

Guidance on the management and governance of additional radiotherapy capacity

Institute of Physics and Engineering in Medicine
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The Royal College of Radiologists

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Foreword

There is a need to increase radiotherapy capacity to meet the current and projected requirements for radiotherapy services in the UK. This is being achieved in a number of ways and commissioners, and those involved in establishing additional facilities, need guidance on the professional and organisational standards that are required to run such additional facilities. Increased capacity can be achieved by extending working hours, constructing satellite units with an organisational relationship to a cancer centre hub, or new stand-alone units. This document gives guidance around the provision of new radiotherapy facilities and is a joint publication from the three professional bodies involved in the provision of radiotherapy services – The Royal College of Radiologist, the Society and College of Radiographers (SCoR) and the Institute of Physics and Engineering in Medicine (IPEM).

As guidance produced by the three professional bodies, this is applicable to the whole of the UK and to any provider, either in the NHS or private sector. The aim of the document is to give guidance to those commissioning and, subsequently, planning, constructing and staffing additional radiotherapy treatment capacity.

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Introduction

The Royal College of Radiologists (RCR) published a document for *Guidance on the Development and Management of Devolved Radiotherapy Services* in 2004.¹

Since then, a number of such units have been set up using a number of different service models.

This document summarises the practical issues to be considered in developing a new radiotherapy service and describes the service models that have been developed.

It should support and inform those with responsibility for commissioning and providing additional radiotherapy capacity.

It should be read in conjunction with key publications (see references).

This guidance applies to services for external beam radiotherapy. Services for brachytherapy and radionuclide therapy are outside the scope of this document.

1. Establishing the case for increased radiotherapy capacity

A. The case for increased radiotherapy capacity

In the UK, the need to increase the capacity of radiotherapy services has been described in:

- *Cancer in Scotland: Radiotherapy Activity Planning for Scotland 2011–2015*²
- *Radiotherapy Equipment Needs and Workforce Implications 2006–2016 (Wales)*³
- National Radiotherapy Advisory Group (NRAG) report, 2007 (England)⁴
- *Cancer Reform Strategy in England 2007*⁵
- *Improving Outcomes: a Strategy for Cancer, 2011*⁶
- The Malthus Programme, 2012⁷
- Department of Health National Radiotherapy Implementation Group. *Radiotherapy Services in England 2012*.⁸

The 2012 Department of Health report on radiotherapy services in England stated that a 67% increase in radiotherapy capacity would be required by 2016. It reported that a 45% increase in patient attendances is required *now* to close the gap in attendances.⁸

In Scotland, in 2006, the Radiotherapy Activity Planning Group advised on the increased demand for radiotherapy for 2011–2015 and the consequent need to increase radiotherapy capacity.²

In Wales, in 2006, the Cancer Services Co-ordinating Group advised on the need to increase radiotherapy capacity between 2006 and 2016.³

In Northern Ireland, the need for further increased capacity after 2015 has been recognised. A second radiotherapy unit is being planned.⁹

B. Improving patient access to radiotherapy services

The *Cancer Reform Strategy (2007)* stated that, 'Additional radiotherapy equipment will be needed in many parts of the country. Local decisions will need to be made regarding the siting of additional capacity, with patient convenience being taken into account. Where it is agreed to develop radiotherapy services on new sites these should be formally integrated into the existing network of radiotherapy provision.'⁵

Patients must be involved in the decision-making on provision of cancer services and detailed project planning for increased radiotherapy capacity.

The DH report on *Radiotherapy Services in England 2012* stated that the uptake of radiotherapy treatments by patients is known to diminish with distance travelled by patients to reach a radiotherapy centre.^{8,10} In England, the 2007 National Radiotherapy Advisory Group (NRAG) report advised that ideally patients would have no more than 45 minutes' travel time to their treatment, although, for some highly specialised services, patients may need to travel further.⁴ In Scotland, a maximum travel time of 60 minutes has been advised.²

C. Financial planning, commissioner support

The case for increased radiotherapy capacity and optimum sites for additional equipment should be developed in discussion with, and supported by, commissioners of services.

From April 2013, radiotherapy services in England will be commissioned as a specialised service by the NHS Commissioning Board (NHS CB). This will mean that more strategic decisions about service needs and the location of facilities can be made. Services will be commissioned against a national service specification. Exact arrangements have yet to be finalised but it is expected that existing and prospective radiotherapy providers will work with commissioning teams covering local areas on behalf of NHS CB to agree services.

A national mandated tariff for radiotherapy will be implemented from April 2013. This recognises the extra complexity of certain types of radiotherapy such as intensity-modulated radiotherapy (IMRT).

Although it is recognised that improved patient access to radiotherapy is essential, this will often mean setting up devolved radiotherapy services which may be more expensive to operate. Extra costs are inevitable because of the duplication of some essential staff posts. There is no plan for the national tariff to recognise any difference in the costs of providing a devolved radiotherapy service.

Experience has shown that it is essential for clinical teams to engage actively with the commissioning process to ensure that commissioners understand the nature and complexity of the radiotherapy service.

D. The cancer network (or equivalent)/clinical networks

Additional radiotherapy capacity will be considered as part of the regional cancer network, or its equivalent. The service will be represented on the network radiotherapy group.¹¹

The cancer network tumour-specific groups are responsible for agreeing patient clinical management guidelines. The cancer unit and cancer centre multidisciplinary teams (MDTs) will follow these agreed guidelines. These will include the radiotherapy clinical pathway (see Section 9 and Appendix 1. Clinical Pathways).

Cancer networks will wish to see a flexible service that fits with patient needs. If this requires patient care to be provided across several sites it is essential to establish a clear clinical pathway for the patient (see Section 9).

The cancer network will have a view on the location of additional radiotherapy capacity to ensure effective integration of the new radiotherapy service into existing clinical pathways (see Section 2).

Clinical pathways should be agreed by the network radiotherapy group.

E. Clinical networks (Scotland)

In Scotland, there are three regional clinical networks. Decisions on the need for additional radiotherapy capacity are made at national level. The Radiotherapy Programme Board advises the Scottish Cancer Taskforce within the Scottish Government.

F. Workforce planning

It is critical that service leads recognise the importance of liaising with those responsible for strategic workforce planning in their region. Consideration must be given to identifying the required increased workforce numbers and skills ahead of any new service capacity becoming clinical. This will necessitate effective communication with the appropriate education commissioners at the earliest opportunity.

Summary

The case to improve patient access to radiotherapy in the UK has been made in previous reports. Service providers and their clinical teams must engage actively with commissioners to agree financial support for additional radiotherapy capacity. A new radiotherapy service must be integrated into the existing network of cancer services. Advanced workforce planning is needed to secure adequate radiotherapy staffing.

2. Developing additional radiotherapy capacity: project management

A. Multidisciplinary involvement in project management

Developing additional radiotherapy capacity will require multidisciplinary involvement in a group to manage the project. A high level of project management is required with clear lines of accountability. Timetables for implementation are essential to deliver an effective service on time and within budget. The project team will need to have capacity within their job plans to be able to dedicate adequate time to the project. The specific costs of this must be recognised and provided for.

