Achieving a world-class radiotherapy service across the UK

A report for Cancer Research UK

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CANCER RESEARCH UK

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1. Foreword

Cancer Research UK's mission is to reduce the number of people dying from cancer in the UK and across the world. One of the central pillars of this mission is to facilitate and drive the development and national implementation of the very best treatment options for patients, which maximise cure rates and quality of life, whilst minimising side effects. Radiotherapy continues to be one of the most important treatment modalities for cancer patients. Its use is likely to increase in the future, as cancer incidence rises, as new and improved radiotherapy technologies are introduced and as research demonstrates how patient outcomes could be improved by combining radiotherapy with other treatment modalities, such as novel drugs. Functional imaging will also play an increasingly important role in radiotherapy administration.

Cancer Research UK's interest in ensuring that the UK achieves a world-class radiotherapy service is evident not only in this report's recommendations for current services and policymakers. It is also reflected in the Charity's increasing commitment to radiotherapy as an area of cancer research. Drug discovery and development have been traditional strengths in cancer research in the UK, but over recent decades radiobiology and radiotherapy research suffered from historically lower levels of funding. Cancer Research UK's five-year strategy, published in November 2008, identifies radiotherapy as an area of unmet research need and a key target area for future research funding.

Cancer Research UK has a long history in radiotherapy research, stretching back to a grant in 1923 for the purchase of radium to treat cervical cancer. More recent research has focused on improving fractionation and dose scheduling to optimise outcomes and patient experience.[1] The Charity is also funding several other areas of radiotherapy research, including work to understand the effect that radiation has on cells and how cancers can become resistant to radiotherapy, to trials looking at ways of using radiotherapy in combination with drugs to treat various types of cancer including lymphoma and bladder cancer.

There are many areas of research in radiotherapy that the Charity is hoping to tackle. These research efforts will be developed as integrated components of more broad-based biological research. Multidisciplinary collaborations will be essential to the future of this field. The Charity will evaluate newly emerging technologies and will work with the National Cancer Research Institute (NCRI) to consider whether opportunities for radiotherapy research in the National Cancer Research Network (NCRN) and Experimental Cancer Medicine Centre (ECMC) networks are being pursued to best effect.

One core element of the Charity's growing commitment to radiotherapy research is its support of the Gray Institute for Radiation Oncology and Biology in Oxford, in partnership with the Medical Research Council and the University of Oxford. This Institute is fast becoming a world-leading facility in researching new translational opportunities, and in providing education for all types of health care professionals in radiotherapy. Further investments in radiobiology and radiotherapy research are being made by the Charity across the UK, as it establishes Cancer Research UK Centres, in partnership with universities, NHS Trusts and Cancer Networks. A number of universities and NHS Trusts are adding to these investments, so that research capacity is being built in a coordinated way. These developments offer great promise for the future.

As an organisation, Cancer Research UK is looking not only to increase investment in research, but also to influence public policy to improve the radiotherapy services available to patients. The aim of this report is to provide a comparative overview of the current plans for radiotherapy services across the UK, with an outline assessment of progress and performance against these.

2. Executive Summary

In recent decades it was widely believed that radiotherapy would not play a key role in cancer treatment in the future, being eclipsed by advances in chemotherapy and immunotherapy. This resulted in an under-investment throughout the UK (and in other countries across the world) in radiotherapy services.

Radiotherapy has, however, continued to be integral in treating and curing cancer, and clinical demand currently outstrips capacity. Given the considerable increases in cancer incidence that are projected in all of the UK nations over the next decade and beyond, ensuring capacity meets demand is likely to be increasingly important.

Since the turn of the 21st century, all the UK governments have recognised that significant increases in radiotherapy capacity are needed if future demand is to be met. Between 2005 and 2007, reports were published in England, Scotland and Wales, with the aim of improving radiotherapy services. The reports all concluded that increasing workforce and equipment capacity would be crucial in meeting current and future demand. The Northern Ireland Executive has also begun to consider how to expand services further.

Now that the national radiotherapy planning reports are several years old this 'state of the nations' report examines progress on these recommendations, and those measures being taken in Northern Ireland. The report focuses on the key issues of patient access to radiotherapy,[i] and levels of staffing and equipment in the radiotherapy services, as well as considering the public profile of radiotherapy in the UK.

It is estimated that around half of all patients should receive radiotherapy as part of their treatment – within a defined time period. Good measures of radiotherapy output are therefore waiting times and patient 'access rates'.

Access rates throughout the UK are currently still well below the estimated 50% optimum level.

Waiting times standards are now in place in all of the UK home nations. The Joint Council for Clinical Oncology (JCCO) standards, set in 1993, provide a benchmark for radiotherapy treatment waiting times, but significant variations in compliance exist across the UK. In addition, these are limited to first treatments only, meaning that the vast majority of radiotherapy treatments are not covered. Progress is being made in England, where, by the end of 2010, standards will be extended to include the need to commence radiotherapy treatments within 31 days of decision to treat. This will be a substantial undertaking for the radiotherapy services.

There has generally been good progress towards implementing recommendations to increase the number of linear accelerators ('linacs'), the machines most commonly used to deliver radiotherapy treatment for patients with cancer. However, there are real challenges to be faced in the retirement and necessary replacement of older machines and how this is being planned.

There has also been good progress in increasing workforce capacity in recent years. Interviews conducted for this report highlighted that workforce issues are beginning to be resolved, but this momentum must be maintained. Workforce capacity is of particular importance for the expansion of overall radiotherapy capacity – sufficient staff are required to operate new pieces of radiotherapy equipment.

Success requires co-ordinated effort within the home nations, for example in introducing the four-tier career framework for radiographers. While government intentions may be good, progress will not be made without the NHS rising to the challenge at local level.

[i] not including brachytherapy

National co-ordination should enable local initiatives to address the variations in access to and need for services. There is also a need for greater focus on up to date published information about the planning, co-ordination and (in England) commissioning of radiotherapy services.

National reports that chart progress would be useful. To complement this, radiotherapy outcome information should be collected and made available, and incorporated into a nationally agreed radiotherapy dataset. Ultimately, good data on radiotherapy activity will help governments and radiotherapy providers to determine if they are achieving real improvements. Unfortunately, obtaining reliable data is currently problematic.

The integration of new radiotherapy technologies will be another important aspect of any future-focussed radiotherapy service. While progress has been made on introducing some new technologies, notably intensity modulated radiotherapy (IMRT), there needs to be a greater focus on making this available to all patients for whom it provides benefits and on introducing systems to support the uptake of other new and emerging technologies, such as proton therapy, where appropriate.

The UK needs to continue to undertake high quality research to understand further cancer indications in which the newer technologies may provide a real benefit that justifies their implementation.

Any vision for future radiotherapy services will need to encompass all of these elements. It will also need to recognise that radiotherapy will remain a major treatment modality for cancer for many decades to come and that its efficacy and cost-effectiveness are likely to increase, as it is combined intelligently with new drugs and as more accurately targeted technologies for delivery are developed.

Finally, it cannot be hoped that the high quality of the UK's radiotherapy services will be widely recognised unless the public hears about it and until it becomes "front of mind" as a key contributor to increasing cancer survival. Raising the profile of radiotherapy in the wider world will also serve to propel the other recommendations in this report.

It is crucial that momentum, commitment and investment be maintained. Continued – and in some cases, urgent – action is required to ensure that all cancer patients in the UK who might benefit from radiotherapy are treated in a timely fashion, and have access to world-class radiotherapy services.

Conclusions and recommendations

The progress that we have seen across the UK since the national radiotherapy planning reports were published clearly demonstrates the importance of careful planning in the delivery of a service as complex as radiotherapy. To maintain this progress continued action is needed to address shortages in capacity, both in terms of workforce and equipment.

Whilst it is important that we do not introduce unnecessary bureaucracy into our radiotherapy services, we do want a service that is made more efficient by being better planned, and those delivering services made more accountable. Only in doing this can we ensure that all patients who may benefit from radiotherapy are being offered this treatment option – within acceptable waiting times.

In addition to maintaining momentum on the current issues, all UK governments should be looking ahead to longer-term requirements to maintain world-class radiotherapy services. National governments in England, Scotland and Wales should ensure implementation of all recommendations in the national radiotherapy planning reports, within agreed timeframes. Despite an overall good service, Northern Ireland is some way behind the other nations of the UK in publishing plans for service improvements and future radiotherapy needs.

It is essential that cancer patients have equitable access to radiotherapy and that provision is tailored to local needs. There is a high level of variation between the level of radiotherapy being delivered across the nations that cannot be explained by factors such as higher incidence of cancer in certain areas. Good data capture and communication are crucial for progress to be charted and services to be benchmarked against each other. It is clear that current datasets are lacking in a number of areas. Effort is needed to address this.

Public awareness of the role that radiotherapy plays in the treatment of cancer is low. A campaign is required with the aim of increasing public awareness of available and potential radiotherapy treatments, as well as the efficacy, safety and cost-effectiveness of radiotherapy and the importance of adequate funding for radiotherapy services.

Recommendation 1: Planning for the future
All UK governments should produce a rolling ten-year plan, setting out a vision and strategy for future radiotherapy services, which should be revised every few years.

The strategy should set out plans for linac replacement and progress towards fractionation and service delivery targets.

Recommendation 2: Measuring success
All UK governments should introduce datasets for the reporting of fractionation, waiting times, access, and patient outcomes. The routine collection of benchmarked radiotherapy data, like that being developed in England, should be obligatory for radiotherapy services across the UK.

Radiotherapy datasets should also incorporate a measure of outcome, to be co-ordinated through the work of the National Cancer Intelligence Network, the results of which should be made available to local providers and the public.

Recommendation 3: Ensuring equity in access
Local radiotherapy providers should be carrying out demand modelling based on differences in cancer incidence on a region-by-region basis. Commissioners, PCTs, SHAs and networks should work with local providers to publish plans for their services, to be updated with progress every few years.

Cancer networks, with guidance from the Department of Health, should work with SHAs and Trusts to ensure that they have plans in place to meet the 2010 radiotherapy waiting times standard and work with those that are under-delivering, to increase their radiotherapy provision.

These plans should include means of sharing best practice in service improvements such as the '3SI approach' and success against service delivery targets, waiting times and patient access rates at the local level.

Recommendation 4: Training the radiotherapy workforce
A national career promotion strategy should be introduced across the four nations of the UK – led by the Society and College of Radiographers and the Department for Business, Innovation and Skills – with a focus on therapeutic radiography. This should include measures of success in implementation of the four-tier skills model, at both national and local levels, and the establishment of Virtual Environments for Radiotherapy Training (VERTs).

In addition a review of clinical oncologist specialisation in the UK should be led by the Royal College of Radiologists and the Royal College of Physicians and involve all key stakeholders.

Recommendation 5: Integrating new technologies
NICE should provide national guidance on novel radiotherapy techniques, such as intensity modulated radiotherapy (IMRT) and proton therapy, where there is a clear consensus that the evidence supports their implementation in certain indications. This should be supported by sufficient funding from government to ensure that all patients who may benefit can get access to these new technologies.

The Departments of Health in the four nations should communicate and support planning on a regional basis for new and emerging radiotherapy technologies, so that sufficient capacity can be planned for. Local providers should detail plans for the delivery of IMRT.

Recommendation 6: Communicating with the public
A UK-wide working group should be formed, incorporating all relevant stakeholders, to formulate a strategy and proposal for awareness raising about radiotherapy. This should be led by the national departments of health, with support from Cancer Research UK and the Royal College of Radiologists.

3. Introduction

Radiotherapy – the use of ionising radiation to treat illness – is a key aspect of cancer care. It can be applied externally from outside the body most commonly using X-rays, or internally from within by drinking a liquid or insertion of radioactive material. Each treatment of external radiotherapy is known as a 'fraction'; these are normally given for periods of consecutive days with rest days in between to recover.

This versatile treatment option is an integral part of many cancer patients' treatment plans. It is considered that around 50% of all cancer patients could benefit from some form of radiotherapy as part of their treatment and it is estimated to contribute to 40% of cases where cancer is cured.

Radiotherapy is usually required for one of the reasons outlined below. Radical radiotherapy is given to try to cure a cancer. This could be:

- as a stand-alone treatment to cure cancer;
- to shrink a cancer before surgery;
- to reduce the risk of a cancer coming back after surgery;
- to complement or enhance the effects of chemotherapy.

Palliative radiotherapy is used to control symptoms and improve quality of life if a cancer is too advanced to cure.

In recent decades it was widely thought that radiotherapy would not have a key role in cancer treatment in the future and that the demand for radiotherapy would diminish as a result.[2] In fact, the opposite has proved to be the case and radiotherapy has continued to play an important part in both curative and palliative treatments for cancer as well as in combination therapies. The number of indications for radiotherapy treatment has increased more rapidly than expected.[3]

This trend is likely to continue, not least due to the considerable increases in cancer incidence that are projected throughout the UK over the next decade and beyond: almost 19% in Scotland,[4] 29% in Wales,[5] around a third in England[6] and by over half in Northern Ireland.[7] This is primarily due to demographic factors such as an ageing population, but earlier diagnoses also mean that there are more opportunities for treatment. Newer radiotherapy technologies, which are much more targeted to the tumour and therefore spare normal tissue from radiation effects, are likely to increase demand for radiotherapy, given the greatly improved "therapeutic margin". Furthermore, as new drugs are developed which act as radio-sensitisers and therefore enhance the effectiveness of radiotherapy as a cure, demand will consequently increase further.

