teamwork between professional and administrative/clerical staff within the department and with clinicians, ward nurses and porters in the rest of the hospital. It is all too easy for meetings simply to reinforce divisions between grades. Each department should organise meetings where staff of all grades are encouraged to attend and, more importantly, to contribute their ideas. Formal agendas and minutes of the decisions should be recorded, and it is helpful also to have occasions when everyone can express their concerns and problems in an informal structure.

'Hot' reporting

In a few departments reports on basic examinations are made available soon after the examination is complete - quickly enough for the report to leave the department with the patient, without causing them an excessive wait. This practice is known as hot reporting. It brings many advantages both to the referring clinician and to the department itself (Box 3).
46. Of the departments contacted in the study, only one maintains this standard (Case study 6, overleaf). A second one reports all films within one session and ensures that urgent films are reported immediately. In the remaining departments films leave the department without a radiologist’s report, and considerable clerical effort is spent later, attempting to obtain films in order to provide a late report, perhaps too late to influence patient management.

47. Most users want to see improvements in the turnaround of reports. As Exhibit 7 (above) demonstrates, despite the moderate importance clinicians place on speedy reporting, their opinion of the service currently offered is low – with 35 per cent rating it as ‘poor’. For the radiology department itself, it is no more work to report today’s films today rather than tomorrow. Rather, ‘hot’ reporting presents a challenge for radiologists to manage the department appropriately.

48. Some factors may make ‘hot’ reporting difficult to organise. Where the department is split within the hospital, the walking time to the main department may make it impracticable. And where the radiologists’ workload is very high, locum cover may be needed in the event of radiologists’ absence, to avoid cancelling a patient list. Otherwise hospitals of whatever size should

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**Box 3**

**Advantages of a ‘hot’ reporting system in an x-ray department**

1. In-patients can take their films and a report to the ward. This provides a radiological opinion at the time when management decisions are being made. Misinterpretation of films by junior doctors is avoided; this can have medico-legal advantages and reduce misdirected further investigations.

2. Patients may, similarly, return to the out-patient department with reported films. Apart from the advantages mentioned above, this may substantially ease the organisation of the clinic, and allow the whole of a patient’s management to be concluded in one visit.

3. If a significant finding is noted on an examination requested by a GP, the radiologist can discuss it at once with the doctor and/or can refer the patient to A&E or to an appropriate clinic, e.g. the chest clinic for a patient with open tuberculosis. Occasionally an acute admission may be arranged.

4. When GP patients take their report with them, it saves postage and ensures the early delivery of the report.

5. The radiologist may arrange further films while the patient is in the department, preventing recalls and enabling the final diagnosis to be reached more rapidly. It may also be helpful for the radiologist to question or to examine the patient, which often helps in the interpretation of the films.

6. The presence of a radiologist makes him or her available for consultation by clinicians or by radiographers. If necessary an anxious patient can be reassured.

7. The secretary can ask the radiologist about any unfamiliar terminology and can check the correct spelling there and then.

8. There are practical advantages in the production of reported films in a regular manner, smoothing the flow of work through the day rather than letting it come irregularly as the typing of tapes is completed. Office staff need no longer waste time answering phone calls about unreported films, locating them, or finally collating them with reports.

*Source: Dr Hugh Saxton.*
organise an element of ‘hot’ reporting. Although a small department may not process enough requests to occupy a ‘hot’ reporter full-time, the service can be combined with other work such as reporting on overnight examinations, vetting requests and taking enquiries. In a large department the pressure of examinations may be considerable at times and it is recommended that there should be enough radiologists available for the work to be covered in two-hour spells. The two sites visited which offered such a service, were able to do this because:

- all the radiologists shared a recognition of the importance of the service (the lead taken by the clinical director may be crucial in this respect) and accepted personal responsibility for seeing that the office was covered if they were unavoidably absent;
- secretarial assistance was guaranteed, supported in one case by equipment which enabled two secretaries each to type directly from any one of five audio-channels.

49. Departments should organise themselves to report all basic films taken during normal opening hours within one session; and they should aim to report as many as possible in time for the report to leave the department at the same time as the patient. There will always be a few films which require more time and study before a good interpretation can be provided. But the only exception to the principle should be if users have clearly indicated that they have other, higher priorities which they wish the service to meet. Precisely how ‘hot’ reporting is implemented will depend on the level of technology available; computer networking, for example, in principle allows the radiologist’s report to reach the ward or clinic before the patient returns.

The Manor Hospital, Walsall, has implemented ‘hot’ reporting for all except out-patient department films, and almost all of the benefits of the previous box have been realised.

The clinical director has organised a rota involving three sessions each working day. The ‘hot’ reporting service is available for seven hours a day, and reports are produced typically within ten minutes of the film being processed, at an average 85 seconds per report. Out-of-hours investigations are reported next morning.

The fact that out-patients’ x-rays are taken in a physically separate department prevents these films being hot reported.

Overall, this department costs 13 per cent less than the average cost of departments performing the same workload (Annual Accounts, Financial Return 21, 1992/93).

There are actually fewer radiologists than average; the four consultant radiologists report all of the department’s 100,000 examinations per year. Nevertheless, reporting accounts for only 30 per cent of the available radiologists’ time, and waiting times for complex investigations are typical of those in most other departments.

Case study 6
‘Hot’ reporting need not necessarily be more expensive.

Walsall Hospitals NHS Trust.

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Recommendations

1. Radiology managers should:
   ◆ make one individual responsible for managing the department’s approach to quality improvement;
   ◆ through the individual responsible ensure that patients’ and doctors’ concerns are systematically addressed, as well as those identified by staff within the department;
   ◆ establish standards against which to monitor performance;
   ◆ record and follow up recommendations aimed at improving service quality.

2. Directors of radiology should:
   ◆ institute ‘hot’ reporting systems, allowing reports on basic examinations to be available before the patient leaves the department – unless referring clinicians indicate that they have higher priorities for the service.

Note: Recommendations addressed to radiology managers in this and subsequent chapters may be implemented by the director of radiology, a business manager or a superintendent radiographer, depending on local management arrangements.
3 Becoming More Efficient

Unit costs vary by 30 per cent between departments.

Rooms and equipment could often be used more intensively.

It may be possible to identify surplus assets and take them out of commission.

Smoothing out peaks and troughs in the workload can help improve utilisation.

Productivity of staff, both radiologists and radiographers, varies widely.

Numbers of staff and skill-mix should be studied systematically in relation to the workload.

Out-of-hours payments for radiographers should be made on an economical basis.

Computer systems and available IT skills must be adequate for management information to be produced.
Variations in efficiency

50. There are large variations in the costs of departments, whatever their size (Exhibit 11). The variations about the line of best fit suggest that there are efficiency differences of ±30 per cent between departments carrying the same workload.

51. Exhibit 11 also indicates that small departments tend to be proportionately more expensive than large ones, because of an irreducible cost of around £0.5m (where the line of best fit meets the vertical axis) incurred in even the smallest departments. In principle, economies of scale could be obtained by merging small departments. But such mergers are not easily achieved between acute hospitals, since there are clinical advantages in providing at least a basic radiology service on site, so that patients do not have to move between hospitals. (In pathology, by contrast, rationalisation should be easier to achieve because it is specimens, not patients, that have to be transported.)