B. The project group

This will include:

- Finance, executive, procurement and legal teams of the relevant trusts (or health boards in Scotland)
- Architectural, building, estates teams
- Radiotherapy medical physics experts
- Information technology teams
- Clinical oncologists
- Therapeutic radiographers
- Patient representatives
- Input from clinical networks/specialist commissioners (as required).

A project lead with radiotherapy experience should be identified.

Early identification of key staff, such as the lead radiographer, lead medical physicist and information technology lead, will ensure that the service is fit for purpose.

C. Scope of the project/level of the clinical service

The scope of the project needs to be clearly defined. This will be based on the options identified within Section 3, and the clinical models of patient care required. An early appraisal should be made of the financial costs of the proposed clinical models for patient care. Experience has shown that there is a potential for conflict between the financial constraints and the aspirations of the clinical teams.

The overriding principle is to establish a clinically safe and effective organisation to provide radiotherapy services.¹² Issues concerned with the selection of patient groups to be treated and the level of clinical support needed to provide a safe service should be addressed early in the project (see Section 9). The level of service required will lead on to assessments of equipment needs and staffing levels. These will feed back into the cost appraisal process, leading to a final decision on the scope and financial costs of the project.

D. Local demand for radiotherapy

The project group will need to give an estimate of the demand for radiotherapy for the local population. In the past, national data (such as those in the reports for England, Scotland and Wales noted in Section 1a), local data on the incidence of cancer and information on population demographics were combined to give estimates of the local demand for radiotherapy. These estimates can be difficult when there are variations in clinical practice in radiotherapy; for example, fractionation in external beam radiotherapy for prostate cancer.

The National Cancer Action Team (NCAT) therefore commissioned the 'Malthus' modelling tool for radiotherapy demand.⁷ This tool uses evidence-based radiotherapy decision trees based on UK clinical practice and local cancer incidence data. From this, it calculates radiotherapy demand requirements and can model forward to take account of changes in cancer incidence as the population ages. 'Malthus' is a decision aid for planning and commissioning radiotherapy services at a local or regional level.

Consideration of radiotherapy capacity and demand is essential for the provision of a needs-based service. This aim is to ensure that patients do not again experience long waiting times for radiotherapy to be available.¹³ Treatment should be delivered in line with the guidelines set out by the Joint Collegiate Council for Oncology.¹⁴

There are three key indicators to consider:

- Activity is a measure of what the service produces: the number of patients treated per year or the number of patient attendances per week
- Demand is the population requirement for radiotherapy: it can be modelled in terms of fractions per million of the population
- Capacity is the potential number of patients who can be treated (attendances) or fractions which can be delivered in a unit of time. As patients are referred in a random way, demand varies from week to week and if capacity is inadequate, waiting lists build up. To be able to treat patients in a timely way and comply with waiting times standards, services need to plan for a 13% greater capacity than average demand.⁴

E. Communication

Patient involvement will allow the expectations of the local population to be effectively expressed. Proposals for the clinical service should be communicated clearly to referring clinicians and providers of local clinical services so that a clear understanding of the local needs for the radiotherapy service is achieved. This should reduce the risk of developing a service which does not meet local needs and expectations.

Summary

Detailed planning is required to assess local patient needs for radiotherapy. A multidisciplinary project management team, with a radiotherapy lead, should agree the scope of the local service and the resources needed to provide a clinically safe and effective service for patients.

3. Expansion of radiotherapy services

A. Providing additional radiotherapy capacity

Options for providing additional radiotherapy capacity include the following.

- Providing additional radiotherapy capacity at an existing centre – this option may not improve patient access to radiotherapy as travelling times for some patients may remain a problem. Providing space for additional building/car parking may also be a problem.
- Setting up a devolved radiotherapy department, with links to a cancer centre, at a location based on an acute hospital site – a number of these devolved/linked departments have been set up in the UK.
- Setting up a devolved radiotherapy department, with links to a cancer centre, at a location other than an acute hospital site – experience has shown that this option has considerable implications for patient safety, case selection and clinical governance (see Section 9). Some devolved radiotherapy units provide treatment only, with no facilities for radiotherapy treatment planning.
- Setting up a fully independent department:
 - Able to treat a wide range of patients, referring elsewhere only selected rare or complex cases, or
 - Able to treat a selected group of patients only.

A number of long established cancer centres work across split sites. The key is to establish clear responsibilities for management and clinical governance (see Section 4).

If additional radiotherapy is planned at a devolved or linked site, technical standards must be high, meeting national standards, with access to modern radiotherapy techniques such as IMRT and image-guided radiotherapy (IGRT).^{12,15}

B. Location of additional capacity

An analysis of patient access to a proposed site, with early involvement of patient groups is essential. Accessibility to existing transport links is a major consideration.

Relationships to existing oncology services should be considered; for example, chemotherapy services.

Relationships to surgical services and other existing patient pathways will also need consideration.

There may be implications for neighbouring radiotherapy services. Discussions between commissioners, providers and networks must take these issues into account.

C. The size of the radiotherapy unit

A minimum of two linear accelerators is recommended to ensure continuity of service.^{1,4,11}

There should be access to treatment simulation (CT simulation) unless a treatment-only unit (as discussed in Section 3A) is planned. Mould room facilities should be considered.

A decision to provide a single linear accelerator service has implications for the scope of practice of such units. UK experience has shown that providing a service with a single linear accelerator will restrict the range of patients treated. The risk of an interruption in a patient's treatment course is increased in such a unit. Given this, such units tend to treat The Royal College of Radiologists (RCR) category 2 patients¹⁶ such as those with early breast and prostate cancer.

The Australian experience of providing single linear accelerator units is of interest.¹⁷ The appraisal of the project concluded that single machine services could work effectively if linked to a cancer centre 'hub', working with joint clinical protocols. The review also advised that such units should be seen as an interim development step and any further units should have at least two linear accelerator bunkers.

The UK experience of devolved radiotherapy units thus far would favour units with a minimum of two linear accelerators, to facilitate engineering maintenance and servicing, with improved continuity of service (see Sections 3D and 10).

This will ensure the best clinical outcome for the patient and the most efficient use of the radiotherapy service.

D. Implications for capacity planning of time needed for equipment quality assurance (QA) testing and maintenance

When calculating the radiotherapy capacity needed for a local population, careful consideration should be given to the impact of necessary equipment QA and maintenance on the availability of equipment for patient treatment. This equipment 'downtime' can be kept to a minimum by appropriate planning (see Section 10). In addition, there is a need to plan for a 13% greater capacity than average demand (see Section 2D). While larger units may be able to justify using an additional linear accelerator in rotation to ensure that there is no drop in capacity due to QA testing and equipment servicing, this is impractical for smaller units and the time needed for these activities must be factored in to the calculation of capacity.

E. Scope for future development

The location of the unit and the detailed building plan should give careful consideration to the possible need for additional accelerator capacity. Several UK units have ensured that foundation work is carried out to allow future building of additional linear accelerator bunkers.

UK experience has shown that improved patient access to radiotherapy leads to an increase in clinical referrals for radiotherapy. Newly established sites have seen that their workload has increased beyond that originally planned.

The project must also consider the need for equipment replacement and plan accordingly (see Section 6E).