The previous under-estimation of future radiotherapy requirements meant that the development and expansion of radiotherapy services across the UK were not treated as priorities. Radiotherapy capacity – the availability of workforce and equipment – suffered as a result. Insufficient capacity has a negative knock-on effect on waiting times for treatment. Any failure to meet waiting times targets can have serious consequences for patients' health outcomes, such as prolonging symptoms or not controlling a cancer. A six-week delay for postoperative radiotherapy, for example, for head and neck cancer increases the risk of local recurrence 2.6-fold[8] and an audit of waiting times in lung cancer patients showed that 20% progressed so that they were unsuitable for radical radiotherapy while on a waiting list.[9]

The proportion of patients who receive radiotherapy as part of their cancer treatment (the 'access rate') for the UK as a whole is 39%, but this varies across the home nations from 43% in Scotland to 32% in Northern Ireland, with 38% in England and 37% in Wales. All are significantly lower than the optimum level of 52%.[3]

Variations in access rates also exist within nations. In regions with higher deprivation, for example fewer patients with cancer receive radiotherapy.[10]

The required increase in radiotherapy activity to ensure both adequate access to treatment and optimal dose fractionation has been estimated at 61% in Scotland, around 70% in Northern Ireland[9] and as high as 92% in England and 97% in Wales.[3] It is therefore important for radiotherapy providers to have detailed knowledge of their own local areas, and undertake demand based planning, in order to meet the needs of their patient population.

It has now been widely accepted by all governments in the UK that action is required to ensure sufficient workforce and equipment not only to meet the demand for radiotherapy, but to do so within acceptable waiting time limits. 2005, 2006 and 2007 saw three of the UK home nations – Scotland, Wales and England respectively – publish reports that set out recommendations to develop and improve radiotherapy services. Whilst these reports provided a useful overview of some of the issues in radiotherapy across the country, they are now several years old.

This 'state of the nations' report compares radiotherapy capacity across the UK and the approaches being taken to address shortages since the publication of the national reports. Northern Ireland is also included where information is available. The report aims to shed light on the reasons behind variations in access to radiotherapy and how well the UK nations are planning future equipment and workforce needs as well as the introduction of new technology. Private radiotherapy provision is not included in the remit of this report.

Patients in the UK are increasingly involved in choices about the cancer treatment that is right for them. To support these decisions, there needs to be readily accessible information on the treatments available. Currently awareness of the role of radiotherapy in the treatment of cancer is low, so this report concludes by examining how to improve communication with the public about radiotherapy.

The principal sources of information for this report were a series of interviews conducted with key stakeholders, in addition to desk research and literature review.

4. National approaches to radiotherapy capacity planning

Radiotherapy has been put back on the map throughout the UK in recent years, not least with three of the UK home nations – England, Scotland and Wales – publishing radiotherapy planning reports between 2005 and 2007, while the Northern Ireland Executive has also taken radiotherapy into account in ongoing initiatives.

In planning for future radiotherapy capacity, the Scottish report – the first of the three to be published, in 2005 – looked ahead to 2015, while the Welsh and English reports, published in 2006 and 2007 respectively, both have implementation timelines to 2016. The Northern Ireland Executive has recognised that consideration needs to be given to planning radiotherapy capacity for the decade 2015-2025, but is yet to publish these plans.[7]

All the UK governments have recognised that significant increases in radiotherapy capacity are needed if future demand is to be met. The national reports include projections for future demand, and, based on this, they examine how to ensure equitable and timely access, primarily through increasing workforce and equipment capacity.

It is important that the English, Scottish and Welsh governments ensure implementation of all recommendations in the national radiotherapy planning reports, within agreed timeframes. In addition to maintaining momentum on the current issues, all UK governments should be looking ahead to longer-term requirements to maintain world-class radiotherapy services.

All UK Governments should produce a rolling ten-year plan, setting out a vision and strategy for future radiotherapy services, which should be revised every few years. The strategy should set out plans for workforce, linac replacement and progress towards targets, as well as the introduction of new technologies.

Planning in the four nations of the UK

Scotland

The 2001 Scottish Government Health Department publication, *Cancer in Scotland: Action for Change*, provided the backdrop for reviewing radiotherapy capacity in Scotland. In June 2003, the Health Department Management Board accepted the findings of an initial report on radiotherapy capacity requirements, and commissioned further work to explore how this could be achieved. The Radiotherapy Activity Planning Group, chaired by the Senior Medical Officer at the Health Department, was reconstituted in April 2004, with a remit to consider radiotherapy service capacity needs for the period 2011-2015. Its report, *Radiotherapy Activity Planning for Scotland 2011-2015*, was published in December 2005.

To take forward issues arising from the report, the Scottish Radiotherapy Advisory Group (SRAG) was established. It was noted in December 2008 that SRAG "is reviewing the *Radiotherapy Activity Planning for Scotland 2011-2015* report to determine the continuing accuracy of the assumptions that underpinned it and to update the capacity estimates required for the future."

Wales

The framework for the review of radiotherapy services in Wales was also put in place early this decade. In 2002, the Cancer Services Co-ordinating Group (CSCG) submitted to the Welsh Assembly Government a strategic plan for cancer services, including a 12 year plan for radiotherapy services drafted by the Welsh Scientific Advisory Committee's Clinical Oncology Sub-Committee (COSC). In 2005, the COSC reviewed and updated its 2002 plan and the following year the CSCG set up a Radiotherapy and Chemotherapy Advisory Group, to further support the initial work that had been undertaken, and to provide advice to inform strategic developments in Wales. The group's report, *Radiotherapy Equipment Needs and Workforce*

Implications 2006-2016, was published in May 2006. Since publication of the report, steady progress is being made on increasing equipment capacity, with the other recommendations being taken forward as part of the Welsh Assembly Government's overall cancer policy *Designed to Tackle Cancer.* The COSC has been asked to oversee implementation, and this is in progress, with involvement from all three Welsh radiotherapy centres.

England

In England, the National Radiotherapy Advisory Group (NRAG), established in May 2004, has a remit of advising Ministers on the current position of radiotherapy services. This Group is also charged with ensuring that current resources are deployed to best effect to reduce radiotherapy waits, improve service delivery in the short to medium term, and making recommendations on how to plan for a world class service in the longer term.

NRAG's report, *Radiotherapy: developing a world class service for England,* was published in February 2007 and accepted in its entirety by the *Cancer Reform Strategy* in December of the same year. The National Radiotherapy Implementation Group (NRIG) is coordinating a number of work streams led by the National Cancer Action Team to ensure that the NRAG and *Cancer Reform Strategy* recommendations are implemented.

Northern Ireland

1996 saw the first major review of cancer services in Northern Ireland: the Campbell Report. The Northern Ireland Executive has noted that since then "there have been significant changes in radiotherapy equipment and treatment planning technology".[7] The Cancer Control Programme for Northern Ireland was developed by the Department of Health, Social Services and Public Safety in 2006 to build on the progress made since the *Campbell Report's* publication, although this was not specific to radiotherapy.

A service framework on Cancer Prevention, Treatment and Care is currently under development. It will prioritise the recommendations made in the Cancer Control Programme, setting standards that are evidence based and can be measured. The draft framework calls for standardised processes for prescribing and checking of radiotherapy treatments, and for all patients with cancer who require radiotherapy to have equitable and timely access to complex radiotherapy techniques.[12]

The Northern Ireland Department of Health, Social Services and Public Safety, together with the Northern Ireland Cancer Network, should fulfil its commitment that the forthcoming service framework for cancer prevention, treatment and care will make recommendations for equitable and timely access to radiotherapy services for all cancer patients.

5. Providing a quality radiotherapy service

i. Reducing variations in access

Table 1 – Overview of access to radiotherapy in the UK[3]

	England	Scotland	Wales	Northern Ireland
Cancer incidence/million	4,502	5,101	5,222	3,912
Radiotherapy access rates (incorporating a re-treatment rate of 21.5%)	38.2%	43.3%	37.2%	32.1%
Required increase in radiotherapy activity to secure adequate access to treatment and optimal dose fractionation	92%	61%	97%	Not specified

The optimum rate of radiotherapy utilisation – the proportion of cancer patients who should receive radiotherapy as part of their treatment (or 'access rate') – is around 50%.[ii] However, as the table above illustrates, access rates in all of the UK nations are well below this level, and there is a significant degree of variation across the UK.

The national radiotherapy planning reports all recognised that a shortfall needed to be overcome if radiotherapy were to be given to all who might benefit from it. The challenge seems to be identifying where patients are not receiving sufficient or timely access to treatment. Good, reliable data on radiotherapy activity are required to do this, and although current mechanisms for data collection do not include this, change is starting to take place.

Data collected in England have varied locally, but this will change with the introduction of mandatory data collection for the radiotherapy dataset in April 2009, in line with NRAG's recommendation on formalising the collection of data on radiotherapy activity.

The Scottish planning report recommended that "mechanisms for data collection be reviewed and new parameters agreed and implemented to support prospective data collection to underpin future radiotherapy modelling."[4] Interviews conducted for this report indicate that there is an appreciation that change is required to obtain good data on radiotherapy activity in Scotland and that work towards this is ongoing.

There is also an urgent need to collect – and communicate – data on pathways of care and patient outcomes across the UK. There is currently enormous variation in practice across the country, and the effect this has on outcomes is currently unclear. The National Cancer Intelligence Network could play a role in this. It would also be helpful to compare outcomes in the UK with those in other countries.

In order for progress in meeting waiting times targets to be recognised, it is important that transparent information on waiting times and trends is presented in a format that is easily comprehensible for the radiotherapy community and patients alike. This is not currently the case in the UK.

[ii] The NRAG report (p.10) uses the 52% identified by Delaney et al; the Scottish Government report (p.15) 50%. The Welsh report notes (p.9) that the proportion of patients receiving radiotherapy as part of their treatment has risen in some countries to 53% in recent years.

Cancer Care Ontario's online reports on radiotherapy waiting times[iii] are an excellent example of how waiting times data can be communicated. Clear monthly reports are provided on radiotherapy waiting times at each of the regional cancer centre hospitals that offer radiotherapy services and for each type of cancer. The National Cancer Intelligence Network Cancer Commissioning Toolkit could play a role in implementing this in the UK.

All the UK governments should introduce datasets for the reporting of fractionation, waiting times, access, and patient outcomes. The routine collection of benchmarked radiotherapy data, like that being developed in England, should be obligatory for radiotherapy services across the UK. This should also incorporate a measure of outcome, to be co-ordinated through the work of the National Cancer Intelligence Network and results be made available to local providers and the public.

Increasing radiotherapy provision

External radiotherapy is given in separate treatments known as 'fractions'. All the national radiotherapy planning reports specified the increases in fractions that are required to meet current and future demand – these are shown in the table below. For comparative purposes, information on Northern Ireland is also included where available. It is important to note that for the provision of radiotherapy to increase, adequate training in specialised commissioning must be provided.

Wales

The recommendations in the Welsh radiotherapy planning report have the longest timescale for implementation: the report recommended 58,000 fractions per million population per annum by 2016, or a total of 174,000 fractions.

Scotland

The Scottish planning report recommended that the service should have the capacity to deliver up to 354,000 fractions per annum by 2011-2015. The required number of linacs is now in place in Scotland, and interviews conducted for this report confirmed that work to meet the 2011-2015 capacity has commenced.

England

The target set in the English NRAG report is perhaps more pressing: 40,000 fractions to be delivered per million population by 2010/11. A report by the Conservative Party in November 2008 highlighted concerns about slow increases in levels of radiotherapy provision in England. Data obtained by the Conservatives showed that in 2007-08, 1.6 million fractions were delivered,[15] which is only slightly more than the 1.5 million (or 30,000 per million population) in 2005.

However, England at least has shown that it does have the capacity for these sorts of increases. Courses per million rose from less than 1000 to nearly 3000 between the turn of the century and 2008. At the same time fractions per course have risen (in line with

Table 2 – Current and required radiotherapy provision in the UK

		England[2]	Scotland	Wales[13]	Northern Ireland[14]
Total fractions/year	Current	1.5 million (2007)	175,954 in 2003[4]	87,566 (2006)	59,000 (2008)
	Required	2.5 million immediately and 2.9 million by 2016	Up to 354,000 (2011-15)[4]	174,000 (by 2016)	
Fractions per million population (pmp)/year	Current	~30,000 (2005)	39,584 (2005)[3]	30,161 (2005)	34,951 (Jan 2009)
	Required	40,000 by 2010 or 54,000 by 2016		58,000 by 2016	

[iii] www.cancercare.on.ca/english/home/ocs/wait-times/radiationwt/

good practice) from 13.4 to 14.3. Overall this represents a very significant increase in capacity.