52. The NHS standard approach to costing radiology work is based on the Körner weighting system, which was developed over ten years ago, before investigations such as CT and MRI scanning were so widely available. The Commission has developed a cost comparison diagnostic (see Appendix 2) which has two advantages over Körner:

- it takes detailed case-mix variations into account, by calculating the cost of each individual procedure separately, based on average unit costs across the hospitals visited; and
- it treats each major area of expenditure appropriately, because the costs of radiologists, radiographers etc. have each been estimated separately for the various procedures.

Exhibit 11
Radiology department costs

There are large variations in the cost of departments, whatever their size.

Note: Körner units measure radiological workload on a scale of one unit for the most basic examinations to 60 units for the most complex.

The output from the cost diagnostic allows the expected cost components in any department to be computed from the current mix of procedures and compared with actual expenditure. In each major area of expenditure, individual departments show wide variations from the expected cost (Exhibit 12).

Exhibit 12
Costs in eleven departments adjusted for the mix of procedures

In each major area of expenditure, individual departments show wide variations from the expected cost.

At the department shown in red, reading from left to right:
- total costs are nearly ten per cent above expected;
- radiologist costs are just below expected;
- radiographer and equipment costs are very low;
- but film and chemical costs are very high...
- ...as are other miscellaneous costs (not shown here).

Source: Audit Commission cost diagnostic.
The next section identifies the areas where there are gains to be made and considers the underlying problems in:

- utilisation of rooms and equipment; and
- average workload per radiographer and per radiologist.

**Asset utilisation**

53. Radiology departments are among the most capital-intensive in the hospital, but only a few have studied directly the utilisation of their rooms or equipment. Low utilisation inevitably leads to high unit costs and poor return on asset values, and may be particularly noticeable in departments that have several rooms devoted to the same type of work. It is not unusual to find rooms in use for less than half the working day (Exhibit 13). In some cases entire rooms may be kept fully equipped but virtually unused. The justification for such arrangements is often that the room is needed as backup in case the main equipment fails, but this ignores the quick response given by service engineers from reputable supplier companies, and the generally low levels of downtime on much radiological equipment, especially in the lower-technology rooms where there is unnecessary duplication.

54. Some hospitals have developed in such a way that they have two or more separate sets of x-ray rooms on the one site. Split departments are less efficient for a number of reasons:
it is harder to coordinate staff to match the pattern of work, so that one sub-department may be overloaded while another appears to be almost empty; they may need more receptionist and office staff; specialist staff such as radiologists may waste time walking between them; it is harder to set up ‘hot’ reporting systems.

Patient arrival patterns

In many departments the distribution of the workload throughout the day is very uneven, which contributes to poor asset utilisation. The peaks and troughs in patient arrivals (Exhibit 14) are caused by:

- in-patients arriving in the department in large numbers in the late morning (a shortage of porters sometimes exacerbates this problem);
- the schedules of out-patient clinics that can create whole sessions that are either busy or slack;
- the arrival of some GP patients on a walk-in basis.

Exhibit 14
Patterns of work across the day

There are peaks and troughs in patient arrivals.

Average number of examinations per hour

Source: Audit Commission study visit.
Throughput per staff member

56. As with fixed assets, radiographic staff are not always fully employed throughout the working day. One study (Ref. 18) found that basic grade radiographers in 29 per cent of sites and senior IIIs in 43 per cent of sites, spent more time ‘ready for work’ than actually carrying out radiology procedures. The Commission found that radiographer productivity varies greatly between NHS trusts (Exhibit 15), as does the mix of radiographic grades employed. Some of this variation is due to the characteristics of the sites (separate sub-departments and outlying hospitals tend to be staffed by relatively senior grades) but the variation in throughput and grading translates directly into variations in unit costs.

57. There is also variation in other important areas of expenditure. The departmental workload per radiologist in particular, although generally higher than the RCR’s own standards (Ref. 19), varies greatly (Exhibit 16, overleaf). But so does the work that they carry out, for instance the percentage of films that are reported. A judgement about how many radiologists a hospital needs implies another judgement about the importance, for example, of comprehensive reporting.

Lack of management information

58. One of the common barriers to efficient working is lack of management information. Some two-thirds of radiology departments have computer systems – one of the highest rates of any hospital department (Ref. 20). The
systems provide valuable support for the day-to-day work such as registering patients, locating previous examinations, and making appointments. But often the data is not summarised and turned into useful management information, either because the software is cumbersome or deficient, or because no one has been properly trained in the full capabilities of the system. In some departments with good systems the data potential is not exploited, because the managers do not appreciate the need for management information.

Becoming more efficient

Adjusting staffing to workload

59. Radiographic work lends itself to measurement, because the procedures are separate tasks, and the work involved with a particular piece of equipment can be clearly specified. It is possible to make allowance for the extra time and sometimes staffing required for patients who need special attention such as children, patients who are frail, who do not speak English, or who have difficulty complying with the procedures. Once the pattern of work is known, it should be possible to quantify both the number of staff and the mix of skills required and to work towards zero-based budgeting for staff and equipment.

60. Any analysis of skill mix has to take account of the variety of tasks and methods of work in radiography. These include:

- direct work – positioning the patient, acquiring the image and evaluating the image;
- indirect work – such as liaising with immediate colleagues and with other departments and dealing with outside enquiries; and
- technical work – such as setting up and testing equipment, and general administration.

There are two possible approaches when the results of a skill-mix review suggest that the mix is wrong:
either the proportion of support staff who can carry out some of the indirect and technical work can be increased, thus allowing the radiographers to concentrate on the imaging process itself;

or the existing proportion of radiographers can be sustained, and efforts made to deploy them flexibly to cover all types of work as and when they arise.

Both approaches have their merit; the important thing is that some systematic review of staffing and skills is carried out (Case study 7).

61. Departments should consider using more part-time staff to smoothe the peaks and troughs in workload, in the same way that some community-based units, which open for less than the full five-day week, do. Bank radiographers can provide useful cover for foreseeable staff shortages. And it should be possible to schedule important non-clinical work, including individual study and project work targeted on quality improvement, in the slack periods. Very busy areas may benefit from extended opening hours, provided that:

- any necessary support services, such as portering, clerical and nursing, can be efficiently organised; and

- the department is prepared to actively promote the ‘extended hours service’ to doctors and patients.

### Case study 7

**Adjusting radiographic staffing to workload**

United Leeds Teaching Hospitals Trust.

The General Infirmary at Leeds has a large department of radiology, employing about 90 radiographers and helpers in six separate areas. Both the numbers and grades of staff deployed in each area have been reviewed against workload using the GRASP software package.

- The work in each area was broken down into separate activities.

- The project manager then assessed both the time required per examination for each activity (either by direct measurement or by consensus amongst the radiographers) and the grade most appropriate to that task, assuming any necessary training to be available.