Summary

Options for providing additional capacity include setting up devolved radiotherapy departments with links to a cancer centre hub. Convenient patient access to the new service is an important consideration. A new unit should have a minimum of two linear accelerators. The building plan should consider the possible future need for additional accelerators.

4. Management and clinical governance

A. Management structure and responsibilities

Whichever option for radiotherapy service delivery is agreed, as discussed in Section 3, it is essential that a management structure is in place with clear lines of accountability and responsibilities for all functions.

The Ionising Radiation (Medical Exposure) Regulations 2000 (IR(ME)R) set out the legal duties and responsibilities of the employer to provide this framework for accountability.¹⁸

In England, national standards set out the appropriate organisational structure for the radiotherapy department.¹¹

The new service will be subject to external peer review; for example, national peer review, IR(ME)R inspection, and QA review (inspection by bodies such as the British Standards Institution [BSI]).

It will also be necessary to give 28 days' notice to the Health and Safety Executive of the intention to offer a new radiation service.¹⁹

B. Essential governance for a new radiotherapy service

For a *clinically safe and effective organisation* to provide radiotherapy services, it is essential to put in place the following:

- Clear professional leadership, with a lead therapeutic radiographer managing radiotherapy services, a lead medical physics expert and a lead clinical oncologist
- Comprehensive IR(ME)R documentation for the new service¹⁸
- A quality management system, with a process for QA in radiotherapy
- A system for reporting radiotherapy errors and near misses and analysis in line with best practice²⁰
- A consistent approach to patient care so that a high level of clinical service is maintained
- Structures and systems to support the continuing education and development of the workforce to meet changing service need.

C. Risk assessment

Before opening, a prospective risk assessment of the new radiotherapy service with independent dosimetry checks of radiotherapy equipment should be undertaken.²⁰

There is a need for an audit and analysis of radiotherapy errors and near misses, particularly in the early stages of the new service, to monitor patient safety events.

D. Definition of links between cancer centre and devolved radiotherapy units

If a devolved radiotherapy unit is established with links to a cancer centre, there should be a single management structure with integration of the devolved radiotherapy service.

This will facilitate the establishment of the essential governance structures, described in Section 4B.

E. Quality management system, radiotherapy error and near miss reporting

The new radiotherapy service must have an externally audited quality management system in place, with clear QA radiotherapy documentation.

For linked units, it is essential that such documentation is easily accessible across all sites, preferably by IT systems (see Section 5). The documentation should be consistent across all sites and provide essential site-specific documentation. Time should be allocated to this task to ensure that high standards are maintained, that the documents reflect up-to-date practice across linked sites, and that the advice contained in them is applicable at all sites.

A system for radiotherapy adverse incident reporting, with reporting of radiotherapy errors and near misses, and analysis should be in place. For linked units, the same reporting system as that used in the cancer centre hub should operate, with a shared review process for adverse incidents. It is good practice to ensure that the

incidents from all sites are shared to identify trends and to learn from issues that occur. Reporting and analysis should follow guidance for best practice.²⁰

F. Communication

It is essential that there is a clear and reliable communication system in place to ensure:

- i. The availability of the lead radiotherapy service manager or their deputy on site
- ii. Rapid access to effective medical physics expert advice
 - A well-documented system for rapid access to effective medical physics advice should be in place to ensure that the service is compliant with IR(ME)R 2000.¹⁸
 - Clearly documented reliable lines of communication must be in place.
 - Rapid access does not necessarily mean the individual must be physically present on site. Rapid access is essential but this can be obtained via a mobile phone or paging system.
 - This is an important practical consideration when there are limitations on the availability of medical physics experts.
 - A formal risk assessment with identified contingencies in place for the issues raised by not having a medical physics expert always on site is essential.
 - Arrangements must be in place if working outside standard hours.
 - IT connections and full usage of the radiotherapy oncology management system will allow rapid communication to review data and offer relevant scientific, technical and clinical advice.
- iii. Rapid access to effective clinical advice (see Section 9).

F. Smaller independent/stand-alone units

While not the primary aim of this guidance, it is important that existing smaller independent/stand-alone radiotherapy units, which may be equivalent in size to some devolved radiotherapy facilities and provide patient access for smaller catchment populations of less than 0.5 million people, should meet all the criteria contained within this guidance document in terms of both clinical and technical quality, governance and risk management.

Summary

The new radiotherapy service must have clear professional leadership, comprehensive IR(ME)R documentation, a quality management system and a system for radiotherapy error reporting. A prospective audit of the service with independent dosimetry checks of radiotherapy equipment should be undertaken. There is a need for an audit and analysis of radiotherapy errors and near misses, particularly in the early stages of the new service. Systems must be in place to ensure rapid access to effective medical physics expert and clinical advice.

5. Information technology (IT)

A. Early involvement of IT professionals

Given that IT is an integral component of the functioning of the new radiotherapy service, it is imperative that a lead IT professional is identified and involved from the onset of the project. Working with the service design team and the building teams at an early stage is essential.

This will enable correct procurement and implementation of IT systems and ensure that IT support staff have a good understanding of the importance and intricacies of radiotherapy systems. This is vital for efficient IT-related problem solving.

B. IT systems: process mapping

At the project outline stage, it is useful to list the IT systems that will be required for the new service. It is essential to map out connections and the flow of data. This can be facilitated by process diagrams agreed by the professional groups involved.

IT links will facilitate timely linear accelerator installation.

C. IT links to diagnostic services

Links to the relevant radiology and pathology services in the network, the cancer centre hub where applicable, and the local host hospital (see Section 7C) are essential.

D. Radiotherapy planning

If treatment planning is not carried out on the new site, it is beneficial to have access to the treatment planning system at the main site from the devolved radiotherapy department to aid prompt assessment of treatment plan-related queries during treatment.

E. Communication

Communication between units can be enhanced with good quality facilities for teleconferencing and video links.

F. Electronic patient records

Experience has shown that using an electronic patient record facilitates communication between the professionals involved in patient care.

It is essential that clear clinical information about the patient is available at each step in the patient's clinical pathway. Errors have occurred when radiotherapy planning is undertaken in the absence of full clinical information. Relying on the availability of paper-based patient case notes for this purpose involves a degree of clinical risk that needs to be carefully assessed. Good access to clinical information, such as that in an electronic patient record, will reduce the possibility of clinical error. Details of any previous radiotherapy given to the patient should be available.

A paper-based system will not be feasible when units are geographically far apart with long journey times for case notes in transit.

Access to the patient's radiotherapy and oncology electronic record should be available for key medical personnel who are involved in the acute medical care of oncology patients. Systems that protect patient confidentiality and other data integrity must be used.

G. Patient administration systems

Methods must be in place to allow safe and reliable:

- Patient referral to radiotherapy services: patient booking for consultation, consent and planning
- Patient transfer between services providing their care
- Patient follow-up arrangements.

Summary

Information technology (IT) is an integral component of the radiotherapy service. IT professionals should work with the service design team at an early stage. Process mapping of the radiotherapy patient pathway ensures that IT staff will have a good understanding of the needs of the radiotherapy service. The use of an electronic patient record facilitates communication between the professionals involved in patient care.