Towards equitable provision within the UK nations

Of arguably equal, if not greater, importance than increasing the total radiotherapy capacity is ensuring equitable provision not just between the UK nations, but also within nations.

This problem is more acute in some areas than others. Access rates ranged from 25.2% to 48.8%. Fractions per million prescribed as a first course of treatment varied from 43.9% to 90.3% of demand. The percentage of patients failing to meet the four-week Joint Council for Clinical Oncology (JCCO) target for radical radiotherapy rose as activity rates increased indicating a mismatch of demand and capacity.

There are concerns about reduced capacity due to staffing issues in the more rural North Wales,[13] the need to provide a second linac in Inverness to serve patients in the Highland region,[4] and current ability to serve the needs of people living in the western parts of Northern Ireland.[7]

Unsurprisingly given the much larger geographical area and population, there appears to be a greater variation of radiotherapy provision within England. Between cancer networks in England, the number of fractions per million population was estimated by NRAG to vary from around 17,500 to almost 48,000: a two and a half fold variation.[2] The Conservative Party's November 2008 report revealed that the current average number of fractions per linac per annum varied between NHS Trusts from 4,376 to 10,126.[15]

The reasons for the high level of variation have not been satisfactorily explained. NRAG recognised that some of this could be due to factors such as higher incidence of cancer in areas with an older population. Nonetheless, it considered the high level of variation to be unacceptable and called on Primary Care Trusts (PCTs) in areas with lower provision to provide more radiotherapy treatment.[2] In England comparison between Strategic Health Authorities (SHAs) showed that increasing deprivation was correlated with lower rates of access to radiotherapy.[10] Although late presentation with advanced stage disease will likely be linked to this, to provide an equitable evidence-based service the needs of the local population should be assessed using demand modelling based on local cancer incidences. This should include data on deprivation, performance status and stage at presentation.

Demand modelling based on differences in cancer incidence is required on a region-by-region basis in England. Cancer networks, with guidance from the Department of Health, should work with SHAs and Trusts to ensure that they have plans in place to meet the 2010 radiotherapy waiting times standard and work with those that are under-delivering, to increase their radiotherapy provision.

Commissioners, PCTs, SHAs and networks should work with local providers to publish plans for their services, to be updated with progress every few years.

ii. Reducing waiting times

Waiting times standards

There are waiting times standards in each of the UK home nations. However, because around 85% of radiotherapy is a subsequent rather than a first definitive treatment,[16] and these targets mainly apply to just the first treatments, the vast majority of radiotherapy treatments are not covered by the existing standards.

England

The NHS Cancer Plan 2000 originally set maximum waiting times targets of 31 days from diagnosis to treatment and 62 days from urgent GP referral to treatment.

From the end of December 2010, a new target will be introduced in England which will apply to all radiotherapy treatments, regardless of whether they are first, second or subsequent treatments.

NRAG highlighted the importance of ensuring that all patients have access to radiotherapy in a timely manner.[2] In line with NRAG's recommendation, there was a commitment in the 2007 Cancer Reform Strategy to extend the 31-day maximum waiting time standard from first treatments only, to second and subsequent cancer treatments. Although this applies

Table 3 – Waiting times standards for cancer treatment

	England	Scotland	Wales	Northern Ireland
31-day targets	Treatment within 31 days of decision to treat, for first, second or subsequent cancer treatment, by December 2010.	31-day target for all patients diagnosed with cancer (whatever their route of referral) from decision to treat, by 2011.	Treatment within 31 days of the patient being informed of the diagnosis and agreeing the treatment plan.	98% of patients to wait no longer than 31 days from decision to treat to first definitive treatment.
62-day targets	First treatment within 62 days of urgent GP referral.	First treatment within 62 days of urgent GP referral.	First treatment within 62 days of urgent GP referral.	At least 75%[iv] wait no longer than 62 days from urgent GP referral to first definitive treatment.

to all cancer treatments, the Strategy recognised that the largest impact of this change would be on radiotherapy services, and therefore set PCTs a deadline of December 2010 to meet the extended target for radiotherapy – two years later than that for surgery and drug treatment.

Scotland

In 2001, the Scottish Government's Cancer Strategy, *Cancer in Scotland: Action for Change* set a maximum waiting time target of two months from urgent GP referral to treatment. In October 2008, *Better Cancer Care, An Action Plan*, introduced a new 31-day target for all patients diagnosed with cancer (whatever their route of referral) from decision to treat to treatment, to be delivered by 2011.[11] Both standards apply to the first definitive treatment only and therefore do not cover the majority of radiotherapy treatments.

The 2005 report *Radiotherapy Activity Planning for Scotland 2011-2015* did not recommend new or additional waiting times standards, but instead focused on reducing waiting times through the overall improvement in radiotherapy. The report outlined the vision that by achieving 354,000 fractions per annum, there should be no routine waiting time for radiotherapy once a radiotherapy referral has been received, with the provisos that demand projections hold true and the effects of the current demand and capacity mismatch are overcome.[11]

Wales

The key waiting time standards for radiotherapy in Wales were set out in the National Cancer Standards in 2005. The following generic waiting times standards apply where radiotherapy is the first definitive treatment and applies to approximately 30% of patients:

- patients diagnosed with cancer but not already included under the urgent suspected cancer category, should start definitive treatment within 31 days of diagnosis; and
- patients referred urgently with suspected cancer should start definitive treatment within 62 days from the receipt of the referral at the hospital.[13]

The Welsh National Cancer Standards also endorse the waiting times as defined by the JCCO, which, as noted in *Radiotherapy Equipment Needs and Workforce Implications 2006-2016*, are of particular importance where radiotherapy is not the definitive treatment.[13]

Northern Ireland

From April 2008, for all patients that received their first definitive treatment for cancer, at least 98% should have waited no longer than 31 days from the decision to treat to first definitive treatment. In addition, for all patients that received their first definitive treatment for cancer following an urgent referral by a GP for suspected cancer, at least 75% should have waited no longer than 62 days from the date of GP referral to the first definitive treatment. This was increased to 95% during March 2009.[19]

[iv] increased to 95% during March 2009.

JCCO standards for cancer treatment waiting times

In addition to the 31- and 62-day waiting times targets, there are also Joint Council for Clinical Oncology (JCCO) standards for cancer treatment waiting times. The JCCO is a joint body of the Royal College of Physicians (RCP) and The Royal College of Radiologists (RCR), which are the two Colleges containing the major non-surgical specialties involved in managing cancer.

The waiting times refer to the time from the decision to treat to the first fraction of radiotherapy:

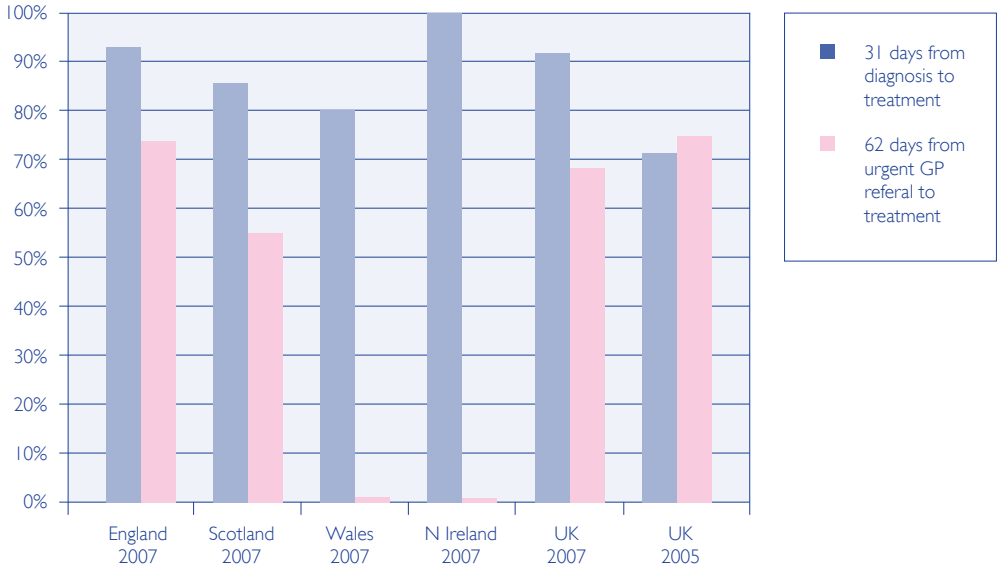
- For urgent radiotherapy or chemotherapy: good practice 24 hours; maximum acceptable 48 hours;
- For palliative radiotherapy (according to severity of symptoms): good practice two days; maximum acceptable 14 days (for non-severe symptoms); and
- For radical radiotherapy involving complex treatment planning: good practice two weeks; maximum acceptable 28 days.

Compliance with waiting times standards

The national radiotherapy planning reports all focussed on ensuring adequate staff and equipment resources to contribute to reducing waiting times (these approaches are covered in more detail in chapter 6 of this report). There has been some reduction in waiting times in recent years. However, waiting times targets are not yet being achieved. For example, from the figures in the Royal College of Radiologists' 2007 audit of radiotherapy waiting times in the UK, it would appear that 10% of patients are waiting more than 41 days for radical radiotherapy.[21]

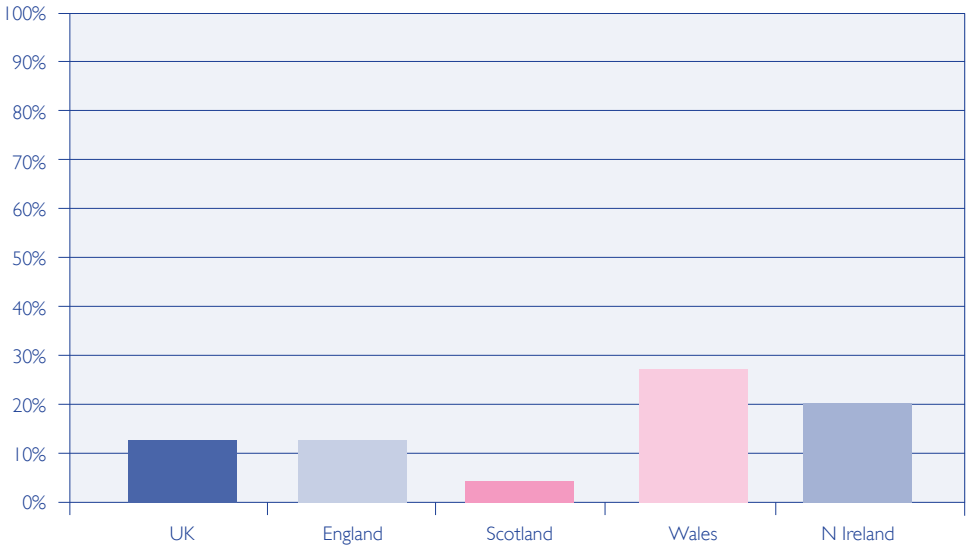
There is wide variation in the levels of compliance across the UK.

Figure 1 – Compliance with 31- and 62-day waiting times targets[v 20]



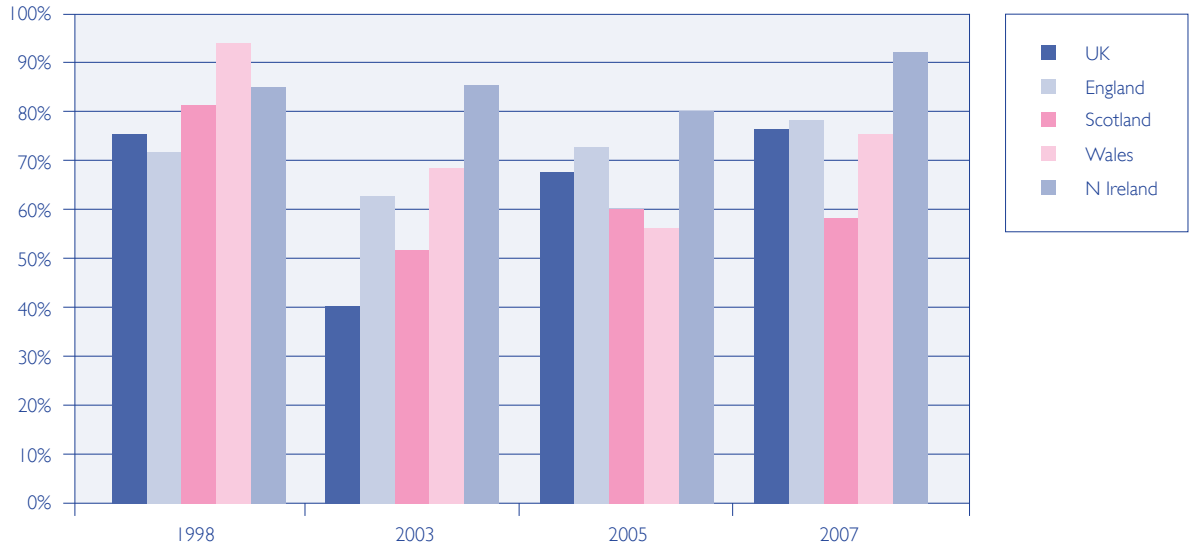
[v] Data for Wales and Northern Ireland based on very small numbers of patients, none of whom were referred within the 62-day waiting time targets.