The average number of examinations in each area was determined for each half-day of the working week. The GRASP software then computed the numbers and grade of staff ideally required. As a result:

- staffing has been rebalanced between areas; for example, a radiographer has been moved from orthopaedic x-ray on afternoons when staff were under-employed there and transferred to the paediatric area which was under pressure on the same afternoon; and

- the grade-mix has been altered: for example, one radiographer post in CT has been replaced by a helper, resulting in greater job satisfaction as well as cost savings.

Variations across the day are also taken into account. Part-timers and helpers are used to cover peak periods and lunch breaks. As its next step, the department will try to minimise the peaks of work, for instance, by ensuring that requests from 10.30am ward-rounds reach radiology promptly, rather than at 1pm as sometimes happens at present.
62. It is difficult to set benchmarks for numbers of superintendent and helper posts. Radiology managers should therefore be explicit about what is expected of both these grades in their particular department. The work the helpers do should be clearly set out: for example, having a helper to accompany patients to and from a busy ultrasound room may well allow the ultrasonographer to concentrate on the work inside the room and enable a greater number of patients to be scanned per session. Similarly, the number of superintendents should be justified — apart from any direct involvement in radiographic work — on the basis of clear job descriptions and performance objectives.

63. Directors of radiology should review each radiologist’s contribution to the general reporting workload and make sure that no individual fails to carry a reasonable share of the department’s work without agreed compensating contributions elsewhere. The workload of most departments exceeds the RCR’s recommended 12,500 maximum examinations per consultant per year (Exhibit 16, above), but some radiologists feel that a greater workload is relatively easily accommodated. Trust management should not support the appointment of an additional radiologist unless:

- the existing radiologists have prioritised their work in discussion with other specialties;
- the workload of each individual radiologist has been reviewed by the director in the light of departmental objectives and the work carried out by the others; and
- options for delegating work (subject to full and proper safeguards) have been carefully considered.

Radiographer out-of-hours costs

64. Out-of-hours staffing practices should relate to the level of work and to the variation which occurs through the night. Here the issue is not so much the number of radiographers required, as the method of payment to adopt. The methods include:

- traditional Whitley Council terms, with a basic allowance plus call-related payments;
- fixed payments, often negotiated to buy out the Whitley terms; and
- shift systems — usually with a premium payment for unsocial hours — with staff either allocated permanently to nights, or rotating between day and night work.

65. Providing an out-of-hours service costs between £100,000 and £300,000 per year in many departments. Good out-of-hours arrangements can therefore offer substantial savings (Exhibit 17). The best practice is to use shifts when there is high demand and Whitley Council rules when demand is low, say less than about one request per hour. In many hospitals the breakpoint is reached at around midnight, when requests from accident and emergency tail off. At one of the study hospitals, during the week, one shift radiographer is on duty from when the department closes at 6pm until midnight; thereafter cover is
provided by a radiographer on call from home who is paid under Whitley Council rules.

Better scheduling

66. The substantial peaks and troughs of work in departments undermine quality and make it almost impossible to minimise patients’ waiting time consistently. They also reduce the possible throughput, by allowing staff and equipment to be underused at certain times of the day. Departments should do all they can to smoothe the patient arrival pattern and make it more predictable:

◆ in-patients: radiology managers should be aware of the times that ward rounds normally take place and should specify clearly when they expect porters to transport patients to and from the department. It may be helpful to monitor delays in bringing patients down from the wards and investigate the reasons for them;

◆ out-patients: departments need to be given adequate notice to enable them to service extra clinics and react to cancelled clinics; failures to do so should be monitored and raised in meetings between business managers;

◆ GP direct-access patients should be encouraged to attend at times when hospital demand is expected to be low – except for the simplest examinations such as chest x-rays. It may be appropriate to offer some patients a choice between a timed appointment with a specified maximum wait and a walk-in service where waiting times cannot be predicted.

Most patients keep appointments and arrive in reasonable time, but the few who fail to do so for lengthy examinations reduce the throughput of the

Exhibit 17

Radiographer costs of the out-of-hours service

Good out-of-hours arrangements can offer substantial savings.

Source: Audit Commission study visits.
department. Clear information to patients and follow-up telephone calls to those who have a history of failed appointments are documented ways of reducing the number missed.

67. Sometimes it is impossible to predict in advance the time needed for certain examinations, particularly for complex special procedures such as ERCPs and angioplasties. In such circumstances, high occupancy levels cannot be achieved throughout a fixed-length working day. But better scheduling of MRI, for example, can be achieved through batching similar types of examinations together.

68. Good information is a prerequisite of effective management. A computerised radiology management system (RMS) is essential, if key analyses are to be produced, including analyses of:
  ◆ delays in reporting (for regular departmental review);
  ◆ trends in workload by referring specialty (for review in SLAs and contracts);
  ◆ patient arrival patterns; and
  ◆ room and equipment utilisation.
Clinical directors and business managers should demonstrate the ability to use such data constructively in addressing the problems of their department. And in order to make full use of the RMS, departments should identify a member of staff whose duties include: becoming fully familiar with the system’s facilities; and making sure that data quality is adequate.

69. The Commission’s auditors will be considering in detail many other ways of improving the efficiency of radiology departments. These include:
  ◆ keeping sickness and other forms of absence under control;
  ◆ training office staff in a variety of skills so that receptionists and clerks can turn their hand to any office task;
  ◆ restricting the use of fully-trained RGN nurses to those situations, usually associated with interventional radiology, in which their clinical skills are essential;
  ◆ reviewing maintenance costs in relation to the service level offered; and
  ◆ negotiating good prices for consumables.
The recommendations of each audit will be tailored to local circumstances, using the evidence of the cost diagnostic (Exhibit 12, above) to help direct attention to areas for savings. If all those departments currently spending above average can bring their total expenditure down to the average level, savings nationally would amount to six per cent of expenditure on radiology, an estimated £30m a year. Further savings may be achievable using the more controversial approaches discussed in the final chapter, such as redefining the limits of the radiographer role and introducing patient-centred care.

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ERCPs: an endoscopic examination of the gall bladder and pancreas using fluoroscopy.
Recommendations

1 Radiology managers should:
   - adjust the opening times of the rooms – either limiting or extending service hours – to match the levels of demand;
   - reduce the variation in workload hour by hour and day by day, by influencing patients’ arrival patterns wherever possible;
   - adjust radiographer staffing more closely to the workload, by employing part-time staff and bank radiographers;
   - use appropriate out-of-hours remuneration;
   - introduce radiography helper posts where their methods of work demonstrably allow the radiographer to concentrate on radiographic tasks;
   - identify a member of staff responsible for management information and for making the most of information systems.

2 Directors of radiology should:
   - review the workload of individual radiologists and ensure that each is contributing adequately to the performance of the department.

3 Other hospital departments should:
   - liaise with the radiology department over cancelled or additional clinics and preparation of in-patients due for x-ray in the department.
Accommodation and equipment is often less than ideal.

The need to ration expensive equipment, and poor quality decisions over the years, have both contributed to this.

Though NHS trusts have gained some autonomy, acquisition processes now involve much more complex working.