6. Radiotherapy planning and delivery

Whichever option is chosen to deliver a new radiotherapy service, it is essential that a clear process for radiotherapy planning and treatment is established for all patients. The choice of equipment and systems will depend on the service model being planned (see Section 3).

A. Radiotherapy planning – CT simulation, CT, MR and PET scanning, and treatment planning systems

As discussed in the 2004 RCR document,¹ it is not necessary for radiotherapy scanning equipment in the linked unit to match that in the cancer centre, as DICOM standards allow compatibility. The benefit of a unit having its own CT simulation facility is that the department is essentially autonomous and patient travelling is minimised.

IT connections must be established between the scanning facility and planning system to enable access to the data. Clear protocols and procedures need to be agreed and in place to ensure the facility is used to its full capacity. This may include scanning of patients who will be treated at the cancer centre.

An alternative is to secure access to an existing diagnostic CT scanner for radiotherapy patients. However, there are issues that need to be considered in doing so: the scanner would need to be upgraded to make it suitable for scanning patients for RT planning (with a flat top, lasers and any other essential requirements for RT planning). Links to the treatment planning system would need to be established. A dedicated therapeutic radiographer would also be required to be present.

Access to MR and PET imaging that can be merged into the treatment planning system should be considered.

It may be possible to share information between different planning systems. However, problems may be encountered in transferring complete plans. If it is decided that treatment planning will be carried out at the linked unit, there are distinct benefits of having matched equipment; for example, in training and familiarity of use. Even if treatment planning is not carried out at the linked site, it is still beneficial to have access to the cancer centre's treatment planning system to aid prompt assessment of treatment plan-related queries during treatment. Although it must be acknowledged that staff at the linked unit may not always be experienced in treatment planning if this is not normally carried out at the unit. Safeguards should be in place to ensure that an inexperienced user cannot inadvertently alter a treatment plan.

Clear arrangements must be established to ensure that enquires related to patient treatment plans, falling outside an agreed protocol, receive a rapid effective response from a medical physics expert.

B. Radiotherapy delivery – linear accelerators (linacs)

Patients must have access, when clinically indicated, to modern radiotherapy techniques such as IMRT and IGRT. All linacs in the new service must be capable of both IMRT and IGRT.^{12,15}

The linacs at a devolved or linked unit do not necessarily have to match those of the cancer centre. However, the benefits of matching equipment must be considered in the decision process; for example:

- A possible reduction in linac and planning system model commissioning time
- The familiarity of equipment if staff are rotating between units
- QA/servicing protocols are already likely to be in place
- If treatment planning is carried out at the cancer centre for a linked unit, planners need to be familiar with a smaller range of linac characteristics
- Plans created for the linked unit will be valid for the cancer centre hub, enabling patient transfer in the case of breakdowns, if necessary.

Appropriate verification systems should be in routine use to ensure treatment accuracy. These will include portal imaging, cone beam imaging and *in vivo* dosimetry.²¹

'Horizon scanning' for new developments in radiotherapy technology and the need to be involved in clinical trials of such new technologies must be considered.

C. Superficial radiotherapy equipment.

An assessment should be made at the project planning stage to establish if superficial radiotherapy equipment for the treatment of skin cancers will be needed.

D. Mould room facilities

The increasing implementation of high-resolution multi-leaf collimators and IMRT is slowly negating the need for customised alloy blocks and electron end-frames – both often associated with mould room production.

The increasing use of thermoplastic shells which can be produced in a CT simulator environment, rather than vacuum-formed shells which traditionally required a mould room, may also diminish the need for a mould room facility.

There is no reason to develop a separate system for the production of complex immobilisation as long as compatibility is ensured by an agreed protocol. It may be useful for a unit to establish an agreement with a nearby larger centre for the production of such accessories. However, if changes need to be made during treatment, turnaround times may be a problem if facilities are not available locally. Therefore, facilities and staff to modify devices should be made available locally. There is likely to be a continued need for the production of individualised bolus material and local shielding in some cases.

E. Equipment replacement

Consideration will need to be given to a planned programme for equipment replacement. Given the recommended times for equipment replacement (software upgrades: three years, treatment planning hardware: five years, CT simulator: seven years, linacs: ten years), a capital replacement programme should be in place and agreed.

Consideration should be given to providing a bunker for decanting purposes to facilitate the installation of new linacs without disrupting the clinical service.

Summary

A clear process for radiotherapy planning and treatment must be established for all patients. Additional equipment will be needed for treatment planning such as CT simulation and a treatment planning system. The need for access to imaging such as MR and PET scanning should be considered. All linear accelerators in the new service must be capable of both IMRT and IGRT. Appropriate verification systems should be in use; for example, *in vivo* dosimetry. There should be a plan for subsequent equipment replacement to minimise disruption of the clinical service.

7. Relationship with 'host' acute hospital services

A commonly selected option for the location of new radiotherapy services is at an acute 'host' hospital site, as discussed in Section 3. A number of key relationships and services should be established to support this.

A. Basic infrastructure services

The project team will address the needs for basic infrastructure support for the radiotherapy facility: utilities, estate services and maintenance, equipment maintenance, cleaning, portering, translation services, catering and so on.

Relevant 'host' hospital staff will all require appropriate radiation safety training.

Access for fire safety is essential.

Transport arrangements for patients, including car parking for patients, is an essential consideration. Access to a hospital discharge lounge may be useful.

B. Implications for 'host' hospital diagnostic and support services

The likely needs for diagnostic and support services, particularly diagnostic radiology, pathology and pharmacy services, should be defined.

Depending on the scope of the radiotherapy service, additional diagnostic radiology capacity such as CT, MR and PET scanners may be required. This will have cost implications for the project.

Pathology and pharmacy services appropriate for the level of service required should be agreed.

Cardiology advice for patients with pacemakers may be needed.

Access may also be required for staff in the event of an injury such as needle-stick injury.

A series of service level agreements will be established. These will clearly set out the responsibilities of the services involved in the joint care of the patient.

C. IT services

The radiotherapy service will need access to the acute hospital information technology systems for pathology and radiology results, and the acute hospital patient electronic record.

Access to the 'host' hospital IT intranet will also be essential as many hospital services are booked in this way.

A reliable telephone system must be in place.

It can be anticipated that there may be compatibility issues between the IT systems in the radiotherapy unit and the 'host' hospital which will require IT solutions.

D. Pharmacy services

It is essential to document which staff are competent and approved to prescribe medication, and how that prescription is carried out (paper scripts, electronic prescribing and so on).

Non-medical prescribing should be encouraged and easily available.

Dispensing of simple medication commonly used for radiotherapy patients should be in place.

Protocols for controlled drugs should be established and audited.

Protocols for emergency drug provision should be in place.

E. Clinical support/resuscitation

It is essential to establish clear clinical protocols to manage patients who develop acute medical problems.

The 'host' hospital acute medical team should be involved and agree management for the expected range of clinical problems – from falls, faints, and simple seizures to the patient requiring major resuscitation. Referral pathways for inpatient admission should be agreed.

The need for specific inpatient beds for oncology use should be assessed (see Section 9D).

Resuscitation facilities with appropriate equipment and competent personnel should be available. The equipment should be the same as that of the 'host' hospital.