Figure 2 – Compliance with JCCO standard for urgent radiotherapy (2007)[vi]



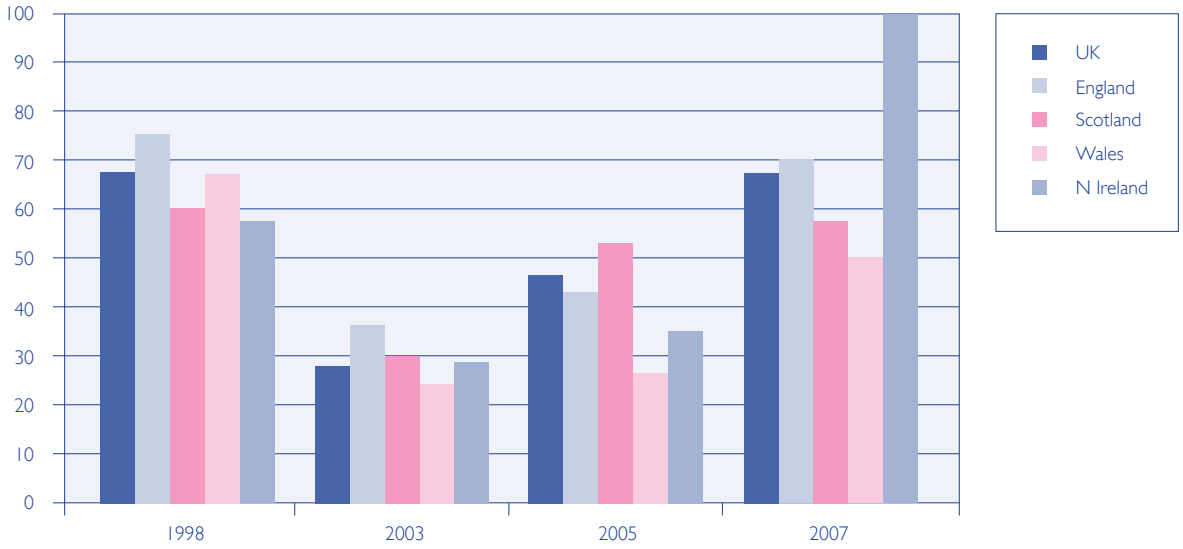
As the figures below show, waiting times compliance for palliative and radical radiotherapy across the UK worsened between 1998 and 2003, before improving in later years.

Figure 3 – Compliance with JCCO standard for palliative radiotherapy[vi]



[vi] 2007 data and data in UK column: Drinkwater KJ, Williams MV, Re-audit of Radiotherapy Waiting Times in the United Kingdom, 2007. Royal College of Radiologists, 2007. All other data from Cancer Services Co-ordinating Group, Radiotherapy & Chemotherapy Advisory Group, Radiotherapy Equipment Needs and Workforce Implications 2006-2016, 2006

Figure 4 – Compliance with JCCO standard for radical radiotherapy[vii]



England

Waiting time compliance in England either equalled or bettered the UK-wide compliance rates in 2007, and was superior to the compliance rates in Scotland on all five criteria, and to Wales in all but one. In 2007 there was only 7% non-compliance with the 31-day target that will be mandatory for all radiotherapy treatment from the end of 2010. However, this was only for the 15% of patients who received radiotherapy as a first definitive treatment, so achieving this target for all patients will be a substantial undertaking for the radiotherapy services.

However, as highlighted by the Cancer Reform Strategy Advisory Board,[6] the long lead-in time needed for commissioning new radiotherapy facilities means that action must be taken now if the new 2010 deadline is to be met. The first annual report of the *Cancer Reform Strategy*, issued in December 2008, included as a priority "ensuring that radiotherapy capacity is being developed in line with the requirements of the 2010 waiting time standard", with most SHAs and their Cancer Networks having shared with the National Cancer Action Team their plans for doing so.[6] It is important that this momentum is maintained; specifically, efforts to meet the new 31-day standard for second and subsequent surgery and drug treatments must not detract from work required to meet the later 2010 target for radiotherapy.

Scotland

As illustrated in the figures above, Scotland fell well below the UK average on all five waiting times compliance criteria in 2007 and ranked lowest among the UK nations in compliance for palliative and urgent treatments. 42% of patients were waiting longer than the recommended two weeks for palliative radiotherapy in 2007, which was significantly more than the 19% in 1998, although only slightly less than in 2005. For radical radiotherapy, 43% of patients waited longer than four weeks in 2007, which was a significant improvement on 2003 and a slight improvement on 2005.

Wales

In 1998 32% of patients were waiting longer than the four-week standard for radical radiotherapy. By 2003 this had deteriorated to 75%. The 2005 RCR audit of radiotherapy waiting times showed that only 57% of palliative and 26% of radical radiotherapy patients were seen within two and four weeks respectively.

The Welsh radiotherapy planning report noted that the three radiotherapy centres in Wales had already been working with Innovations in Care, a programme established in 2000 to modernise practice and reduce waiting times across the NHS in Wales, to examine how to improve waiting times.[13] There had been some improvement by 2007, with 77% of palliative

[vii] 2007 data and data in UK column: Drinkwater KJ, Williams MV, Re-audit of Radiotherapy Waiting Times in the United Kingdom, 2007. Royal College of Radiologists, 2007. All other data from Cancer Services Co-ordinating Group, Radiotherapy & Chemotherapy Advisory Group, Radiotherapy Equipment Needs and Workforce Implications 2006-2016, 2006

and 50% of radical patients being seen within the two- and four-week timeframes. NHS Wales statistics for April-September 2008 show that of the patients waiting for inpatient or day case admission for radiotherapy, none were waiting for more than one week. This suggests a rapid and marked improvement, although further data would be required to determine whether this is a sustained trend.

Work continues in Wales to ensure that waiting times targets are met. Local health boards and radiotherapy centres, supported by regional cancer networks, were tasked with establishing plans, by March 2009, to include increasing capacity on existing linacs to meet the JCCO waiting times recommendations for radiotherapy as required by the National Cancer Standards.[22]

Northern Ireland

Northern Ireland ranked highest among the UK nations in 2007 in terms of waiting times compliance for palliative and radical radiotherapy, achieving a significant improvement on previous years. There was full compliance in Northern Ireland with the 31-days measure and between April and June 2008, 98.6% of patients receiving radiotherapy were treated within 31 days.[23]

A multi-faceted approach to reducing waiting times

NHS Cancer Improvement's radiotherapy team provided an interesting case study in reducing radiotherapy waiting times: the '3SI' approach.[viii] The team believed that '3SI' – a combination of Sustained Investment/Service Improvement/Staff Involvement – can lead to not only the 31- and 62-day targets being met, but also the more stringent JCCO targets. The basis of '3SI' is that no matter how well radiotherapy departments are run, they cannot deliver without adequate resources.

The '3SI' approach was implemented in Sheffield and Leeds by NHS Cancer Improvement's National Radiotherapy Leads, Dr Peter Kirkbride (Clinical Director Radiation Services, Weston Park Hospital in Sheffield) and Angie Craig (Operational Head of Radiotherapy at Leeds). An overview of the '3SI' experience in Sheffield and Leeds is provided in Annex A. '3SI' was mentioned in the Welsh radiotherapy planning report, but widespread communication and adoption of this approach is lacking.

Best practice in service improvements, such as the '3SI approach' should be shared between all radiotherapy departments. This should be taken forward by the National Cancer Action Team in England and its equivalents in Scotland, Wales and Northern Ireland.

[viii] All information from Kirkbride, P and Craig A, *'3SI'* or *'How to reduce radiotherapy waiting times'*

6. Resourcing a world-class radiotherapy service

i. Workforce

The national radiotherapy planning reports identified shortfalls in radiotherapy workforce across all staff roles, and concluded that increasing the workforce was key to meeting future radiotherapy demand.

England: "The rate limiting step in improving productivity will be the number and type of staff available to deliver treatment and support the department – particularly radiography staff."[2]

Scotland: "It is projected that the capacity of radiotherapy services in Scotland will need to increase by 51% in order to meet future demand. Regardless of how this additional capacity is achieved, a concentrated and considerable investment in the workforce is required."[4]

Wales: "The extra radiotherapy equipment and the potential for extended working hours will require increased staffing of clinical and medical oncologists, radiographers, clinical scientists, dosimetrists and engineers."[13]

These views were supported in interviews conducted for this report.

While it has been recognised that the reasons for staff shortages are complex and wide-ranging,[4] contributing factors include high attrition rates affecting retention of existing staff, recruitment issues and attracting sufficient students into training.[2]

There are several ways in which the national planning reports recommended that radiotherapy workforces be grown to meet future radiotherapy demand. Primarily, these included improving the skills mix of the radiotherapy workforce and investing in training. An overview of the national approaches and progress in each area is provided below.

Across the UK nations it will be important, when devising new approaches to address current shortages and build the radiotherapy workforce of the future, that those involved in delivering the service - the oncologists, the radiographers, and the radiation physicists - are included in their development. Without this local level buy-in the NHS cannot hope to ensure that these initiatives are uniformly implemented.

England

The NRAG report recommended that the Department of Health, working with the NHS and other key stakeholders, develop a workforce strategy for England to identify and deliver the required numbers and skills mix of staff needed to support service improvements and increases to radiotherapy.[2]

The NRAG Workforce Sub-Group, on which the Department of Health is represented, has been relaunched to look at how to address the workforce issues and provide tools to enable this to happen. In addition, as noted in the *Cancer Reform Strategy* first annual report in December 2008, the Department of Health and the National Cancer Action Team will be reviewing progress made by SHAs in developing long-term workforce strategies. This will include an urgent review of workforce supply, demand and skill mix to identify required investment in staff numbers and types of training commissions.[6]

Scotland

The Scottish planning report concluded that a sustained and long-term workforce initiative was needed to provide time to develop the workforce required by 2011–2015. Such a national workforce strategy should also support new ways of working, skill mix initiatives and the development of new roles.[4]

Progress is ongoing. SRAG is conducting a review of staffing needs, which is expected to be published in 2009, and the new Scottish Cancer Taskforce is also understood to be looking in 2009 at how to help Health Boards plan for increased staff numbers.

Wales

In Wales, the Welsh Assembly Government's Workforce Development Unit is working closely with

Table 4 – Current and required therapeutic radiographer workforce

		England[25] (FTE)	Scotland[4] (WTE)	Wales[5]
Therapeutic Radiographers	Current	1775.96	162.6	97.18
	Required		217.6 for service redesign 243.2 for service redesign + 3/4 additional linacs[ix]	Max. increase of 96

the CSCG's Cancer Workforce and Training Group to identify education and training needs for the workforce, although this is not specific to radiotherapy.

Therapeutic radiographers

Therapeutic radiographers are the only health care professionals registered to deliver radiotherapy treatments to patients. They constitute the majority of the radiotherapy workforce.[2]

Since the publication of the radiotherapy planning reports, the problem of attrition does not appear to have improved. Indications from the Society and College of Radiographers (SCoR) are that the therapeutic radiography student attrition rate in the UK was almost 50% for the 2007-2008 academic year – the highest ever.

England

While numbers of radiographers continue to rise year on year, there are still significant recruitment and retention issues for this sector of the radiotherapy workforce. There was a 11.7% vacancy rate in England in 2006 (which equated to 221 vacant posts) and a 35% attrition rate from training. Pressures on clinical departments have led to a 'poor experience' for some students on placements, which is known to have contributed to the high attrition.[2]

However, these challenges should be taken in the context of recent progress being made. The number of therapeutic radiographers rose by 40% between 2000 and 2006.[17] This can be attributed to a doubling of student placements in the early part of this century, underlining the importance of investing in training to meet the capacity needs of the future.

Scotland

The Scottish radiotherapy planning report noted that 32.35 of 162.64 WTE posts were vacant, which is a vacancy rate of almost 20%, and attrition from training, despite improvement, remained high at around 20%.4

Wales

The Welsh planning report focussed on the highly-pressured working environment being faced by therapeutic radiographers, particularly the high levels of overtime "due to the pressure of work and to improve the waiting list". As a result, statutory and mandatory training is not being completed as well as it should be, the work/life balance of radiographers is suffering and continuing professional development is not being properly pursued. As well as highlighting as an immediate priority the recruitment of radiographers to build up the workforce, it too recognised a clear need to retain radiographers being trained in Wales.[13]

Since the planning report was published, there has at least been some positive news in Wales. Numbers of trainee therapeutic radiographers have increased in recent years by15 in 2006, 21 in 2007 and 17 in 2008. However, an expansion in the number of training places commissioned is currently restricted by capacity for clinical placements.[14]

Northern Ireland

The situation in Northern Ireland is slightly different. The supply of undergraduate radiographers from the University of Ulster exceeds current recruitment needs. However, this may not continue to be the case in the foreseeable future: not only it is thought that significant numbers may be lost with the planned expansion of radiotherapy facilities in the Republic of Ireland, but more therapeutic radiographers need to be trained in advance of the new radiotherapy facility opening in Altnagelvin in 2015. A review of commissioned undergraduate places is expected to take place in light of this proposed new facility.[14]

[ix] This increase on the current establishment only takes into account core staff requirements, i.e. staff for linacs and not for the many other roles which therapeutic radiographers undertake in a clinical oncology service.