NHS trusts need to plan ahead for capital spending; utilisation review and funding strategies are vital.

Future decisions must be based on thorough business case evaluations.

Post-project reviews offer the opportunity to improve decision-making.
This chapter describes the problems in departments that are caused by an inappropriate asset base — equipment and accommodation that falls short of modern standards or is now not suited to the clinical demand. It sets out the steps trusts need to take to manage the asset base effectively, from devising a capital programme through to developing a good business case.

An inappropriate asset base

Most departments probably have items of equipment that are too old, out of date or no longer appropriate to their needs; also their accommodation often creates problems for staff and patients. The existing asset base represents the accumulated effect of successive spending decisions taken often over several decades. The products of those decisions may no longer be what is most needed, but they are very difficult to revise since the infrastructure required (radiation shielding, electrical cabling, floor- and ceiling-based mountings) sets decisions literally in concrete. Meanwhile the demand for radiology has changed and expanded greatly over at least 25 years, and most departments show symptoms of being poorly adapted to the current workload, both in accommodation and equipment. Accommodation often has:

- patients waiting in crowded reception areas or along corridors;
- inadequate toilet facilities and lack of privacy;
- difficult access for hospital in-patients on trolleys;
- ultrasound scanners squeezed into small rooms;
- poorly-located offices and inadequate staff-training facilities;
- old film storage in inconvenient locations.

The equipment itself may:

- be liable to breakdown or costly to repair (availability of spare parts may compound this problem);
- be awkward to use, limiting the throughput attainable by the operator;
- give poor quality images (especially old ultrasound scanners and image intensifiers);
- demand higher levels of radiation than more modern equipment;
- lack the full range of ‘extras’, thus limiting the investigations that can be carried out in line with clinical advance.

Old equipment is not necessarily a problem of itself; in some departments it is a newer item of equipment which causes staff most problems.
72. In addition, some departments simply lack equipment that would be of benefit. The distribution of equipment across the country is uneven, with MRI scanners, for example, concentrated in particular geographical areas (Exhibit 18). It is not easy to define the appropriate level of provision for a population, but it is difficult to explain and defend both the high and the low extremes of provision shown in this exhibit.

73. There are two chief reasons why the existing assets often fall short of what is required: the competing claims for rationed public sector capital and the sometimes poor quality of decisions in the past when capital assets were acquired.

74. Much of the equipment is very expensive, and capital has had to be rationed. Many departments have responded to shortfalls in investment by raising funds from donations or charitable appeals. Too often though, the new funding has not covered either the running costs or depreciation of equipment that has been bought, and expenditure has had to be cut back elsewhere to enable the new service to operate.

75. In the past decision-making has been slow and inadequate. Too often, choices were dominated by technical considerations, with little account taken of users' views (referring clinicians, radiography staff or patients). On occasion, a project proceeded because it reached 'its turn in the queue', even though the needs of the department might have changed radically since it was first advanced. And financial good practice has been in short supply:
   - departments have had difficulty comparing the value for money offered by different suppliers of equipment when some load more of the costs onto the maintenance contract, and others offer package deals, such as a free processor in return for a long-term contract for supply of x-ray film;
   - purchasers initially funded capital charges in full, so departments have had no effective incentive to rationalise assets, at least in the short term;
   - the 'whole-life' costs of equipment have seldom been considered;
   - there has been little incentive for managers to consider the stream of income that an asset might generate.

76. In the past purchasing decisions were made in conjunction with the regional scientific officer on the advice of a scientific advisory committee. But with the demise of the regional role, the responsibility has devolved to managers in trusts. It is possible that the tendering processes associated with a multitude of individual trust purchases may be adding significantly to the administrative costs both of suppliers and of the NHS. Trust managers are unlikely to have the same degree of technical knowledge as did the regional scientific officer, and they also have to learn to manage a much more complex network of relationships (Exhibit 19) in order to acquire the technical and financial expertise they need.

77. Trust managers now have an increasing range of opportunities open to them:
- They have considerably more freedom to determine the detail of their own capital programme (although this involves them in the difficult task of determining priorities between departments including radiology).
- They have access to capital from private finance sources and, indeed, now have to consider these sources first.
- Meanwhile, the choice of equipment is getting more complex; the range of options is growing steadily, and ‘next year’s model’ may often look a better buy than this year’s.

Exhibit 19
Managing the acquisition of equipment

With the demise of the regional role, trust managers now have to manage a more complex network of relationships.

Source: Audit Commission.
There is an emergent market in second-hand equipment. Opportunities to sell second-hand may help trusts to upgrade; however, purchasing second-hand can be beset with problems, for example, over who is responsible for ensuring that it is commissioned satisfactorily.

78. Faced with this increased freedom it is all the more important that trusts develop their own mechanisms for deciding what they need to buy and for managing the decision-making process.

Managing the asset base

The capital programme

79. As a first step, each NHS trust needs a capital programme that looks some years ahead, covering acquisition of new assets and replacement of existing ones. The replacement programme will need to be internally consistent, considering lead times and phasing of each investment. For example, the purchase of a radiology information system needs to be related to the hospital’s IT strategy and particularly to hospital-wide systems such as a patient administration system (PAS). This programme must be fed (see Box 4) by:

- the trust’s overall strategy;
- anticipated technical developments;
- anticipated life of existing assets;
- utilisation review; and
- funding strategy.

Box 4
Prerequisites for a trust’s capital programme

- What is our strategy?
  - Which specialties and what services are to be developed?
  - What is the desired balance between centralised and outreach services?
- What technical developments are anticipated?
- How long will existing assets last?
  - When will each become clinically or technically obsolete?
  - When is performance likely to deteriorate significantly?
  - When will use lead to unacceptable risks?
  - When will replacement become more economical than continued use?
- Which assets will we need to replace?
- What are the funding options?
Review of utilisation and space

80. The utilisation review should cover all equipment, regardless of its likely remaining lifetime. Worthwhile revenue savings can sometimes be made by taking individual surplus items out of commission. For example:

- The University Hospital of Wales has saved £55,000 maintenance costs by withdrawing from use one of two CT scanners which became surplus after an MRI scanner was installed. The remaining CT workload can now be dealt with on one machine, since its working day has been extended by five hours.

- At Watford General Hospital a study has indicated that one out of the four general rooms can be closed (for possible alternative use) without detriment to the service.

Exhibit 13, above, showed that many radiological rooms are underused. Much larger benefits are likely in the long term, if departments undertake comprehensive review of the utilisation of space and equipment.

Funding strategy

81. A funding strategy is necessary to support the capital programme if only because of the continuing competition between hospital departments for direct NHS capital funding. Moreover, government regulations now require trusts to consider leasing and joint partnership with the private sector first before NHS capital is committed. The guidance (Ref. 21) states clearly that private financing should not be regarded merely as an extra source of capital (it remains true that the government can always raise capital at lower interest rates than the private sector). The intention should be to transfer risk to the private sector and bring fresh management expertise to bear on the NHS. An operational lease of a scanner, for example, draws on the lessor’s ability and experience in respect of maintenance, upgrade and eventual disposal of the equipment, which no individual trust can replicate.