Policies for resuscitation and training methods commonly differ between hospitals and these should be jointly agreed. Compliance with training should be monitored.

An assessment should be made of the radiotherapy clinical team's competence in dealing with a patient collapse.

A service level agreement should be implemented and reviewed regularly.

If the radiotherapy service is not located on an acute hospital site, there should be a clear process on how to get access to emergency medical services (see Section 9B).

F. Staff training for local hospital procedures

It should be recognised that radiotherapy service staff will need induction and ongoing training in local hospital procedures such as resuscitation, fire training and infection control for example.

Clear methods for audit and inspection from both the radiotherapy unit and the local hospital should be identified and co-ordinated to prevent duplication.

G. Legal and contractual issues

Given the complexity and range of infrastructure service and clinical services required, it is important to allow sufficient time in the project planning process to agree legal and contractual issues.

Summary

A new radiotherapy service will need to establish a number of key relationships and services with the host hospital service on which it is based: basic infrastructure support and diagnostic, pathology and pharmacy services. Additional diagnostic radiology capacity may be needed. Access to resuscitation facilities with appropriate equipment and competent personnel must be available.

8. Professional staffing

A. Management of professional staff in a devolved radiotherapy service

Staffing and skills mix models must be designed and agreed with input from the radiotherapy manager, the lead medical physicist and the clinical director.

The best use of all workforce skills is needed to meet the needs of patients. Different skills mix models may emerge depending on the additional capacity service model chosen.

It is essential that staffing skills are continually developed. This must be supported with appropriate funding to ensure that the service is maintained and improved over time.

If additional radiotherapy capacity is set up at a devolved radiotherapy site with a link to a cancer centre (see [Section 3](#)), it should be agreed whether staff are managed separately in each of the departments or specified staff are rotated between sites.

This decision will often be influenced by local geography and distances between the departments; for example, the effect of travel times for staff groups.

For separate staffing, issues to be considered are:

- A core group of staff become highly trained in additional roles for the benefit of the satellite, trained in site-specific issues, equipment and procedures
- There may be greater flexibility in training needs, managing holidays, working hours and so on
- There is a possible improved potential for recruiting staff from a different geographical area (although this may have implications for neighbouring radiotherapy services)
- Staff may have more stability in place of work and arrangements such as transport, parking, childcare, work–life balance
- There may be improved staff morale with a cohesive team providing a local service
- There is a potential for isolation of staff from other centres
- There may be reduced opportunities for staff to gain experience of specialised radiotherapy techniques such as in paediatrics.

For a system based on staff rotation, issues to be considered are:

- Staff become familiar with working practices across all sites
- Specialist knowledge may be more readily available because a wider group of staff have experience of the linked site
- Staff have direct access at the main site to further training
- During staff shortages, it may be easier to redistribute staff
- Staff may maintain specialised skills by rotation back to the main site
- Rotation may give greater assurance about consistency of standards across sites
- There may be difficulty providing staff training in issues that are specific to each hospital site such as resuscitation, fire training, evacuation procedures, in a constantly changing group
- There may be difficulty in progressing professional projects with a staff group which constantly changes
- There may be difficulty with staff transport or child care. This has implications for recruitment and retention
- Increased staff travelling expenses may result.

Given these pros and cons, many units have adopted a hybrid of partly fixed and partly rotational staff.

Careful consideration is needed to ensure appropriate training for staff (see [Section 8J](#)).

B. Therapeutic radiographers

The radiotherapy service must be managed by a therapeutic radiographer.

Recruitment should allow the appropriate number of therapeutic radiography staff in accordance with the Society and College of Radiographers (SCoR) benchmark guidance.²² The four-tier career progression model should be implemented to ensure that all skills are used effectively for the benefit of patients.⁴ The most effective mix of the four tiers of therapeutic radiographer staff (assistant practitioners, practitioners, advanced practitioners and consultant radiographer practitioners) will depend on the local service profile and size of the unit.

The staffing structure should have appropriate allocation of grades and working practices. This will give staff flexibility to work across all areas.

Post-registration education and training should be offered to enhance workforce flexibility. In addition to the routine training requirements for link workers in resuscitation and manual handling, further training in additional skills such as intravenous cannulation, on-treatment review and supplementary prescribing will help streamline services for patients, particularly where radiographers are managing pathways of care as advanced and consultant practitioners.

Imaging review skills are essential to develop image guided radiotherapy.

There should be full access to continuous training with appropriate resources.

A practice educator role must be agreed to support the development of the workforce and students on clinical placement. It is important to retain staff and students through developing and embedding a learning culture from the outset.

In addition, therapeutic radiographers have the skills and knowledge to provide important links between the centre/unit and the community. The benefits of these roles should be explored when considering staffing structures.²³

Research is likely to become a core component of many clinical services. Appropriate levels of radiographer staffing with posts aligned to the Agenda for Change Researcher profiles should be identified and supported.

There should be flexibility in working hours to provide continuity of the service (see Section 10). Additional staffing within and beyond the radiotherapy service will be required to support extended working hours.

C. Medical physicists

Recruitment should allow the appropriate number of medical physicists in accordance with the guidance from the Institute of Physics and Engineering in Medicine (IPEM).²⁴

There is a clear need to agree flexibility in working to cover equipment servicing (out of hours or weekends), QA and out-of-hours treatments.

A medical physics expert must be available for consultation at all times during operation of the service. This may be via telephone, provided robust communication links are in place.

D. Radiation protection advisers (RPA)/radiation protection supervisors (RPS)

RPAs are generally not required to be on site; however, there should be a minimum of one RPS on site most of the time. This will allow working practices to be monitored as any changes can have implications for radiation protection which might escape the attention of visiting staff.^{1,25}

E. Engineers/technologists

Recruitment should allow the appropriate number of engineers/technologists in accordance with IPEM guidance.²⁴

There is a clear need to agree flexibility in working to cover QA, servicing, and out-of-hours working, with staff available on site.

It is particularly important to ensure that there is sufficient staffing to obviate the need for lone working. Lone working of engineering staff is a recognised safety risk and is strongly discouraged.

There may be need for staff to undertake additional roles to provide cover such as firstline IT support, equipment QA, for example.

The option of purchasing maintenance services from linac suppliers will need careful consideration. The potential implications for equipment downtime need to be included and specified in any contractual agreement. Equipment manufacturers may provide on-site engineering staff.

F. IT staffing

On-site support is essential at the start of a new centre. An assessment should be made of the staffing arrangements for continued IT provision.

Devolved or linked units will establish links with their hub IT service. Additional IT staff will be required to carry out tasks at the linked unit but also remotely on the hub main site. There should be clear rotas for regular visits by the IT service team to ensure ongoing issues are addressed. Spare IT equipment should be kept on site for replacement purposes.

G. Medical and nursing staff

The level of clinical support needed is discussed in [Section 9](#).

There are real advantages in enabling therapeutic radiographer and nursing staff with extended skill training to undertake patient consent, drug prescribing, on-treatment review and clinical examination.

Experience has shown that using a mixed skill clinical support team with medical staff, radiographers and nursing staff is an advantage.

H. Allied health professionals

Patients should have access to the full range of support and rehabilitation services needed for their care (see [Section 9](#)).