A national career promotion strategy should be introduced across the four nations of the UK – with a focus on therapeutic radiography. This should be a joint undertaking by all relevant stakeholders, but led by the Society and College of Radiographers (SCoR) and the Department for Business, Innovation and Skills.

Improving the Skills Mix

As well as recognising the need to increase staff numbers to varying extents the national planning reports also covered workforce redesign focussing on skills – rather than job titles – in order to improve recruitment and retention and enable greater efficiencies.

In 1999 the SCoR introduced a four-tier career progression model for radiographers which includes assistant radiography practitioners, radiography practitioners, advanced practitioners and consultant radiographers. This also provides improved career progression for radiographers, which should help retention. Implementation of the four-tier structure is also intended to have a positive impact on other staff in the radiotherapy services, for example by enabling more appropriate use of the higher level skills of clinical oncologists. It is estimated that while, on average, 20% of radiotherapy practice is complex and requires fully trained clinical oncologists, the remaining 80% could be managed by non-medical advanced/consultant practitioners who have the necessary knowledge and skills and are based entirely within the radiotherapy centre.[2]

Implementing the four-tier skills model throughout the UK will also maximise the potential of therapeutic radiographers and enhance the quality and value for money of radiotherapy services.

While effective implementation of the four-tier model is a challenge, probably due to a combination of factors such as local interpretation, nervousness, and confusion about job boundaries with other professions such as nurses, work is ongoing to bring about progress. As well as spreading good practice, the SCoR has introduced an accreditation process for assistant practitioners. The SCoR will publish the advanced practitioner accreditation process in 2009, which should help overcome confusion around that role and lead to consistency.

All local radiotherapy departments should implement the four-tier skills model.

England

NRAG noted that implementation of the four-tier skills model had been patchy in England, and strongly recommended that all radiotherapy centres publish timetabled implementation plans. NRAG recommended that targeted funding would stimulate the full uptake of the four-tier model, particularly the advanced and consultant level posts. If such investment could not be secured, NRAG called on SHA commissioners and service employers to fund the fast track career progression required to develop the higher-level skills required as part of this model as a priority.[2] Interviews conducted for this report suggest that the four-tier skills model is still not being fully implemented across England, particularly the assistant practitioner grade, and the National Radiotherapy Implementation Group (NRIG) is looking at the issues affecting funding for these posts in England.

Scotland

The NHS Education for Scotland (NES) Radiographer Role Development Project has already developed the radiography role with the intention of improving recruitment and retention. In addition, the Scottish planning report recommended the promotion and support of assistant therapy radiographer posts and advanced practitioner or consultant therapy radiographer posts.[4] A Higher National Certificate programme for assistant practitioners has since been created at Stow College in Glasgow, and there is also a Certificate of Higher Education course at Robert Gordon University. However, it is understood that these courses are under-subscribed despite pump priming having been provided by the Scottish Government.

Better Cancer Care, An Action Plan, published by the Scottish Government in October 2008, noted that implementation of four-tier career progression framework was improving but was not consistent across Scotland. It called on NHS Boards to maximise the potential of the four-tier model, with continued support from NES and other partners.[11]

Wales

The SCoR, working together with service managers, is taking the lead in exploring how to implement the four-tier skills model throughout Wales, although at the time of writing this was at a very early stage. However, the Welsh Assembly Government is encouraging the training of assistant practitioners, supporting a one-year full time day release course that has been developed at

the University of Cardiff. In addition, the Welsh planning report noted a partnership between the North Wales cancer centre and Sheffield Hallam University to provide an assistant practitioner distance-learning course.[13]

Northern Ireland

The Northern Ireland Cancer Centre also has plans to look at skill mix in relation to the roles of radiographers (and dosimetrists) to ease the pressure on other staff groups.[14]

Investing in Training

NRAG underlined the importance of identifying and implementing a course of action to reduce attrition before investing in further training numbers, noting that the SCoR was working with the education providers on 'good practice' guidance, which includes ensuring the role of the therapeutic radiographer is clear to students when applying.[25]

NRAG recommended that one way to reduce attrition rates would be to improve trainees' training experience and to increase training capacity to reduce pressure on existing clinical services. Two projects were proposed to support this:

- the development of at least two multi professional skills laboratories by the end of 2008; and
- the introduction of Hybrid Virtual Environment skills training facilities (which simulate radiotherapy equipment and treatment rooms, effectively bringing the clinical environment into the academic environment) from 2007. SHA workforce commissioners and higher education providers were to roll this out across the ten educational providers and 52 clinical sites from 2007 to support first year students and assistant practitioners.[2]

At the time of writing, the development of the multi professional skills laboratories had not been progressed. NRIG is currently exploring how this could be moved forward. However, there is a question about whether this has been overtaken by the introduction of virtual training environments for radiotherapy treatments.

Virtual Environments for Radiotherapy Treatments (VERTs) should be available for radiotherapy trainees in all of the UK nations.

England

There has been good progress in establishing virtual training facilities. The SCoR officially launched the VERT project in October 2008. As of the beginning of January 2009, the vast majority of clinical sites in England – 29 in all – had VERTs. It is expected that the impact of VERTs on attrition and recruitment will be evaluated by October 2009.[6]

Northern Ireland

A VERT facility was in place in Northern Ireland – at the University of Ulster – before any others were established in the UK.

Wales

In Wales, the Welsh Assembly Government has funded virtual reality-based simulation training on the operation of linear accelerators, which commenced in autumn 2008 and is housed at the Radiography School at Cardiff University.[26]

Scotland

At the time of writing there were no VERT facilities in Scotland.

Clinical oncologists

Clinical oncologists administer all forms of non-surgical cancer treatments, including radiotherapy and chemotherapy. Although all three national radiotherapy planning reports highlighted the need for additional clinical oncologists to be recruited, the main focus was on the provision and training of therapeutic radiographers and radiotherapy physicists. Interviews conducted for this report confirmed that these are the radiotherapy professions facing the most pressing recruitment and retention issues.

It is interesting that only the Scottish planning report examined the clinical oncologist workforce supply, noting the low retention rate for specialist registrars and calling for further work to consider if the current training opportunities and retention of trainees in Scotland will adequately meet future needs.[4]

The NRAG report drew attention to some workload issues affecting clinical oncologists. Improvements in screening and diagnostic services were resulting in an expanding patient base and an increased workload,

Table 5 – Current and required clinical oncology workforce

		England[25] (FTE)	Scotland[4] (WTE)	Wales[5]
Clinical Oncologists	Current	407	43.2	
	Required	600	60	13-23 additional oncologists (clinical and medical)

meaning that many clinical oncologists were "very hard-pressed (and burned-out)".[25] The introduction, through the four-tier career model for radiographers, of advanced and consultant practitioners is intended to make more effective use of clinical oncologists' time, although as noted above, the implementation of this is patchy so it is unlikely the benefits are being felt widely at this stage.

Specialisation

There are different approaches to clinical oncologist specialisation in different countries. These include site specialisation, i.e. by tumour type, and specialisation by treatment modality, i.e. either chemotherapy or radiotherapy. It is clear that the UK is one of the few developed countries where clinicians delivering radiotherapy do not focus exclusively on this, but also deliver chemotherapy, often across a variety of different tumour types. This seems somewhat at odds with the more general specialisation, combined with multi-disciplinary team working, that has taken place as part of the modernisation of cancer service and clinical research provision. There are many and varied views on this issue.

A full and open discussion on what specialisation means to clinical oncologists in the UK would help to determine whether any change in approach would be beneficial for both oncologists and patients. An emerging view in some quarters is that three types of specialisation may be most appropriate, with some pure radiation oncologists, some pure systemic therapists (medical oncologists) and some who do both, but who specialise in certain tumour types. These tumour types might be in some of the more common cancers, where workload is high but the treatments may be relatively more straightforward. Furthermore, the optimal approach may be different in different parts of the country, depending on patient case-load.

A review of clinical oncologist specialisation should be undertaken, led by the Royal College of Radiologists and the Royal College of Physicians and including all key stakeholders.

Radiotherapy physics staff

This group comprises clinical scientists, dosimetrists and engineering technologists:

- Clinical scientists are trained in radiation physics and design, build, develop and manage the scientific infrastructure of radiotherapy.
- Dosimetrists provide support to clinical scientists in delivering the clinical physics service to radiotherapy.
- Engineering technologists are clinical technologists with electronic and mechanical engineering skills, and they are responsible for carrying out equipment management.

Shortfalls in the workforce establishment across all the radiotherapy physics professions were reported in all the national radiotherapy planning reports. With new developments in radiotherapy technologies, such as intensity modulated radiotherapy (IMRT) and image generated radiotherapy (IGRT), which are dependent on sufficient physics expertise, these workforce shortages are of particular concern.

England

NRAG found radiation physics the most difficult group for which to forecast future supply and demand, due to suspected undercounting in the Department of Health annual census.[25] Interviews conducted for this report suggest that there are currently about 250-300 fewer medical physicists than the number required in England by 2010, meaning that there is still considerable progress to be made. Indeed, a survey conducted by the National Cancer Action Team in late 2008 revealed that "87% of trusts were not doing as much intensity modulated radiotherapy as they wanted to because of a shortage of physicists".

Table 6 – Current and required radiotherapy physics workforce

		England[25] (FTE)	Scotland[4] (WTE)	Wales[5]
Radiotherapy physicists	Current	All radiotherapy physics staff: 893.64	42.5	26.3
	Required		71.5 for service redesign (80.1 if + 3/4 linacs are added)	20
Dosimetrists	Current	All radiotherapy physics staff: 893.64	41.5	16.4
	Required		48.8 for service redesign (54.6 if + 3/4 linacs are added)	20
Engineers	Current	All radiotherapy physics staff: 893.64	35.5	14
	Required		42.3 for service redesign (47.3 if + 3/4 linacs are added)	16

Some progress has been made in increasing training for radiotherapy physics staff. In England, a working group has been established – chaired by the Department of Health's Chief Scientific officer – to look at the role of healthcare scientists in radiotherapy to support the development of the radiotherapy workforce.[6]

Scotland

The Scottish planning report noted that recruiting graduates with engineering degrees to the NHS was becoming increasingly difficult in the face of considerable demands from industry and other private and public sectors.[4] In October 2008, the Scottish Government's report, *Better Cancer Care, An Action Plan*, highlighted continued significant shortages in radiotherapy physics staff despite an increase in training posts following the recommendations of the Scottish radiotherapy planning report. The Action Plan identified the need to explore further cooperation and collaboration at a national level between the five radiotherapy physics departments, particularly for complex radiotherapy treatment planning.[11]

Wales

According to the Welsh planning report, there have been problems in recruiting experienced and professionally registered staff in Wales and newly qualified staff have been lost in part due to the lack of permanent funding within Trusts. Worryingly, some 30 to 40% of the South West Wales Radiotherapy Physics Group is also expected to retire by 2015.[13] Prior to the publication of the Welsh planning report, the three radiotherapy centres in Wales had been working with Innovations in Care in order to introduce improvements in service efficiency. As part of this process, the skill mix of staff within radiotherapy physics services had evolved with role extension, which saw, for example, clinical technologists undertaking some tasks previously the preserve of clinical scientists.[13]

The Welsh radiotherapy planning report noted that funding of radiotherapy physics trainee posts up to state registration level will provide additional flexibility to treatment centres when addressing the availability, recruitment and retention of a skilled professional workforce and matching to permanent posts.[13]

Northern Ireland

In Northern Ireland there have been difficulties in meeting some of the targets for radiological science and imaging because of staff shortages, although additional posts were introduced in 2008/9.[28]

Auxiliary staff

Radiotherapy requires a mix of skills from a range of staff, including administrative and clerical staff and nurses. One component of the four-tier skills model is improving the skills mix of accounts & clerical staff to enable other staff to spend more time on clinically focussed roles.

Interviews conducted for this report indicate that progress throughout the UK has been varied and that there is potential for more to be achieved. For example admin staff could be trained to handle complex patient referral processes. The challenge lies in recruiting the right quality as well as the right numbers of staff for these less well-paid roles.

> The 3 Counties Cancer Network report that "... the Radiotherapy Department in the Oncology Centre is working hard to reduce current waiting times for treatment. This work has included (…) reviewing the skill mix in the Department so that more tasks are being undertaken by support workers, assistant practitioners and administrative staff – this frees up the 'experts' to undertake those tasks that only they are able to perform". [29]

Wales
Only the Welsh radiotherapy planning report specified what increase was needed in the auxiliary radiotherapy workforce. Even prior to the publication of the report, the radiotherapy cancer centres in Wales work with Innovations in Care included a focus on service improvement through the appointment of booking clerks.[13]

England
The NRAG report adopted a position on nursing staff for radiotherapy services, concluding that there was no need to develop new nursing roles within the radiotherapy department, providing that radiographers take on new or extended roles (such as supplementary prescribing or on-treatment reviews) and implement the assistant practitioner role.[25]

ii. Equipment

Linear accelerators ('linacs') are the machines most commonly used to deliver external radiotherapy treatment for patients with cancer. Linacs are also used for some of the newer, more advanced, radiotherapy techniques such as intensity modulated radiotherapy (IMRT).