82. NHS trusts are relatively more familiar with the concept of leasing equipment than with private sector partnership, and their interest in leasing scanners and other major radiological equipment appears to be growing. Over 30 trusts have registered an interest in leasing such items at Newchurch & Company’s ‘marriage bureau’, a Private Finance database to bring together NHS and private sector partners organised on behalf of the NHS Executive. But the same database shows very few radiology departments seeking out contract services or joint ventures; and the study team found few departments expressing such interest on their visits during the winter of 1993/94. Moreover, only four private sector entries on the database specifically mention radiology as an area of interest.

83. It is hardly surprising that progress is slow; until recently, many schemes were being financed under conventional arrangements agreed directly with RHAs. Entering into partnership with the private sector, or even in some cases signing a major lease, may bring both parties onto unfamiliar ground. For example:

As at November 1994.
Clinical directorates are unaccustomed to, and sometimes unenthusiastic about, entrepreneurial activities such as identifying additional income streams or allowing for the cost of capital.

Private sector finance providers for their part are concerned about the levels of risk that they are required to underwrite if the project is to meet the Treasury's rules.

In order for private finance to be involved more often and more successfully, both the NHS and the private sector will need deliberately to cultivate a culture in which such schemes will flourish. In NHS trusts imaginative leadership from chief executives will be vital. They will need to:

- ensure that managers receive the detailed guidance (Refs. 21, 22) recently published, and have access to the advice and support they need to put it into practice;
- give incentives to clinical directorates to develop good business cases, encouraging them to market their services and identify additional income streams; and
- demonstrate to the private sector their interest in innovative approaches to service delivery.

The private sector too needs to be more aware and better informed.

**Business cases**

Thus good practice starts with the establishment of a capital programme which will be affordable and meet the trust’s real needs several years ahead. The trust needs to consider this programme on a regular basis, to take account of changing needs and sources of funds, and make decisions about the elements which are current priorities. In some cases it may be worth postponing replacement until new types or models of equipment become available. The key mechanism for making these decisions well is now the business case, which must be produced to support each individual scheme (Ref. 23), however small. Detailed guidance on preparing business cases has been issued by the NHS Executive in its *Capital Investment Manual* (Ref. 22).

Business cases should (see Box 5):

- consider a wide range of options;
- bring all relevant costs and income into an assessment of net present value;
- show that the decision is in line with the needs of users and commissioning bodies.

If the decision is that new equipment will be acquired, managers will have to determine:

- the scope of the purchase (equipment only, or ‘equipment plus’); and
- the most appropriate finance option.
<table>
<thead>
<tr>
<th>Box 5 Elements of a good business case</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Consider a wide range of options:</strong></td>
</tr>
<tr>
<td>- do nothing;</td>
</tr>
<tr>
<td>- upgrade existing facilities;</td>
</tr>
<tr>
<td>- provide the service elsewhere in the department, for example, by extending opening hours;</td>
</tr>
<tr>
<td>- buy the service elsewhere;</td>
</tr>
<tr>
<td>- acquire new equipment now.</td>
</tr>
<tr>
<td><strong>Include all relevant costs and income:</strong></td>
</tr>
<tr>
<td>- initial and staged capital outlay;</td>
</tr>
<tr>
<td>- running costs including maintenance over the life of the equipment;</td>
</tr>
<tr>
<td>- cost of bearing increased working capital;</td>
</tr>
<tr>
<td>- cost savings elsewhere in the hospital;</td>
</tr>
<tr>
<td>- income from marketing the service;</td>
</tr>
<tr>
<td>- exit costs and resale value;</td>
</tr>
<tr>
<td>- results of sensitivity analyses.</td>
</tr>
<tr>
<td><strong>Relate to wider context:</strong></td>
</tr>
<tr>
<td>- trends in the volume of work;</td>
</tr>
<tr>
<td>- viewpoints of staff who will use the equipment, of clinicians, and patient benefits;</td>
</tr>
<tr>
<td>- environmental impact and radiation safety;</td>
</tr>
<tr>
<td>- the department’s other plans (for digital imaging, room rationalisation or outreach services);</td>
</tr>
<tr>
<td>- the strategic direction of the trust and its main purchasers.</td>
</tr>
</tbody>
</table>

Source: Audit Commission.
Thus each business case must propose clearly the scope of the proposal and the financing mechanism, balancing risks and flexibility (Exhibit 20).

A particularly important requirement is that business cases for expensive specialist assets, such as MRI scanners or angiography suites, give adequate consideration to the option of purchasing the service from outside the trust – whether from a mobile service, a local private provider or another NHS trust. The benefit to patients and clinicians of having these services permanently on-site needs to be considered, as do the cost savings due to patient transport not being needed. Nonetheless, the NHS as a whole will not be best served if there is over-provision in response to the pressure most trusts feel to acquire their own specialist equipment. Even assuming good business cases to be in place, it is open for debate whether NHS approval mechanisms will deal adequately with these pressures. Purchasers will need to have a clear view on how they wish to see local providers invest. Ultimately there may be a case for NHS Executive regional offices to exercise some regulatory function, perhaps based on a standard level of equipment per million population.

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**Exhibit 20**

**Options for finance and scope in acquiring new equipment**

The scope of the proposal and the financing mechanism must balance risks and flexibility.

**Notes**

1. Preventative maintenance and repairs
2. As (1), plus upgrades to maintain parity with new models
3. Finance leases will not normally pass the value for money test for private finance projects

**Finance**

<table>
<thead>
<tr>
<th>Scope of the deal</th>
<th>Single payment</th>
<th>Equal instalments over a fixed period</th>
<th>Fee per item of service</th>
</tr>
</thead>
<tbody>
<tr>
<td>Equipment only</td>
<td>Traditional outright purchases</td>
<td>Finance lease (3)</td>
<td></td>
</tr>
<tr>
<td>Equipment and care package (1)</td>
<td>Comprehensive package purchases</td>
<td>Operating lease</td>
<td></td>
</tr>
<tr>
<td>Equipment and life-cycle package (2)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Equipment and operating IT</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Audit Commission.
87. Business cases should also be carefully made out for proposals which are controversial or outside mainstream radiology, for example:

- acquisitions to be funded by donation or charitable appeal;
- radiographic equipment to be controlled by departments other than radiology;
- radiography based outside the hospital in community or primary care settings.

Purchasing and post-purchase review

88. The process of acquisition itself requires particular skills:

- writing specifications;
- negotiating on cost;
- dealing with administration, advertising and tendering so as to comply with legislation and avoid bureaucracy;
- ensuring that the terms of contracts and leases are as advantageous as possible.

NHS trusts should consider whether they have all the expertise needed in these areas or whether they need to purchase advice from elsewhere.