Access to other services such as patient information and social work advice should be available.

I. Administrative and clerical staff

A team that supports bookings, reception and appointments is essential.

Consideration should be given to extend their role to give additional support to the clinical team; for example, providing training to the level of health care assistant for phlebotomy, basic clinical observation skills, glucometer usage and so on.

Clerical support is also required to arrange patient appointments, discharge letters and follow-up appointments.

J. Staff training

Very careful consideration must be given to how staff training will be achieved and staff competence maintained. The issues discussed in [Section 8A](#) concerning staff rotation need to be addressed.

Methods such as e-learning, video conferencing and so on should be used to facilitate training. This should reduce staff travelling for training, and improve staff availability for clinical duties.

The additional costs of providing training must be recognised in project planning.

There will be a requirement to introduce additional on-site radiation protection assessment, local rules, environmental audits and additional training to on-site staff not familiar with radiation areas.²⁵ These need to be integrated into current monitoring systems.

K. Training a future workforce

New centres offer new and additional opportunities for clinical training of the future workforce. It is critical that service leads recognise the importance of liaising with those responsible for strategic workforce planning in their region. Consideration must be given to identifying the required increased workforce numbers and skills ahead of the new service capacity becoming clinical. This will necessitate effective communication with the appropriate education commissioners at the earliest opportunity.

Service leads should work with education providers to explore the potential and work jointly to ensure the new service has all the requirements to support the development of clinical placements for therapeutic radiography, medical physics and clinical oncology workforce students and trainees.

To increase clinical placement availability across the UK, it is recommended that all new radiotherapy departments should consider offering clinical placements for the training of pre-registration radiographers. Full guidance on *Approval and Accreditation of Practice Placements at all Levels of Pre-Registration Education* is available from the Society and College of Radiographers.²⁶

Summary

The appropriate size and skill mix of the required radiotherapy workforce must be designed and agreed with input from the radiotherapy manager, the lead medical physicist and the clinical director. This will be based on guidance from the Society and College of Radiographers, the Institute of Physics and Engineering in Medicine and The Royal College of Radiologists. Additional education and training should be offered to enhance workforce flexibility. There should be flexibility in working hours to provide continuity of the patient service.

9. Clinical pathways and management

A. Clinical pathways

There is a risk that there will be fragmentation of care if a patient's clinical care takes place at multiple sites and with multiple clinical services. Clear clinical protocols must be agreed for the chosen categories of patients being treated within the centre.

An overall plan should be in place for the clinical management of the patient within a clinical care pathway. The clinical management of the majority of patients is within the setting of an appropriate multidisciplinary team (MDT), following cancer network or national disease management guidelines.

The radiotherapy clinical pathways for planning and treatment are summarised in flow diagrams (see Appendix 1).

While an MDT will usually advise on the necessary components of patient care and the responsibilities for each part of care, the final treatment decision will be made following a discussion between a clinical oncologist and the patient, and appropriate consent for treatment is then given. Adequate governance processes should be in place to ensure that the clinical responsibility for patient care is clear and consistent throughout the treatment pathway.

B. Clinical management

The clinical oncologist responsible for referring a patient for radiotherapy will be a member of the MDT defining the overall care pathway for the patient.

The clinical oncologist authorising radiotherapy is responsible for ensuring that:

- Appropriate clinical review is in place
- Competent clinical support for the anticipated toxicity of radiotherapy is available
- Facilities are available to escalate the level of medical care needed, including resuscitation. If the full range of resuscitation facilities is not available on site; for example if the radiotherapy service is not located on an acute hospital site, there should be a clear process on how to get access to emergency medical services. This should be agreed by the linked cancer centre's clinical director and medical director.
- Protocols are in place to ensure that the team delivering radiotherapy contact the clinical oncologist and radiotherapy planning team when there are significant deviations from the authorised radiotherapy plan.
- Robust communication methods are in place between the team delivering radiotherapy, the clinical support team and the clinical oncologist to ensure rapid access to effective clinical advice.

These tasks may be delegated to a suitably entitled therapeutic radiographer, working in accordance with IR(ME)R procedures¹⁸ and guidelines agreed by the clinical oncologist (at consultant practitioner level with appropriate training) and approved by the clinical director.

The 2004 RCR Guidance document¹ discusses case selection for treatment at a linked or devolved radiotherapy site (see Section 9C).

A risk assessment of each patient's care should be undertaken to ensure that their clinical needs will be met by the level of clinical support available. The clinical support team and treatment team radiographers should assess the patient at the beginning of and also throughout the radiotherapy course to ensure that the patient is receiving the appropriate level of medical care.

A mixed clinical support team of radiographers, nurses and medical staff can be considered. The clinical skills needed for the team members should be defined.

Clear clinical protocols for patient care with defined responsibilities must be in place. Appropriate levels of education and training are essential to support changes to skills mix.²⁷ Staff are obliged under IR(ME)R, Regulation 11, by their regulatory and professional bodies and employing authority not to work outside their agreed scope of practice.¹⁸ Staff should not feel under pressure to operate outside their level of competence.

Detailed issues such as the care of patients with pacemakers should be included in clinical protocols.

C. Case selection/clinical risk assessment

The selection of which patient groups are to be treated in the new service should be considered at an early stage in the project plan (see Section 2C). The principles of case selection were discussed in the 2004 RCR document.¹ Clear clinical protocols must be agreed for each category of patient being treated.

The likely case mix will include patients with:

- Early breast cancer
- Prostate cancer.

The majority of these will be fit patients with few medical co-morbidities.

The wish to improve patient access to radiotherapy will mean that most radiotherapy units will also wish to treat patients with:

- Lung cancer (palliative and radical, without concurrent chemotherapy)
- Bladder cancer
- Rectal cancer

and those patients needing

- Palliative radiotherapy for metastases from common solid tumours
- Radiotherapy for myeloma or lymphoma, as agreed by the specialist MDT.

These patients will require an enhanced level of clinical support. It is essential that a risk assessment for each patient is undertaken to ensure that their likely clinical needs can be met.

Patients with brain tumours (primary or metastatic) will require a particular risk assessment by the responsible IR(ME)R practitioner.

Patients requiring more complex management such as those with:

- Head and neck cancer
- Gynaecological cancer needing combined external beam radiotherapy and brachytherapy
- Lung cancer, with concurrent chemotherapy
- Oesophageal and upper gastrointestinal cancer
- Sarcomas
- Paediatric cancers

will need a further increase in the level of clinical support that may only be available at a cancer centre or fully independent department.

Decision-making on the patient mix treated should focus on the level of clinical support and care that patients need. There should be few restrictions on patient access to complex radiotherapy techniques, when clinically indicated.

D. Need for inpatient medical care

Inpatient medical care may be provided by a unit with access to oncology beds. This will facilitate the management of complex cases and concurrent chemo-radiotherapy. The specific use of these oncology beds should be agreed with the host hospital.

Many devolved or linked units will not have access to oncology beds. The majority of patients attending for radiotherapy will not need inpatient care. Referral pathways for those that do need inpatient care should be agreed with the local hospital medical teams.