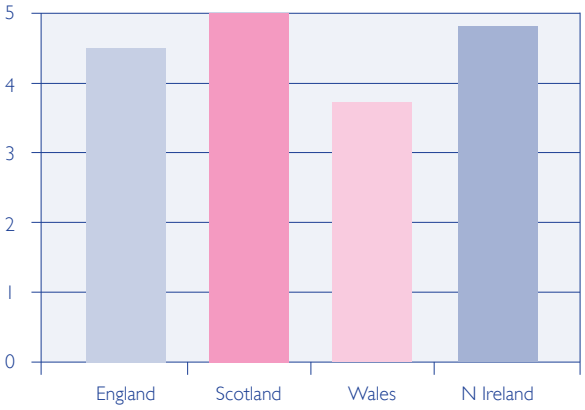
Linacs have a finite working life expectancy, which depends on their hours of clinical use. For example, a linac being used for 40 hours per week can be expected to have a working life of about 12 years[4] at the most, by which time its major components will start to wear and accuracy will decrease. In conjunction with plans to acquire new linacs existing equipment must also be replaced in a timely fashion. This was recognised in all of the radiotherapy planning reports.

Other types of supporting equipment are also used in radiotherapy. CT simulators and planning computers are used to plan treatment, and linacs must be housed in radiotherapy bunkers to ensure that staff are protected from radiation. Investment in this equipment is important and while this features in the radiotherapy planning reports, the main emphasis is on the current and future supply of linacs.

Current and future linac requirements

There is some variation between the UK nations both in terms of current equipment resources and approaches to managing future equipment requirements. In June 2005, the EU-funded QUARTS (Quantification of Radiation Therapy Infrastructure and Staffing needs) survey indicated a requirement for the UK of 6.5 machines per million of population, compared with the Royal College of Radiologists' recommendation of 5.5 to 6. Although all four nations fall well below these levels, there are plans to increase the number of linacs over the next decade – substantially in the case of England and Wales. Progress on commissioning additional and replacement linacs varies across the UK.

Figure 5 – Linacs per million population[x 2,4,13]



England

The English NRAG report noted that 233 linacs were expected to be in place by 2008/09, and identified a need for around 90 additional linacs, which "implies that each of the 51 radiotherapy centres in England is likely to require additional machines."[25] All new linacs commissioned in England are of the highest technical specification.

Progress in expanding equipment capacity has been slower in England than some of its neighbours, although planning and preparation is taking place. In line with the goals set out in the Cancer Reform Strategy, the National Cancer Action Team advised Strategic Health Authorities and Cancer Networks in the summer of 2008 to initiate action immediately in order to deliver increased capacity to meet the new 31-day waiting time standard by 2010. Commissioners were advised to establish an accurate, up-to-date picture of their local radiotherapy services and benchmark how far removed these were from the NRAG recommendations. Based on this, they were asked to consider the future shape of their radiotherapy services and set out how this should be put in place, and make recommendations on whether the necessary expansion in capacity would best be delivered by new linacs at existing centres and/or at new satellite centres and capital replacement plans.[31]

Good progress has been made by the National Cancer Action Team in producing tools to assist Commissioners in planning for increases in radiotherapy capacity. A radiotherapy capacity planning tool (R-PoRT) is being developed to help service departments assess capacity. R-PoRT, which will allow scenario modelling and costing of potential service changes, is being piloted in three radiotherapy departments and is intended to be offered to all centres from Spring 2009.[6]

By December 2008, most SHAs and their Cancer Networks had shared their plans with the National Cancer Action Team[6] and work to increase capacity has already started, with decisions in some areas to establish satellite radiotherapy centres.[32]

A commissioning framework, which was launched by the National Cancer Action Team in November 2008, is intended to aid the expansion of radiotherapy services by allowing the independent sector to come into the marketplace. It comprises a contracting framework toolkit, which sets out what is required of a clinically safe and effective organisation that is providing radiotherapy services. This is turn is supported by a service specification and a generic patient pathway.[33]

It is also important for the commissioning framework to be supported by a good tariff. Radiotherapy tariffs are currently a big problem in England, ranging across Trusts from £82 to £242 per fraction. The NRAG implementation group is working through detailed evidence on costing, but as some Trusts will have to make more of an adjustment than others, this issue is unlikely to be resolved overnight. It is thought that there may be an indicative tariff by 2011 and a national target by 2012. Although this is later than anticipated, a significant lead-in time is required and the cost of new technologies has to be taken into account and built into the tariff, which is not straightforward. However, it is important that the timescale does not slip beyond 2012.

The NRAG report also called for replacement programmes to be in place locally to ensure linacs are replaced every ten years, noting that "in the past health economies have not always appreciated the need to update machines and they need to make provision for this on-going commitment."[2] The current age profile of linacs in England means that between six and 35 linacs will need to be replaced each year – a total of 178 between 2007 and 2016 – almost twice the number of additional new linacs needed by 2016.[2]

[x] Based on population statistics from Northern Ireland Department of Health, Social Services and Public Safety, *Regional Cancer Framework, A Cancer Control Programme for Northern Ireland, 2008*

Until 2006, the Government funded the procurement of linacs through the New Opportunities Fund and the Capital Investment Programme. Since the end of these programmes, however, "the replacement of linacs has virtually stopped". This is a cause for serious concern. Responsibility for the purchase of major items of capital equipment, such as linacs, is devolved in the English health service, but despite the detailed preparation to expand radiotherapy services, the cost of replacing existing linacs has not been included in the overall funding available to the NHS.

Local providers should publish plans to ensure adequate replacement of linacs on a rolling basis in England.

Wales

The Welsh radiotherapy planning report determined that, to meet the target 58,000 fractions per million population, Wales should plan for six to ten new linacs by 2016. The report presented various options for service models to meet the estimated demand for radiotherapy, with the exact number of new linacs dependent on the service model adopted.[13]

The Welsh planning report also recommended that, in order to achieve the target of 58,000 fractions per million population, Wales should plan for 11 replacement linear accelerators by 2016, again depending on the service model adopted.[13]

Steady progress seems to be being made in Wales. In February 2007, the Welsh Assembly Government Health and Social Services Committee recommended that the Welsh Government, together with the CSCG, formulate an urgent implementation plan to address issues raised by the Welsh radiotherapy planning report. This was to include securing the funding of new and replacement radiotherapy equipment.[35] The Welsh Government accepted this recommendation in principle and noted that it has made investments in new facilities and equipment through the Capital Investment Programme, with the onus now on Cancer Networks to formulate and implement commissioning strategies to utilise these services.[24]

Some positive steps forward have been taken. Velindre cancer centre (South East Wales) has procured one additional and one replacement linac, and has submitted a business case for a further additional linac. Proposals have also been developed for a radiotherapy satellite unit in South East Wales, housing two linacs and three bunkers. Subject to approval, the new satellite unit is expected to be ready in 2012-13 to meet capacity requirements in the region. Elsewhere in Wales, one linac at the South West Wales cancer centre in Swansea has been upgraded, and North Wales is developing a business case for two replacement linacs and the installation of an additional bunker for a new, fourth linac. The CSCG programme remains on target to provide 17 linacs – an increase of six – by 2015.[14]

Scotland

Although it did not identify an immediate requirement to increase the number of linacs in Scotland beyond the 25 expected by 2007/08, the Scottish report on radiotherapy planning noted that a small number – three or four – of additional linacs would be needed should the projected required capacity of 354,000 fractions per annum hold true.[4]

Scotland's 25th linac, which will be sited in Inverness, was due to be delivered in January 2009. Due to building requirements the schedule for this has slipped. Progress in Scotland is otherwise on track in terms of delivering the required complement of linacs.

The Scottish planning report noted that the current rolling programme of radiotherapy equipment replacement (covering linacs, simulators and planning systems) is working to a ten-year replacement timetable. Funding in is place for the replacement programme. Scotland appears to be a step ahead of the rest of the UK in this regard. Through a national inventory of radiotherapy equipment, it is clear what equipment is needed at each site in any given year, and funding is in place to purchase it. Furthermore, all new linacs commissioned in Scotland are of the highest technical specification, with on-board imaging, electronic portal imaging and multileaf collimators.

The Scottish Government noted recently that the SRAG's Technical Specification and Evaluation subgroup had proven "an extremely effective forum for ensuring the timely replacement and efficient procurement of the stock of treatment machines across the cancer centres" and that the Group should continue with this role.[11]

Northern Ireland

The Northern Ireland Executive judged in its 2007 *Regional Cancer Framework – A Cancer Control Programme* for Northern Ireland that it had sufficient

linacs (eight) to meet its population's needs until at least 2015.[7] To provide the additional radiotherapy capacity required beyond then, a new satellite radiotherapy centre is to be established at Altnagelvin Hospital in Londonderry by 2015, which is expected to house two linacs in the first instance.

Since the publication of the 2007 Framework, however, it has been recognised that extra radiotherapy capacity will be needed ahead of 2015. In 2008 the Northern Ireland Executive stated that additional funding will be allocated to deliver radiotherapy capacity for an additional 600 patients per annum from 2010/11, and asked Trusts to establish plans by the end of March 2009 to ensure that this extra capacity can be delivered.

A business case has subsequently been drafted which proposes investment in two additional linacs. This is currently under consideration by the Northern Ireland Department of Health, Social Services and Public Safety.

The Northern Ireland planned linac replacement programme runs from 2013. However, there is concern that there could be a deficit between capacity and demand between 2013 and the new radiotherapy satellite unit opening in Londonderry in 2015.

Satellite Units

In recognition of the accessibility difficulties faced by some patients, the provision of satellite radiotherapy units is an approach that is being considered in all of the UK nations. The value of satellite units has been a topic for debate amongst the radiotherapy community. However, where these are adequately regulated to ensure that the same high quality of care can be delivered as would be expected from the radiotherapy centres across the UK, satellite units can have a role in increasing service capacity.

England

Although the NRAG report concluded that neither a major reconfiguration of radiotherapy facilities nor a major investment in satellite centres was necessary in England,[25] the provision of some satellite units is going ahead. Satellite centres are to be locally run and driven by Cancer Networks, but, as recommended by NRAG, a national overview is needed to ensure even access to radiotherapy services. Commissioners have been asked to submit plans to the National Cancer Action Team. A significant impact is expected on travel times for patients in those areas that are introducing satellite services.

In July 2008 the 3 Counties Cancer Network, which serves Gloucestershire, Herefordshire and South Worcestershire, announced that agreement had been reached to set up one new satellite unit in Worcester and one in Hereford. This is expected to reduce journeys for many cancer patients currently travelling to the Oncology Centre at Cheltenham.

A new radiotherapy centre being built in Oldham is expected to save patients in the area "the equivalent of travelling to the moon and back in just one year".[32]

Scotland

A report published by the Scottish Government in October 2008 recommended that the possibility of one or more small 'satellite' centres should be explored as they might allow some treatment to be delivered closer to patients' homes.[11]

Wales

Although it did not include a specific recommendation on satellite units, the Welsh planning report noted that the expansion of radiotherapy facilities may provide an opportunity for improving access to radiotherapy with linked satellite units, and that building constraints at existing sites may increase the likelihood of this.[13]

Northern Ireland

The Northern Ireland Executive recognised that, in the period 2015-2025, a satellite radiotherapy unit could be required.[7] It was announced in 2008 that this will be built at Altnagelvin hospital in Londonderry and once it is in place by 2015, 90% of the population will be within one hour of radiotherapy services.[37]

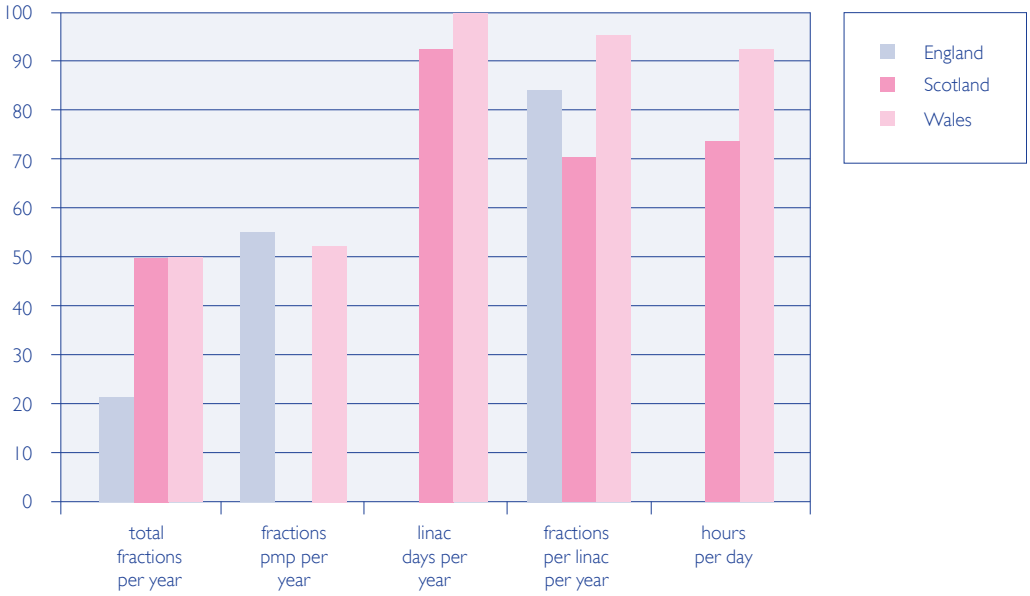
Increasing linac productivity

The national radiotherapy planning reports were all of the view that simply having a greater number of linacs would need to be supported by improved productivity from the existing services.