89. Finally, NHS trusts should review the process of acquisition once the project has been implemented. All projects benefit from post-project evaluation (PPE), and it is mandatory (Ref. 22) for all projects over £1m. The purpose of PPE is to improve project appraisal, design, management and implementation. It can help managers ensure that all potential benefits of a project are realised and remove any feeling that preparing a business case is a paper exercise in which comprehensiveness and accuracy are of little account. The evaluation should be conducted when the investment has been in use some time and normally within 12 months of commissioning.
Recommendations

1. Radiology managers should:
   - produce robust business cases to justify all future replacement and acquisition of assets, showing in particular that:
     - existing equipment is being used to the full;
     - the investment meets clinical needs and priorities of the hospital and local GPs and commissioners;
     - income will be generated to meet the costs of capital and running costs;

2. and in order to do this:
   - keep equipment and room utilisation under regular review;
   - consider options of buying specialist services, such as MRI and interventional work, outside the trust.

3. Radiology managers should also:
   - outline the capital investment decisions affecting their departments five to ten years ahead, showing the broad financial implications and the key business planning issues about each;
   - work with the finance department on leasing and private finance options, concentrating not merely on the formal rules, but on good practice in working with suppliers and finance houses.

4. Directors of finance should:
   - assist radiology departments to identify income streams associated with capital decisions, and move towards allowing them to retain such income.

5. Commissioning authorities should:
   - take a clear view about what major capital investment they will support and on what basis they will fund the revenue consequences.
The pace of change in radiology will demand a high quality of strategic thinking.

Technological advance will affect both radiological procedures, and administration and communication.

Pressures for community-based radiography will raise difficult questions about costs and quality, as will new patient-centred facilities that may wish to include radiology.

New roles for radiographers and support staff will have to be reflected in any locally negotiated pay and conditions.
The future of radiology

90. There is a pressing need to sort out the problems within the current structure, and departments must also face increasingly radical changes as radiology moves into its second century. These include:

◆ technological advances in imaging, communication and administration;
◆ changes in clinical practice; and
◆ extended roles and new career structures for staff.

91. Some of the possibilities described in this final chapter are expensive, but they already exist, either in the United Kingdom or abroad. Departments need to start considering the options now, if their response is to be strategic rather than piecemeal, proactive rather than reactive. And the profession needs to make sure that:

◆ radiology is put firmly on the NHS research and development agenda, and new procedures are properly evaluated in terms of the balance between cost, effectiveness, safety and acceptability; and that
◆ it takes the lead in marketing innovative practice to clinical colleagues and purchasers.

Technological advance

92. The varieties of technically feasible examination are already legion: surgery guided by real-time MR, three-dimensional and holographic images, and positron emission tomography (PET). Technology already exists to transform both imaging and administrative tasks. Some developments in imaging will offer better alternatives to conventional radiological procedures, in the same way that cardio-vascular examinations and MRI of the brain and spinal cord are replacing procedures which caused the patient more discomfort and even some risk. Information technology also has the potential to transform administrative systems, by allowing examinations to be requested direct from terminals on the wards and in clinics and surgeries. Data can be passed easily between clinical and administrative functions, as computer networks begin to serve the whole hospital, and digital radiological equipment allows images to be stored and transmitted electronically. Electronic links between health care facilities (hospitals and health centres) open the way for images to be immediately available to specialists.

93. The potential exists for information technology to transform every stage of the radiological process (Exhibit 21), but the capital funding required for widespread implementation would be immense. There has been insufficient evaluation of costs and benefits in the past. But recently the NHS Executive has commissioned evaluations of:

◆ PACS (picture archiving and communications systems) from the Health Economics Research Group at Brunel University;
◆ the place of MRI in the district general hospital, and the use of imaging in the management of back pain, within the Health Technology Assessment Programme.
National and local research programmes should continue to cover studies such as these.

**Changes in clinical practice**

94. The changes in clinical practice that will be important in shaping the radiology service of the future include:

- community-based radiography; and
- the move towards patient-centred care.
The current objective of developing services in primary care settings is a decentralising force that pulls in a different direction from the concentration of high-technology investment in centralised hospital departments. Some GP practices have begun to offer basic x-ray and ultrasound examinations on site, either by installing equipment permanently, or by hosting a mobile service (Case study 8).

The growing interest from GP fundholders in particular is likely to lead to further development of such services (Exhibit 22). The benefits of easier access for patients, and more control over service delivery for the GP, are obvious, but it is not clear whether they outweigh the possible problems and the extra cost. The cost to the fundholder of a practice-based service may in some cases be lower than the hospital’s contract sum; however, the cost to the NHS as a whole may be higher if all that happens is that extra equipment is being provided to deal with the same level of demand. Whoever manages the service (and that can be either the practice itself, an NHS hospital, or a private provider) must show that the benefits are achieved with the fewest possible problems (Box 6, overleaf).

The idea of ‘patient-centred care’ is that a small team of multi-skilled health workers can provide most of the care patients need more efficiently and effectively than a large assortment of professionals who are physically scattered all over a hospital site, not least because communication within a small team is easier. The debate about whether to entrust any diagnostic imaging to such a patient-centred team is ongoing. Many of the benefits and problems associated with community-based radiology also apply to radiology within the patient-centred hospital. Radiology services will be among the most difficult to incorporate successfully into the model, if only because of the high capital cost involved. Small workloads and low utilisation mean that ward-based equipment will incur significant additional unit costs. Nevertheless the quality benefits can be high (Case study 9).

The changes in technology and clinical practice outlined above will inevitably call for radical rethinking in the third area of major change: staff competences and career structures.

- The grading structure for radiographers agreed by the Whitley Council (Ref. 24), based as it is on supervisory responsibilities and unsupervised duties, is now widely regarded as unsatisfactory. NHS trusts will need to move towards more flexible pay schemes which relate the remuneration of individual radiographers to their skills and competences, both professional and managerial.

- Traditional demarcation lines between the work carried out by radiologists, radiographers, departmental helpers and staff in other departments have been softening for several years. A growing volume of literature attests that radiographers and other staff can be fully capable of undertaking extended roles. For example, radiographers now give intravenous injections and in some places supervise barium examinations; some A&E nurses can request...
Case study 8
Radiography in a GP’s surgery
Cross Keys Practice, Princes Risborough

The Cross Keys is a fundholding practice about eight miles from the two nearest hospitals. Following a marketing exercise by one of the hospitals, the South Buckinghamshire Trust, a mobile x-ray set was provided at the practice by the trust. Two part-time radiographers together provide a basic x-ray service (Körner categories A and B only) for three sessions a week. Films from the morning session are taken by the radiographer to the hospital and reported the same afternoon.

The reasons for setting up the service were:
- for the convenience of the patients; and
- to complement other services, such as outreach clinics, being provided at the practice.

The practice had no particular criticism either of the technical quality of the service previously provided, or of their direct-access referral rights to the hospital.

Patients have welcomed the improved access, since many can walk to the practice. They have commented on the friendly, individual nature of the service in the practice, although the actual waiting times may be no longer at the hospital.

As regards costs, the number of examinations per session is lower than a hospital department could achieve, but this has to be set against the low cost of the equipment and the small building area used.

Case study 9
Radiography within patient-centred care
Kingston Hospital NHS Trust

Kingston Hospital has installed a general x-ray room within its 114-bed general medical unit. The two radiographers who staff the room on a job-share basis are professionally responsible to the main radiology department, but act day to day as members of a patient-centred team. As such, they carry out a variety of non-radiographic care for patients, including helping with endoscopies.