In some situations, patients having treatment at a devolved radiotherapy unit will need admission to the main site, and continuation of their radiotherapy will require appropriate planning. It is important, therefore, that protocols are as closely matched as possible with those of the main hub site.

Links to the local acute oncology service should be established.

E. Clinical radiotherapy planning

An independent unit will have radiotherapy planning on site in the usual way. For linked/devolved units, planning may take place locally or remotely at the cancer centre hub.

It is essential that full patient information (such as histology and imaging reports) is available at all steps in planning. In particular, the details and documentation of any previous radiotherapy should be fully available. This should include specific information such as digitally reconstructed radiographs from previous treatment. An electronic patient record will facilitate planning on remote sites.

F. Concurrent chemo-radiotherapy

Concurrent chemo-radiotherapy has been shown to improve outcomes in a number of disease groups.

Provision of treatment with concurrent chemo-radiotherapy requires careful clinical risk assessment.

Simple clinical regimes, such as those using oral chemotherapy such as temozolomide in gliomas or capecitabine in rectal cancers, will require a basic level of clinical support.

More complex regimes, such as those requiring careful scheduling of intravenous chemotherapy and radiotherapy, or with an expectation of increased acute clinical toxicity, will need an enhanced level of clinical support. This must be of the same standard as that available at a cancer centre, and as agreed within the commissioning contract and service specification.

These considerations will also apply to the use of biological agents such as cetuximab.

G. Patient review

The clinical oncologist authorising radiotherapy is responsible for ensuring that appropriate patient review is in place.

Clinical protocols for review should be in place. Patients should be informed of the review process.

On-treatment review is carried out by defined members of staff who have been appropriately trained; for example, therapeutic radiographers, nurses and medical staff. Changes in the skill mix of staff have resulted in this task being increasingly undertaken by appropriately competent therapeutic radiographers and nurses.

Training in supplementary prescribing, and subsequent annotation to the register with the Health and Care Professions Council of competence to undertake this role, enables patient care to be given in a timely manner.

The clinical oncologist should be contacted for clinical problems that arise outside the protocol. There should be agreed robust means of contacting the treating clinical oncologist or other medical professional designated to take such calls.

Full usage of the radiotherapy oncology management system is advisable. This allows real-time review of portal images and clear documentation of clinical and other professional advice and authorisation.

H. Aftercare and follow-up

Clear written advice must be given to the patient and their general practitioner about arrangements for aftercare, contact numbers if unexpected out-of-hours care is required and follow-up arrangements.

This is of particular importance when care is provided across multiple sites.

The establishment of a local radiotherapy service provides an opportunity to establish good links between the radiotherapy service and the community it serves. Provision of staff time for community liaison will assist this process.²³

I. Links to specialised services (eg, neurosurgery/urology)

The co-location of specialist surgical services may influence plans for the unit and case selection.

The presence of a regional neurosurgical service may allow the development of specialised radiotherapy services such as stereotactic radiotherapy for brain tumours.

Specialist urology services will facilitate the care of urological patients needing management of specific clinical problems such as urinary retention.

J. Support and rehabilitation services

Patients should be able to get access to the range of support and rehabilitation services and care needed during and after treatment. Written information and contact telephone numbers should be provide for patients to meet their treatment and after treatment care needs.

Linked and devolved radiotherapy services should ensure that there is equity in access to support services. These will include:

- Specialist nurse support
- Patient information and support services
- Palliative medicine services
- Access to allied health professionals required for their care, such as physiotherapists, lymphoedema practitioners, occupational therapists, speech and language therapists, dieticians, and so on
- Counselling and clinical psychology
- Social worker services, including benefits advice.

Summary

There is a risk that there will be a fragmentation of patient care if this takes place at multiple sites with multiple clinical services. An overall plan should be in place for the clinical management of the patient within a clinical care pathway. The clinical oncologist authorising radiotherapy is responsible for ensuring that appropriate clinical review is in place; that there is competent clinical support for the anticipated toxicity of radiotherapy, and that facilities are in place to escalate the level of medical care needed. Decision-making on the patient case mix treated should focus on the level of support and care that patients need. Clear clinical protocols should be agreed for each category of patient being treated. Patients should be able to get access to the range of support and rehabilitation services and care needed during and after treatment.

10. Operational issues

All radiotherapy units are obliged to provide a cost-effective, efficient and safe service. Given the extra costs noted in Section 1C, this will be particularly the case for smaller units. The new service will need to show a good level of performance for patient throughput and also the delivery of a high standard of complex radiotherapy techniques.

The following operational issues are very much dependent upon the agreed staffing model; for example, on staff availability and flexibility. These issues must be considered when agreeing the job descriptions for the workforce being employed within the service.

A. Working day/week

As the new service is planned, detailed agreements will be required on the working hours of the unit. This will impact on the number of staff required at the unit. Arrangements for working on public holidays and the need for weekend working should be agreed.

B. Equipment QA and servicing time

The NRAG 2007 report⁴ recommends that individual linacs should not be out of action for planned servicing and QA for more than 19 days per annum. Planned servicing and QA should take place outside normal working hours wherever possible.

There must be written protocols and procedures agreed detailing how QA and servicing will take place and defining clear lines of accountability and responsibility.

There is a need for all staff groups to work flexibly to accommodate servicing/QA of the linacs.

There are various options available for servicing/QA of the linacs; each have their distinct advantages and disadvantages.

- Servicing/QA during the clinical day
 - The service/QA linac is out of action for a day while the other linac(s) work an extended day. In a smaller linked department, this option can mean a long extended day on the other linac(s) and also may require the cancellation of some patients to keep this manageable. The risk of linac breakdowns on service/QA days needs to be thought out very carefully and actions agreed in advance.
 - The service/QA linac finishes early/starts late while the other linac(s) work a slightly extended day to compensate. This option would require a modular approach to servicing/QA, with service/QA items broken down into smaller components that can be finished within the time allocated. This is not normally an issue except for the more extensive checks.
- Servicing/QA in the evenings – this is where all servicing and QA is carried out after clinical treatments have completed. This may not be an option if there is a long extended normal working day. This may also be difficult from an engineering/physics staffing level perspective.
- Servicing/QA at weekends – this option depends on the size of the staff group available. In a small staff group, the frequency that each member is required to be available may impact on staff morale. The financial aspects of working on the weekends need to be agreed. It has the benefit of being able to carry out work without interruption from possible breakdown of the other linac(s).

C. Contingency for equipment breakdown

Management of unscheduled treatment interruptions must be outlined in departmental protocols and follow the RCR guidelines.¹⁶ There is good evidence that unscheduled interruptions in radiotherapy courses can lead to worse outcomes in several cancer types.¹⁶

Although equipment breakdown is inevitable, unplanned downtime can be reduced by a more proactive approach. Regular monitoring of machine parameters to enable planning of major component changes can reduce unplanned equipment downtime.

With two or more matched linacs in a radiotherapy unit, there is the possibility of transfer of patients to the other machine relatively straightforwardly during breakdowns, although there is a requirement for staff to work flexibly.

In some devolved or linked units, it may be feasible to transfer selected patients to the cancer centre hub. This will only be possible if the linked unit has matching accelerators and planning systems.

The transport needs of patients will need to be considered to facilitate this approach.