Extending hours of operation

Several studies have looked at ways in which local providers can make the most out of the equipment they have purchased. A 2007 analysis of extended working hours in radiotherapy in the UK concluded that two shifts covering an 11 and a half hour working day was a robust alternative to the normal working day. This took into account efficient use of radiographers and patient preferences for out-of-hours appointments. 95% of radiotherapy departments contacted as part

Figure 6 – Linac productivity (per cent of recommended)[xi]



of the analysis reported that they had experience of extended working hours. However, one-third said that they would not be able to implement extended hours again without an increase in staff and the radiotherapy budget.

England

The NRAG report recommended an immediate aim for all radiotherapy departments to deliver at least 8,000 fractions per linac per year averaged across all linacs in the department, with 8,300 to be delivered by 2010/11 and 8,700 by 2016. In addition to recommendations on linac fractions, NRAG advised that radiotherapy departments should operate a five day week, with a total of 239 days per year (allowing for closure on only three bank holidays), and on average slightly over nine hours per day, with a minority of a department's machines running for an extended day, for example 11.5 hours.[2]

On the most pressing of these recommendations – the immediate aim of 8,000 fractions per linac per year – progress appears to have been slow. A report published by the Conservative Party in November 2008 revealed the current average number of fractions per linac per annum to be 7,400 – well below the NRAG recommendation of 8,000 fractions.[15]

While local demand varies across the country, the NRAG recommendation that centres should be achieving 4 to 4.5 fractions per hour target could be seen as a proxy for determining whether the right patient throughput is being achieved. Better local data is needed to determine what is appropriate for each local area.

However, planning is taking place. The 3 Counties Cancer Network has published plans to make adjustments to the working day so that linear accelerators are available for longer periods, allowing more patients to be treated.[29]

It is too early to establish what progress has been made on other service efficiency recommendations, for example on operating hours and days worked per year. Interviews conducted for this report suggest that this is being given some consideration, but progress is dependent on local needs first having been modelled and the recruitment of more staff.

Scotland

The Scottish radiotherapy planning report did not recommend a specific increase in the number of fractions delivered per linac, but rather the total number of fractions delivered in Scotland per annum.

The report also recommended a service redesign to meet future capacity requirements. This focused on increasing the core clinical service to ten hours per day, five days per week, and achieving 257 clinical days per

[xi] Gaps indicate where recommendations varied across the national radiotherapy planning reports.

annum by reducing the number of days lost due to closure for public holidays and routine maintenance.

The Scottish Government has also recently noted that it has been difficult to implement the extension of the working day in all areas due to a combination of issues such as staff shortages.[11] Interviews conducted for this report indicate that some centres are already operating ten-hour days, but at others lower local demand means this is not yet necessary. Bank holiday working still varies between centres. It is understood that discussions with trade unions are ongoing regarding potential changes in working practices.

In addition, the report highlighted the lack of uniformity of workload and patient throughput per linac. This was thought to be partly due to the variation in factors such as clinical service hours and patient populations, but meant that in the central belt of Scotland, demand exceeded capacity. It was felt that ensuring, as far as possible, an equal workload across all of Scotland's linacs would be an important factor in optimising potential radiotherapy capacity across the country. The report recommended that further work be undertaken to explore how far workload redistribution could optimise the use of linac capacity.[4]

The Scottish Cancer Taskforce will be looking at the planning of radiotherapy workload, and progress on this will be outlined in the Scottish Cancer Taskforce annual report.[11] The introduction of one or more satellite centres in Scotland could lead to the radiotherapy workload being better distributed.

Wales

The initial service efficiency measures recommended in the Welsh radiotherapy planning report were not as far-reaching as those in the English and Scottish planning reports. The number of linac working days per year was to be kept at 244, and the number of hours per day kept to eight (only one of the three Welsh radiotherapy centres would need to increase its operating hours to meet this).[13]

However, a number of potential future service models were outlined for increasing capacity to meet the 2016 target of 58,000 fractions per million population. Depending on the service model chosen, linac operating hours could increase to nine or ten hours, but the benchmark of 8,000 fractions per linac per year is retained.[13]

Progress on the service efficiency recommendations is expected to commence in 2009. Health Boards and radiotherapy centres, supported by Regional Cancer Networks, were asked to establish implementation plans by March 2009 to address the recommendations of the Welsh planning report; these plans are to include increasing capacity on existing linacs to meet waiting times standards.[22] In addition, it is also understood that a decision is awaited as to whether government support will be available in 2009 to implement extended working hours.[14]

Plans for delivery of services by local providers should include details of fractionation targets and changes to service delivery, such as increased working hours, to meet these targets.

iii. Emerging technologies

It is becoming clear that one area where the UK lags significantly behind its neighbours is in the provision of new technologies on the NHS. The regional radiotherapy planning reports, and particularly those published in England and Scotland, note the importance of introducing new, advanced radiotherapy techniques.

However, the implementation of these new techniques will require extra linac and workforce resources. The Radiotherapy Development Board is developing a strategy for the implementation of intensity modulated radiotherapy (IMRT) and image guided radiotherapy (IGRT) across the UK. This will include the evaluation of existing practice in departments, as well as guidelines on implementation and the identification of workforce and skills issues.

Intensity modulated radiotherapy

Intensity modulated radiotherapy (IMRT) shapes the radiation beams to closely fit the shape of the cancer and alters the radiotherapy dose depending on the thickness of body tissue. IMRT is delivered using linacs with a special device called a multileaf collimator that moves around the patient and shapes the beams of radiotherapy to fit the tumour. The importance of IMRT has been recognised in all four UK nations and is being used to varying degrees throughout the UK. The emphasis needs to be on making this technology available to all patients who might benefit.

England

The NRAG report stated that IMRT is likely to be used in conjunction with 4D adaptive radiotherapy, which takes into account tumour volume in three dimensions as well as changes with time (the 4th dimension). NRAG expected that this standard of care should be achieved for all departments in England within five to ten years.[39] This technology is now standard on modern radiotherapy equipment: the UK trade association for radiotherapy technology providers has confirmed that more than 80% of its first world linacs delivered are now capable of image guided 4D adaptive radiotherapy.[34] One of the main aims of the National Radiotherapy Implementation Group (NRIG) is to assist the change to ensure that IMRT (and IGRT) are being used. The issue of training existing staff to use new technologies is also being considered by the relaunched NRAG Workforce Sub-Group.

However, from interviews conducted for this report, it seems that IMRT is still seen by many in the English radiotherapy community as too difficult to implement. Due to the fact that it takes longer to plan and deliver, patient throughput is initially adversely affected. The National Cancer Action Team is taking steps to facilitate a more widespread use of IMRT. The Team held a one-day meeting day in November 2008 and has conducted a survey on IMRT use, which revealed that while IMRT may benefit around 20% of cancer patients[27] it is currently only used to treat around seven percent of patients in the NHS.

In September last year, NICE made a decision to halt appraisals of the use of IMRT in the treatment of several types of cancer. This innovative new way of treating patients is standard practice in the US and some other European countries, yet the UK currently has limited access to this technology within the NHS. The lack of facilities and workforce to deliver this technology was the basis of NICE's decision to halt the appraisal. However, a NICE recommendation in favour of the uptake of IMRT would create an impetus for the NHS to implement this new technology as fast as possible.

Scotland

When the Scottish radiotherapy planning report was published in December 2005, IMRT was not in clinical use anywhere in Scotland. The report noted that the Radiotherapy Advisory Group, reporting to the Scottish Cancer Group (which has now been superseded by the Scottish Cancer Taskforce) was being established to coordinate developments such as IMRT and IGRT to ensure equitable access across Scotland.[4]

Work to introduce IMRT in Scotland is ongoing. All Scottish departments have the capability of delivering IMRT. It is now available in Glasgow and Edinburgh, although there are some limits on the number of patients that can be treated. In Glasgow IMRT is being delivered for head and neck cancer and prostate cancer only. The provision of IMRT in the north of Scotland is also being considered, and the SRAG asked all radiotherapy centres to keep them informed of their plans for IMRT.

Wales

The Welsh Standards National Cancer Standards require that radiotherapy equipment capable of delivering IMRT be available to each Network.[13]

Northern Ireland

The Cancer Control Programme for Northern Ireland noted that there have been significant improvements in the numbers and types of radiotherapy treatments available in Northern Ireland, including the introduction of IMRT.[7]

NICE, and its equivalent in Scotland, should provide national guidance on novel radiotherapy techniques, such as intensity modulated radiotherapy (IMRT) and proton therapy, where there is a clear consensus that the evidence supports their implementation in certain indications. This should be supported by sufficient funding from government to ensure that all patients who may benefit can get access to these new technologies.

Local providers should detail plans for the delivery of IMRT.

Proton therapy

Instead of using X-rays, proton therapy aims proton beams at the cancer. Because protons release their energy when they stop rather than when they are travelling through tissue, most of the radiation goes directly to the cancer, reducing damage to the surrounding normal tissue.

Proton therapy is not currently available in the UK. However, the NRAG report recommended that the Department of Health should set up a clinical

reference panel to approve referrals of appropriate NHS patients to proton therapy centres outside the UK and develop a business case for at least one modern proton treatment facility in England.[2] From April 2008 proton therapy is commissioned on a national basis. A Clinical Reference Group has been set up within the National Commissioning Group which proposes to identify funds to refer ten patients in 2008/09, 25 in 2009/10 and 50 in 2010/11.

The first annual report of the *Cancer Reform Strategy* confirmed in December 2008 that the Department of Health would indeed consider options for providing modern proton therapy services in this country and that work is being undertaken to establish an agreed set of clinical indications for this treatment and an outline service specification. A Proton Therapy Advisory group has been established to provide expert clinical and scientific advice and the Government has stated that they plan to have a draft outline business case setting out the options for the procurement of proton therapy services early in 2009.[6] In addition, the National Radiotherapy Implementation Group's Workforce Sub-Group is looking at what proton therapy training is needed for oncology consultants.

The Scottish radiotherapy planning report suggested that proton therapy facilities, among other new technologies, be reserved for consideration in any future review of radiotherapy services.[4] In the meantime, referral pathways are being formalised to allow Scottish patients to be referred abroad for proton therapy treatment.

Stereotactic radiosurgery

Stereotactic radiotherapy is occasionally used to treat brain tumours. The treatment is given to the tumour from many different points around the patient's head. Stereotactic radiotherapy given as a single treatment (fraction) is known as stereotactic radiosurgery.

Although none of the radiotherapy planning reports made recommendations on stereotactic radiosurgery, it is being used in the UK (except in Northern Ireland) and there are some plans to examine its further use.

England

In England, stereotactic radiotherapy and radiosurgery are both performed at Addenbrooke's Hospital, and both the Sheffield and London GammaKnife Centres treat NHS patients. The National Radiotherapy Implementation Group is looking at how to take forward stereotactic radiosurgery provision and what equipment would be needed to deliver this.

Scotland

In Scotland, stereotactic radiosurgery is available in both Glasgow and Edinburgh for intra-cranial treatment, and consideration is being given to expanding this to extra-cranial treatments.

Wales

Stereotactic radiotherapy and radiosurgery are performed in Wales at the South East Cancer Centre.

Image guided radiotherapy

Image guided radiotherapy (IGRT) is a new way of using scans during radiotherapy treatment. Radiotherapy planning is usually only done before treatment starts, using 3D CT scans (and sometimes MRI scans) to plan the area that is going to be treated (the radiotherapy field). It is important that the field contains all the cancer, plus a border around it. Treatment is then given to this same area each time a patient goes for radiotherapy. For IGRT, linacs have a special built-in CT scanning panel, which is used to take scans before each treatment. This enables a much more detailed picture than with normal CT scans, so the radiotherapy field can be planned much more accurately. IGRT enables the radiotherapy field to be changed to fit the tumour as it shrinks and changes shape during the course of treatment.

England

The NRAG report recommended that IGRT be evaluated and, following assessment, implemented depending on its efficacy compared to other less expensive options.[39] In England, IGRT is at an earlier stage of implementation than IMRT, but this new technology is beginning to be introduced. Linacs capable of delivering IGRT have been introduced on the agreement that they need to be used and assessed for the Centre of Evidence Based Purchasing (CFEP). The issue now is to ensure that these machines are used to their full capability and that there are sufficient staff with enough time to do so. Some hospitals have started to look at tomotherapy, which integrates IMRT and IGRT. Clatterbridge Centre for Oncology and Addenbrooke's each have a tomotherapy unit and the new Northern Centre for Cancer Care at Newcastle will also have a tomotherapy machine.