The way general x-rays are provided for the patients has altered radically as a result. Arrangements can be made directly by professionals on the ward; the 20-minute journey to the main department and the subsequent wait there are things of the past. The technical quality of the service is maintained through links with the main radiology department. Communication is greatly simplified, since one quarter of the steps in the process of obtaining an x-ray have been eliminated and the number of staff necessarily involved has dropped from ten to five. With the single exception of the time required for films to be reported by the radiologists, there is no doubt that the unit is now able to offer a substantially improved service to its patients.

The financial case, however, has yet to be fully made out. Although there are considerable efficiency savings in portering and handover time, the volume of work carried out on the equipment is low, typically only ten examinations, mostly of the chest and limbs, per day. The unit costs associated with the equipment itself – capital charges and maintenance – are therefore much higher than in a centralised department. Usage will increase due to the opening of an elderly assessment unit on the same floor, and this will help towards balancing the cost of equipment.

x-ray films. The possibility that radiographers could be trained to interpret certain images is of particular interest, in view of the difficulties that some departments currently experience with the reporting service. These changes have been driven in part by the need for medical staff to respond to the increasing volume of work and the desire to specialise, in part by radiographers’ professional desire to increase their own competence.
Managers should encourage such flexibility wherever it increases efficiency or benefits patients, provided it takes place within proper arrangements for delegation. These include safeguards such as suitable training and back-up, participation in audit and provision of a formal letter of delegation.

◆ In addition to extending the role of radiographers upwards, there is scope for radiographers to delegate some of their more straightforward work to assistants. NHS trusts and training bodies may even find it worthwhile to consider training non-radiographers (such as the current helpers) to take a limited range of basic x-ray images. It could, for example, be efficient and effective to have such an assistant working in parallel with a radiographer in the general rooms of a district hospital, carrying out the more basic x-ray procedures on the relatively healthy patients.

Conclusion
99. The benefits of these changes will not be fully realised if they are introduced without forethought, or have to be imposed on reluctant hospitals and departments. In the past, the management task has been seen as an operational one, keeping the work going and gradually expanding as new technology can be financed. Now, however, there is an extra challenge: to prepare for strategic change and seize the opportunity to implement it. This will demand good business planning, imaginative use of statistical information, and an awareness of the needs of clinical colleagues and the views of patients, to an extent that has seldom been demonstrated in the past. Developing these skills will ensure that clinical radiology makes the most effective contribution to the NHS as it enters the twenty-first century.

Box 6
Community-based radiography: a checklist for purchasers and providers

Ensure high standards of service:
- Comply with referral guidelines – demonstrate that inappropriate examinations are not being done just because the equipment is there.
- Liaise with nearest hospital over film storage and records of patients' examinations.
- Review with peers the quality of images (and of ultrasound interpretation).
- Keep staff formally trained and up to date with their skills and practice.
- Review radiation protection regularly (x-ray only).

Reduce unit costs:
- Use equipment and accommodation that are small, consistent with a community setting.
- Maximise throughput by encouraging widespread use of the service locally.

Review benefits obtained:
- Better access for patients and GPs.
- Radiography provided as part of a package of local services.

Source: Audit Commission.

Currently, any person employed by the NHS as a radiographer must have state registration (regulations made under the Professions Supplementary to Medicine Act, 1960).
Recommendations

1. The Department of Health and national professional bodies should:
   ◆ commission more evaluation of technological and clinical innovation, dealing both with costs and with benefits to clinicians and patients.

2. Commissioning bodies should:
   ◆ review the costs and benefits of basing radiographic services in the community, as part of their strategies for increasing the amount of service provided in a primary care setting.

3. Trust personnel directors should:
   ◆ move towards a more flexible pay and grading structure for radiographers.

4. Clinical directors should:
   ◆ consider delegating more of the work traditionally performed by radiologists and x-ray nurses to experienced radiographers, subject to careful authorisation and detailed audit.
Action Checklist

1  Managing the workload
   ◆ Circulate referral guidelines to hospital clinicians and GPs.
   ◆ Address inappropriate radiological requests in the clinical audit programme.
   ◆ Establish clear agreements between radiology and referring clinicians on service level and quality standards.
   ◆ Move towards internal trading as soon as hospital information and financial systems allow.

2  A better quality service
   ◆ Assign individual responsibility for ensuring that quality initiatives continue and that recommendations are followed up.
   ◆ Allocate responsibility for helping patients with problems before, during and after their time in the department.
   ◆ Institute ‘hot’ reporting systems.

3  Becoming more efficient
   ◆ Review the workload of all staff including radiologists and assign objectives – are all staff contributing fully to the department’s objectives?
   ◆ Use appointment systems to smoothe out arrival patterns in the department.
   ◆ Use economical out-of-hours remuneration.
   ◆ Assign responsibility for improving management information.

4  A more appropriate asset base
   ◆ Rationalise the use of existing rooms and equipment based on a review of occupancy.
   ◆ List the business cases likely to be required over the next few years and begin to collate the information needed on:
     - performance;
     - user views;
     - running costs;
     - alternative technical and financial solutions; and
     - demand, income streams and competitors.
Into the second century

- Examine the scope for proper delegation of clinical tasks.
- Review decentralised services in the hospital and in the community in terms of costs, benefits and development options.
- Introduce elements of pay and grading for radiographers which directly reward skills and experience.

Actions for other hospital departments:

- Identify within their business plans any developments which will increase the workload in radiology and discuss the financial implications.
- Take an active part in joint clinical meetings, for example, to improve their pattern of requests.
- Notify the radiology department promptly of in-patient requests and of additional or cancelled clinics.
Directors of radiology and trust senior managers are under pressure to respond to the rising demand for radiology services by increasing the number of professional staff. Before they make the decision to recruit an additional radiologist (at a cost of around £60,000 a year) or radiographer (around £20,000 a year depending on grade), they need to be sure that all the available opportunities to make savings have to be taken.

Note: The scope to make savings varies widely. The savings quoted indicate what might be achievable in a typical non-teaching department. It will not be possible in every department to achieve the savings identified under the various headings, but it will always be useful to pose these questions:

- have inappropriate requests been reduced as far as possible?
  - saves consumables at once – up to £10,000 a year;
- does the department have assets that are surplus to requirements?
  - have they been taken out of service?
    - saves maintenance immediately – typically ten per cent of the asset value;
    - eventual saving on capital when planned replacement of surplus equipment does not occur – whole of asset value;
    - eventual value of space released – depends wholly on local circumstances;
- is the mix of skills right?
  - are tasks delegated properly within the structure of the department?
    - remove a ‘working’ radiographer post that is not justified by the workload (£15,000 a year);
    - replace basic/senior radiographer time with helpers (£7,000 a year);
    - regrade ‘long term service award’ superintendent post (£5,000 a year);
- is the out-of-hours service provided on the most economical basis (often £50,000 a year)?
Appendix 1: Surveys of Patients and Clinicians

This report has emphasised throughout that departments need to understand users' views of the service. On this principle, the study team when visiting a hospital made opportunities to meet referring clinicians, ward nurses and local GPs to obtain their views of the service. Additional information was subsequently strengthened for two user groups:

- hospital clinicians, because of the wide range of views held by those in different specialties, and because these clinicians largely determine the demand for hospital radiology; and
- patients, whose viewpoint had not been directly investigated by the Commission team.