Engineering and physics staff may need to work flexibly to be able to support any emergency/unplanned repair work and subsequent testing that is required.

D. Emergency/out-of-hours clinical service

The scope of the radiotherapy service may include the provision of an emergency clinical service, with the need for an out-of-hours service.

Clinical protocols should be in place to ensure that a high standard of care is given.

Arrangements should be in place for the appropriate staff (medical staff, radiographers, medical physics, engineering and IT staff) to be contacted and be available.

Summary

A new radiotherapy service will need to show a good level of performance for patient throughput and also the delivery of a high standard of complex radiotherapy techniques. Detailed plans for equipment quality assurance and servicing should be in place to minimise equipment downtime.

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Approved by Council of the Institute of Physics and Engineering in Medicine: 13 November 2012

Approved by the Council of the Society and College of Radiographers: 30 November 2012

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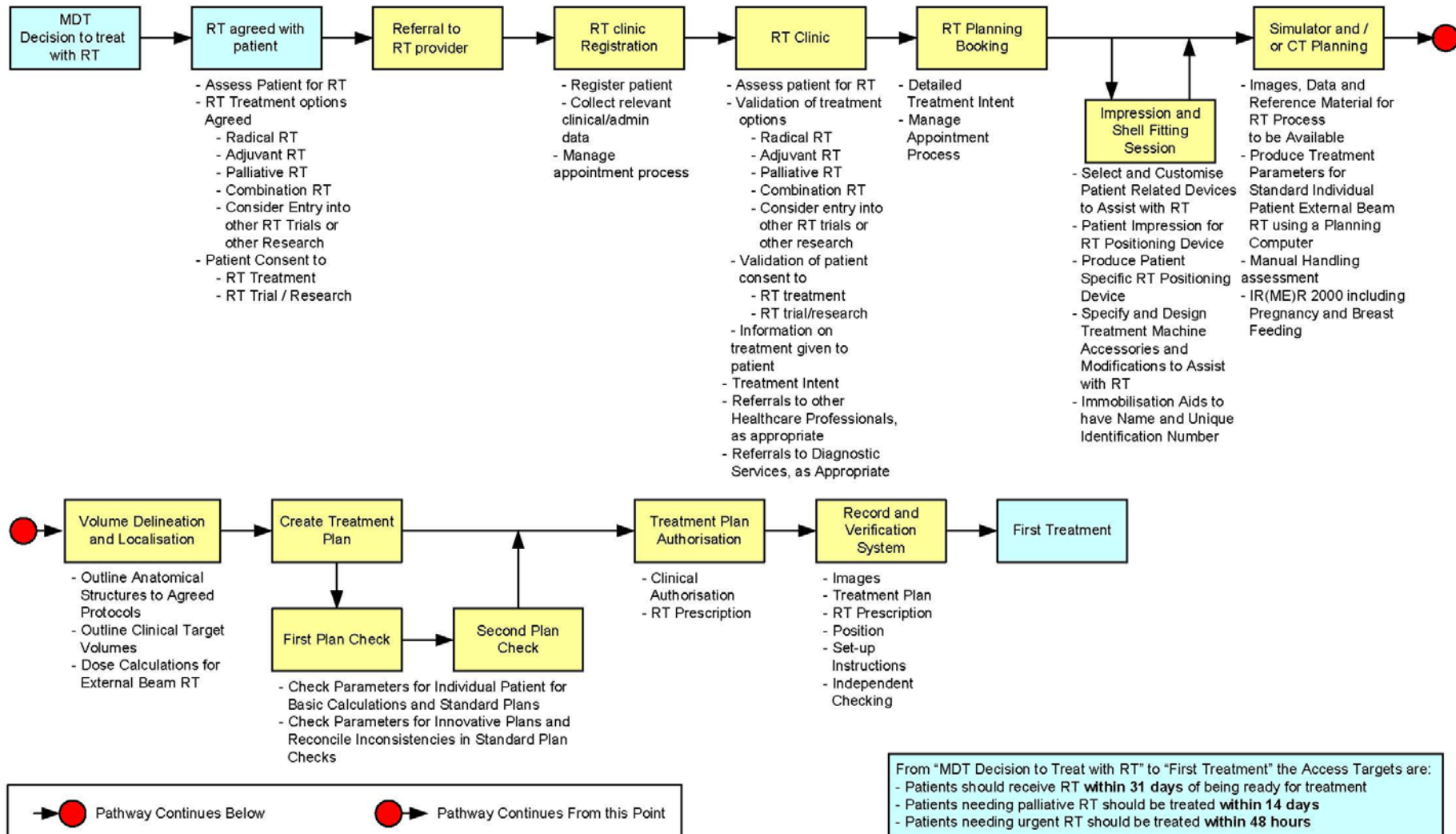
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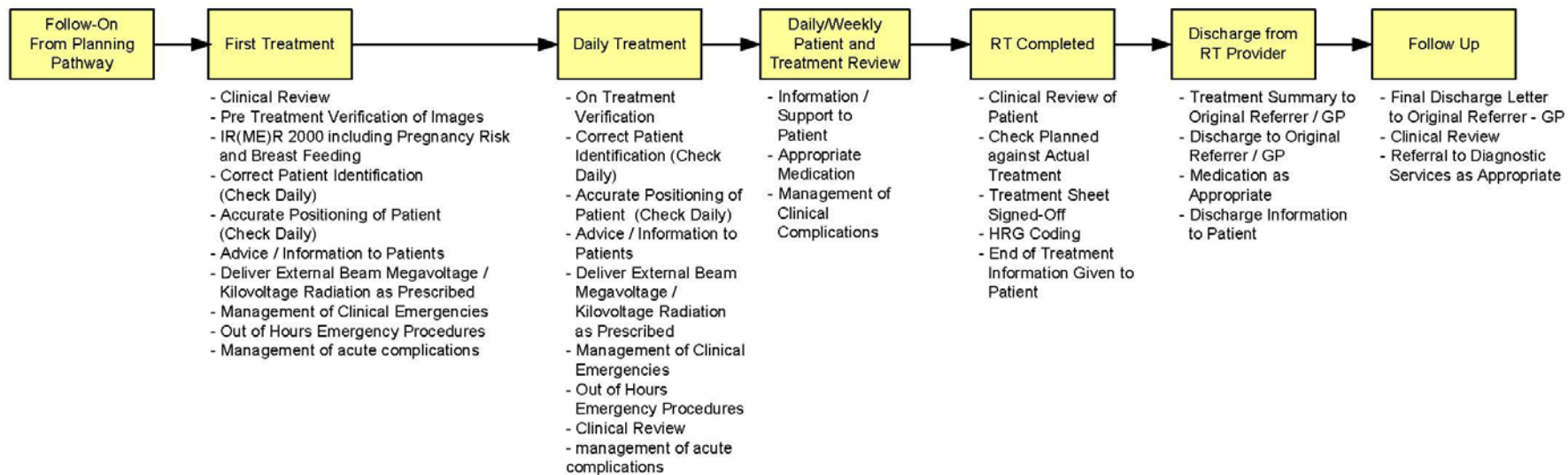
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Appendix 1. Generic radiotherapy (teletherapy) pathway - planning



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