Scotland

The Scottish radiotherapy planning report noted that a Radiotherapy Advisory Group has been established to coordinate developments such as IGRT to ensure equitable access across Scotland.[4] At the time of publication Glasgow and Edinburgh had purchased IGRT equipment and expected to be using it clinically by 2009. Research conducted for this report has confirmed that, as of December 2008, this equipment had been installed at Glasgow and Edinburgh and clinical protocols were being worked out.

Wales

In Wales, the Velindre cancer centre has the equipment needed to deliver IGRT, although availability of IGRT at the centre is still limited. The upgrade of a linac at the South West Wales cancer centre in Swansea is expected to facilitate IGRT.

Northern Ireland

No linacs at the Northern Ireland Cancer Centre are currently capable of delivering IGRT. The draft service framework on cancer prevention, treatment and care notes that "at present Northern Ireland does not have the full range of modern radiotherapy techniques", and calls for all patients with cancer who require radiotherapy to have equitable and timely access to complex radiotherapy techniques.[12]

The Departments of Health in the four nations should communicate and support planning on a regional basis for new and emerging radiotherapy technologies, so that sufficient capacity can be planned for.

The future of radiotherapy research and its impact on clinical practice

The National Cancer Research Institute (NCRI) has recently completed a review of its strategy for radiotherapy and radiobiology research, which has resulted in the establishment early this year of a new NCRI Clinical and Translational Radiotherapy Research Working Group. The Working Group will have a broad, strategic remit with the aim of developing a portfolio of practice-changing trials. The group will be responsible for ensuring coordination across all aspects of radiobiology and radiotherapy research, together with actively promoting the translation of new discoveries into practice. The workings of this group will be essential in ensuring a coordinated and collaborative approach to radiotherapy research.

There are already important research studies in radiotherapy which are likely to impact on clinical practice. Research currently funded by Cancer Research UK includes:

- The PARSPORT and COSTAR trials, comparing standard radiotherapy with intensity modulated radiotherapy (IMRT) for head and neck cancers;
- Radioimmunotherapy research at the University of Glasgow to discover the most effective timing schedule and dosage needed to achieve cancer cell death using radioimmunotherapy treatments, which use antibodies to 'home in' on cancer cells and specifically destroy them, while leaving healthy cells unharmed;
- The SCOPE 1 trial which is testing the addition of cetuximab to radiotherapy in oesophageal cancer;
- Clinical research at the Institute of Cancer Research, led by Professor Alan Horwich, which aims to improve radiotherapy and chemotherapy treatment for many types of cancer, focusing on breast, lung, bladder, testicular and prostate cancer;
- Professor Peter Hoskin's work at Mount Vernon Hospital, leading a number of clinical trials looking at ways of using radiotherapy in combination with drugs to treat various types of cancer including lymphoma and bladder cancer. He is also testing the ability of radiotherapy to relieve symptoms such as bone pain that occur when cancer spreads;
- Professor Gillies McKenna's research in Oxford on understanding the effect that radiation has on cells and how cancers can become resistant to radiotherapy;
- The work of Professor Michele Saunders and her team, testing whether multiple, low doses of radiotherapy together with chemotherapy can successfully be used to treat brain tumours. The team is also using sophisticated imaging techniques to detect areas of low oxygen within the tumours. This information can be used to target the radiotherapy more effectively thereby reducing the damage to normal cells and tissues.

While some of these and other studies will take time to produce results and influence clinical best practice, planning for future radiotherapy services will need to be flexible enough to take account of their findings.

7. Spreading the word: raising the profile of radiotherapy

Radiotherapy is estimated to contribute to 40% of cases where cancer is cured. Yet any review of media coverage in recent years would suggest that this message is not being widely communicated. In addition, anecdotal evidence suggests that many patients are fearful of radiotherapy.

There are some areas of cancer treatment that are well-known and well-publicised. Patients' attempts to ensure equitable access to new cancer medicines such as the breast cancer drug Herceptin, have been widely reported. But there have not yet been reports of patients requesting access to newer radiotherapy treatments, for example.

As detailed in this report, a great deal of work is taking place in the UK to move towards world class radiotherapy services. However, without communicating these developments to the public, it cannot be hoped that the high quality of the UK's radiotherapy services will be widely recognised. Informing the public about radiotherapy treatments is particularly important in terms of patient choice, and also in ensuring that patients, as advocates for local cancer services, understand the importance of adequate funding for radiotherapy. An awareness raising campaign may also have a beneficial impact on recruitment into the radiotherapy services.

The profile of radiotherapy in the wider world needs to be higher. There is an opportunity for communicating on radiotherapy in a way and on a scale not undertaken to date. Work would need to be undertaken to define the messages to be disseminated, but these could include, for example, raising the public's level of awareness of:

- the importance of radiotherapy
- available and potential radiotherapy treatments;
- the efficacy and safety of radiotherapy;
- how radiotherapy has improved patients' lives; and
- the cost-effectiveness of radiotherapy.

A UK-wide working group should be formed, incorporating all relevant stakeholders, to formulate a strategy and proposal for an awareness raising campaign about radiotherapy. This should be led by the national departments of health, with support from Cancer Research UK and the Royal College of Radiologists.

Annex A – the '3SI' experience

NHS Cancer Improvement's radiotherapy team has provided an interesting case study in reducing radiotherapy waiting times: the '3SI' approach. The team believes that '3SI' – a combination of Sustained Investment/Service Improvement/Staff Involvement – can lead to not only the 31- and 62-day targets being met, but also the more stringent JCCO targets which apply to all patients receiving radiotherapy. The basis of '3SI' is that making departments more efficient in order to reduce waiting times is only one part of the solution, and that no matter how well radiotherapy departments are run, they cannot deliver without adequate resources.

The '3SI' approach was implemented in Sheffield and Leeds by NHS Cancer Improvement's National Radiotherapy Leads, Dr Peter Kirkbride and Angie Craig.

The Sheffield Experience

At Weston Park Hospital in Sheffield a success rate of more than 90% was achieved for all three JCCO targets for all patients.

- **Sustained Investment** by the commissioners and Trust is considered to have been key to this success. The number of linacs has increased from four to seven since 1999, extra CT simulators and an MRI scanner have been installed, and the facility has been expanded twice.

- **Service Improvement** - Following capacity and demand assessments, the department has also implemented a programme which includes: radiographer breast mark up, radiographer image review, expediting referral processes for palliative radiotherapy, initiation of SpR led palliative radiotherapy treatment sessions, radiographer review clinics, radiographer consent, appointment of booking clerks, patient group directives to allow dispensing of limited supply of medications without physician involvement, team working in site groups and redefinition of senior roles in the department to allow more efficient management and clinical delivery.

- **Staff Involvement** - Support for the changes from all levels of staff has been key, with engagement from senior medical staff being particularly crucial. By creating a high quality working environment, staff morale in the department has been significantly improved, and as a result new staff have been attracted from across the country. Interestingly, the department adopted the policy of recruiting radiographers when they graduated, in advance of new equipment becoming clinically operational, which has created a better learning environment for newly qualified radiographers, and allowed other radiographers more time for personal development and role extension.

The Leeds Experience

Low treatment capacity (only 2.96 linacs per million population) and problems with recruiting and retaining staff, presented considerable challenges in improving waiting times in Leeds. Furthermore, the department already used some of the lowest clinically acceptable fractionation regimes (in other words, the minimum treatment regimens), had already introduced extended roles for radiographers, and had a good number of radiographer helper support roles. This meant that there was a much smaller margin of impact for any redesign. Consequently, the '3SIs' were applied in a different order to suit the circumstances.

- **Staff Involvement** - Working groups involving all levels of staff were established for all new projects, resulting in good progress in staff recruitment, induction, development and retention.

- **Service Improvement** - Reliable, real time data is now available covering every aspect of the service, which means that the department can highlight and evidence issues as they arise, and use the data to plan and quantify solutions. A departmental plan centred around Service Improvement is now in place, and capacity is being further expanded through measures such as the introduction of assistant and development consultant practitioners, radiographer consent confirmation, filmless

working, clinician team working covering scheduled volume/outlining and prescribing sessions and a weekly palliative fast track clinic.

- **Sustained Investment** - At the end of 2007, the team moved to a purpose-built Oncology Wing in the centre of Leeds, which is equipped with ten linacs and 12 bunkers. The Private Finance Initiative (PFI) deal that has enabled this has consolidated all tertiary cancer services in Leeds on one site, as well as covering equipment provision and replacement programmes for the next 20 to 25 years.

Annex B – implementing the four-tier career progression model

In 1999 the Society and College of Radiographers introduced a four-tier career progression model for radiographers. The four tiers consist of the following roles with escalating responsibilities:

- Assistant practitioner
- Practitioner
- Advanced practitioner
- Consultant practitioner

The Four Tier Model has four aims:[44]

- to define multidisciplinary teams not by profession, but by the skills and competencies that best deliver the patient or client's needs;
- to promote new roles, extended roles and advanced practice that will encourage lifelong learning;
- to widen the routes of access to clinical careers and improve recruitment and retention of the health professions; and
- in the public interest, to maintain practice standards and develop the inherent potential of all clinical practitioners.

As well as providing improved career progression for radiographers, which should help retention, implementation of the four-tier structure also has a positive impact on other staff in radiotherapy services, for example by enabling more appropriate use of the higher level skills of clinical oncologists.

Example of Best Practice: Addenbrooke's

Addenbrooke's Foundation Trust in Cambridge has established a new model of service delivery based upon the four-tier model with a non-medical consultant and advanced practitioners focusing across disease pathways as well as practitioners and assistant practitioners. This model has enabled the radiotherapy centre to meet Department of Health waiting times targets, and to recruit and retain staff. Prior to implementation of the four-tier model, the centre had one of the highest vacancy rates for therapeutic radiographers in England, but it is now fully staffed.[25]

The NRAG Workforce Sub-Group Report outlined how Addenbrooke's achieved this:

Addenbrooke's identified three areas as requirements for successful role redesign:

- a commitment to change at both Trust and department level;
- a multi professional forum to agree change in working practice; and
- a project manager, with a working knowledge of radiotherapy, to ensure the work is taken forward and implemented.

Staffing Linear Accelerators

Assistant practitioners were trained to work alongside radiographers in the pre-treatment imaging area and delivering radiotherapy on the linear accelerators. This allowed the radiotherapy department, in the first instance, to staff a linear accelerator for both a 10 and 8 hour working day. This was successful and an assistant practitioner is now part of each linear accelerator and pre-treatment imaging team.

Outcome:

- achieved waiting time targets;
- assisted implementation of new treatment techniques; and
- provided career progression opportunities for both assistant practitioners and Radiographers who were able to undertake continuing professional development.

Expert Practice

Advanced and consultant therapy radiographer practitioners can be used to undertake agreed advanced level clinical and technical activities, when underpinned by a robust education and competency based framework. These activities result in the ability to offer a patient centred service and enable best practice.

Cancer site pathways

Examples of practice:

- Co-ordinating the pathway through to the radiotherapy and chemo irradiation process.
- Obtaining fully informed patient consent for agreed groups of patients.
- Undertaking radiographer led treatment planning e.g. palliative brain tumours.
- Seeing patients in radiographer led clinics during and following radiotherapy and undertaking toxicity assessment and management.

For example:

- The gynaecological consultant radiographer monitors patients following pelvic irradiation in order to minimise the impact on sexual function. This practice has extended to include patients from other disease sites with similar problems.
- The expert practitioner in head and neck cancer has set up an Allied Health Professional Clinic, which includes specialist, dieticians, speech therapists and nurses. Patients are seen weekly and the acute side effects of radiotherapy are managed and the patient supported through their treatment.

Outcome:

- Improved patient pathway efficiency.
- Improved patient experience.
- Clinical oncologist time used more effectively.
- Enabled career progression.

Radiotherapy Process

Examples of practice:

- Radiographer led virtual simulation.
- Computer planning within a skills mix setting with physicists and dosimetrists.
- Radiographer led pre-treatment plan verification.
- Radiographer led portal image review.
- Radiographer led intravenous contrast administration for pre-treatment CT scanning.

Outcome:

- Improved radiotherapy process efficiency.
- Implementation of new clinical practice.
- Physicist and clinical oncologist time used more effectively.

Managing the radiotherapy process - role of non-clinical staff

Booking patient appointments for radiotherapy was considered too complicated for non-clinical staff and this was undertaken by or co-ordinated by radiographers. Using IT systems to assist scheduling of staff and patient appointments for all stages of the radiotherapy process, underpinned by appropriate "in-house" training now allows effective use of administration and clerical staff releasing the radiographers to undertake clinical roles.

Having established an efficient database of patients' activities, it is possible for an administration manager to actively manage timing of an individual patient's appointments to ensure they do not wait beyond the cancer targets. This also allows a proactive view of the patient pathway and radiotherapy process, highlighting potential blockages to the service management team in a timely fashion to avoid delays.

Admin and clerical staff are also trained to support and run the patient clinics. This released radiographers and nurses another scarce resource.

Outcome:

- Improved radiotherapy process efficiency.
- Radiographer time used more effectively.
- Meeting the cancer targets.

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