There is not enough space in this document to report the findings in full. It is intended to publish them elsewhere, probably in appropriate professional journals, during 1995.

Hospital clinicians

A simple two-page postal questionnaire was sent to 950 clinicians randomly chosen across England and Wales during May and June 1994. The total was made up of: 200 each of general surgeons, general physicians, orthopaedic surgeons and A&E consultants; and 50 each of neurosurgeons, paediatricians and geriatricians. Respondents were given a list of aspects of the service (Box A, overleaf) and asked to rate:

- the importance of each aspect to them, on a five-point scale from 'crucial' to 'irrelevant'; and
- the quality of each aspect of the service in the NHS hospital where they did most of the work.

A response rate of about 50 per cent was obtained.

Patients

The purpose of this survey was to give patients an opportunity to speak about the whole process, starting when they were told that they needed an x-ray or scan, through to receiving the final results. Structured interviews were carried out soon after the examination, normally in the patient's own home. Respondents were aware that they were talking to someone unconnected with the hospital and not involved in their care.

ICM Research Ltd won the contract to carry out this work.

Five hospitals participated in this part of the study. These hospitals selected patients from their records and wrote to them inviting them to participate. The objective was to cover a mixture of different radiological procedures:

- abdominal ultrasound;
- limbs/extremities;
- chest x-ray;
CT of the head;
MRI of the spine;
barium enema;
arteriogram or venogram; and
mammogram.

About 80 patients volunteered to be interviewed, a response rate of about 25 per cent. However, the response rate was substantially higher for some of the more complex examinations and the survey is therefore more representative of these.

Box A
Service aspects assessed by the survey of referring clinicians

**Provision of diagnostic images and reports**
- Availability of old films
- Quality of images
- Speed with which urgent examinations arranged
- Speed with which non-urgent examinations arranged
- Radiologist reporting of all films
- Speed with which reports are returned
- Quality of reporting
- A broader range of examinations to be available

**Service to patients**
- Shorter waiting times for patients in the radiology department

**Advice and consultation**
- Radiologists’ availability for consultation
- Constructive helpful advice
- Joint clinical meetings
- Action to reduce the burden of inappropriate examinations
Appendix 2: Cost Diagnostic

Introduction

This Appendix outlines a diagnostic tool which the study team has developed and which will help audited radiology departments to compare their own costs with those at other hospitals.

The diagnostic is a spreadsheet in which the costs of each of over 200 different radiological procedures have been identified separately under 11 different headings such as staffing, equipment, consumables etc. The diagnostic provides a way of assessing the resources normally required to perform the work of a radiology department. These can easily be compared to actual expenditure levels (Exhibit A).

Exhibit A
Typical output from the diagnostic

In this example staffing levels are roughly as expected, but equipment costs are high.

Source: Audit Commission.
The diagnostic is easy to apply (Exhibit B). The input to the diagnostic is simply the numbers of each individual procedure performed by the department in a year. The output is a series of expected total costs based on the performance observed by the study team at hospitals throughout England and Wales.

Source: Audit Commission.
The diagnostic is needed because:

- Körner units, the current standard system in England and Wales, do not accurately quantify the resource implications of workload (Exhibit C).
- Radiology departments and managers need to compare expenditure under different areas to help them know what to do.

Exhibit C
Körner classification

While useful as a simple work measure, Körner units are not a good indication of overall cost.

Source: Audit Commission.
How does the diagnostic work?
The Commission’s diagnostic takes the number of procedures the department performs in a year, and for each procedure multiplies the number by an appropriate weight. These scores are then added up to give a total expected cost.

This expected cost can be further broken down into each type of resource in turn (for example, radiologists, radiographers, films and chemicals etc... eleven in all) because each individual weight can also be broken down into its component parts.

The weights are derived from the average costs of every procedure at 25 hospitals visited. Unlike Körner units, there is no error due to classifying the procedures into a smaller number of groups.

How accurate is it?
The study team has taken a number of steps to ensure the accuracy of the diagnostic:

◆ It used an identical full cost recovery method, which ensures that all costs are accounted for, at each of the study hospitals.
◆ Professional staff in each department determined the relative costs of procedures.
◆ The method of allocation varied depending on the resource in question but was consistent between hospitals. For example, staff costs and equipment costs were always allocated according to time taken.
◆ In order to get equipment costs at each hospital, each major piece of equipment was allocated to procedures separately, and the costs were then summed.
◆ A series of checks was made before calculating costs, including checking expenditure against budget reports.
◆ The calculated costs were agreed as accurate with each hospital before they were included in the model.

Do the results represent a comparison with national averages?
No. They represent a comparison with a particular set of 25 hospitals visited by the study team. They show levels of efficiency that are not merely possible, but in fact routinely achieved at these departments. Better performance is typically achieved by half of the hospitals visited.

How will the diagnostic be used?
The diagnostic has been developed as an audit tool. Auditors will use it as a starting point for their audits, along with other more qualitative indicators. In some cases, if the auditor is satisfied that the department is providing a good quality and timely service in an economic way, then the rest of the audit may not be necessary.
Appendix 3: Acknowledgements

Hospitals visited

During the winter of 1993/94 the study team visited the following hospitals to interview staff in radiology and other departments:

- Carlisle
- Chester (Countess of Chester and Chester Royal Infirmary)
- Frimley Park
- Hillingdon
- King's Lynn (The Queen Elizabeth Hospital)
- Leeds General Infirmary (United Leeds Teaching Hospitals Trust)
- Llandough
- Sunderland (City Hospitals, Sunderland)
- Sutton Coldfield (Good Hope NHS Trust)

Advisory group

The study team was assisted by an external advisory group consisting of:

- Professor Judith Adams
  Vice President and Dean, Royal College of Radiologists
- Dr Michael Brindle
  Consultant radiologist, King’s Lynn
- Mr Bill Corlett
  IT manager, Wrexham Maelor NHS Trust
- Mr Neil Crawford
  Tavistock Clinic consultancy unit
- Dr Claire Dicks-Mireaux
  Consultant radiologist, Great Ormond Street
- Sir Terence English
  Consultant cardiac surgeon and Audit Commission member
- Mrs Valerie Edwards
  Past president, Society and College of Radiographers
- Dr Peter Isaacs
  Consultant physician, Victoria Hospital, Blackpool
- Mr David Powell
  Finance department, Lister Hospital, Stevenage
- Mr David Ralphs
  Consultant surgeon, Norwich and Norfolk Hospital
- Dr Elizabeth Wilson
  Department of Health
- Mr Sandy Yule
  Radiology manager, University Hospital of Wales

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*National Report*

**Improving Your Image**

*How to Manage Radiology Services More Effectively*
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