Radiotherapy: developing a world class service for England

Report to Ministers from National Radiotherapy Advisory Group

26 February 2007

Contents

Executive Summary

1. The National Radiotherapy Advisory Group (NRAG) was asked to advise Ministers on:

   a. the current position of radiotherapy services in England;
   b. how to ensure current resources are deployed to best effect;
   c. how to plan for a world class service in the longer term.

2. There is a general consensus among experts that the projected need for radiotherapy was significantly underestimated 15-20 years ago. There is a large gap (63%) between current activity levels and optimal treatment levels, if radiotherapy were to be given to all who might benefit. The position is set to worsen as cancer incidence increases with the ageing population. This means that PCTs will need to commission more fractions (ie. attendances for radiotherapy treatment) for their population.

3. NRAG acknowledges actions the Government has already taken to increase both radiotherapy equipment and staff. However, the underestimate of need in the past, coupled with increasing demand, leaves the NHS with insufficient equipment and workforce to meet current and future need.

4. The important thing now is for clinical staff working with cancer patients to be able to identify and ensure that all patients who could benefit from radiotherapy have access to this treatment option and that they can be offered it in a timely manner. One way to ensure this happens is to set a specific waiting times target for the start of radiotherapy treatments for <u>all</u> cancer patients, not just for those for whom radiotherapy is the first treatment (the current Government target). **NRAG therefore recommends that, as part of the Government's commitment to go further on cancer waits, the 31 day target from diagnosis to first definitive treatment is extended to include all radiotherapy treatment.**

5. Whether this recommendation is accepted or not, immediate action needs to be taken (particularly on workforce) to make up the shortfall in capacity that currently exists. Given the long lead in time for increasing radiotherapy capacity, urgent action is also needed to plan for expansions in capacity (both equipment and workforce) to cope with the continual increase in demand over the next 5-10 years.

6. NRAG estimates that there is a two and a half fold variation in the number of fractions that are provided per million population between cancer networks. Whilst some of this difference may be due to a greater burden of disease in some areas, for example, due to older populations along with other issues such as travel time to centres it cannot account for the entire variation. NRAG therefore considers this

level of variation to be unacceptable. This inequity should provide an incentive for PCTs in lower providing areas to commission more fractions for their populations.

7. At present, the NHS delivers around 1.5 million fractions annually – that is around 30,000 fractions per million population. However, to achieve optimal treatment levels (as set out in the treatment pathways in the scenario planning report) NRAG advises that around 2.5 million fractions should be delivered each year in England – that is around 48,000 fractions per million population. Given the increase in cancer cases predicted over the next 10 years due to the ageing population and other factors, NRAG estimate that by 2016, the NHS will need to deliver around 2.9 million fractions across the country – this is around 54,000 fractions per million population.

8. **NRAG strongly recommends that NHS radiotherapy services should be developed to deliver up to 54,000 fractions per million population throughout the country by 2016** - a 91% increase on current activity. However, NRAG acknowledges that workforce and treatment capacity need to be increased in order to deliver this recommendation. NRAG therefore proposes that the NHS takes a stepped approach towards meeting this requirement with **an interim aim of delivering 40,000 fractions per million population by 2010/11**. It is estimated that 8 out of the 39 radiotherapy departments that responded to the 2005 radiotherapy equipment survey are already achieving this interim aim. NRAG advises that **these health economies should be challenged to deliver up to 54,000 fractions per million population ahead of schedule in line with local population projections**– this should ensure that they have the capacity to provide patients with optimal treatment in a timely manner as soon as possible.

9. This increase in provision cannot be achieved overnight and this report recommends actions that need to be taken in both the short and long term to address this including:

   a. **Making the best use of the resource we already have** - NRAG believes that some increase in capacity could be achieved by using existing equipment to its full potential. It recommends that ***all radiotherapy departments should ensure that their linear accelerators (linacs) deliver at least 8,000 fractions per annum averaged across all linacs in the department with immediate effect.*** They should then build on this, for example, as workforce increases, to ***deliver at least 8,300 fractions per annum by 2010/11 and at least 8,700 fractions per annum by 2016 based on an average across all linacs in the department***. It is for local health economies to determine how best to achieve this but NRAG advise that some actions that could facilitate this would be to ensure that:

i. each linac delivers 4- 4.5 fractions (ie. patient treatments) on average per hour;

ii. linacs within radiotherapy departments work on average 9.2 hours per day with a minority running for an extended day (eg. 11.5 hours);

iii. radiotherapy departments operate 239 days per year – a standard 5 day week, closing for only 3 bank holidays and ensuring that each linac is out of action during normal working hours for no more than 19 days for QA/servicing a year. In addition, departments undertake some palliative radiotherapy on Saturdays. [Availability of staff and the appropriate skills mix will be the rate limiting factor for many localities seeking to increase productivity in this way.]

iv. radiotherapy departments have a service efficiency machine ie. an additional machine that would be in use 50-75% of the time providing capacity to deal, for example, with unexpected peaks in workload or linac breakdown without increasing waiting times for patients and minimising the need for cancellations/ rescheduling.

v. in addition to having a service efficiency machine, radiotherapy departments progressively increase capacity so that they operate at 87% capacity ie. they are capable of delivering 13% more activity than is actually required (10% to allow for variations in demand; 3% to allow for testing techniques & staff training). This is essential if timely treatment is to be offered to all patients and is consistent with the approach for managing bed occupancy in the NHS.

b. The **development of a long-term workforce strategy and supporting short term actions to maximise the investment made in the current and trainee workforce –** this is key as the rate limiting step in improving productivity will be the number and type of staff available to deliver treatment and support the department.

Specific actions recommended are:

Long Term

i. The Department of Health should work with SHAs, the Workforce Review Team, professional bodies and education providers to support the development of a long-term workforce strategy for radiotherapy. This should identify the feasibility, risks and timeframe for delivery in workforce resource terms and also identify the investment required in numbers and types of training commissions – this should be a priority as modelling

has shown that ***significant increases in radiotherapy equipment capacity cannot be supported within the existing radiotherapy workforce of 3400 FTE staff*** (which includes therapeutic radiographers, clinical oncologists and medical physics).

Short Term

ii. The following short-term actions need to be undertaken to maximise the current investment made in the existing and trainee workforce and to inform the development of the future workforce profile:

- deployment of staff is a local issue but radiotherapy centres should be supported by SHAs, Royal Colleges and Professional Bodies in developing local workforce proposals to deliver effective skills mix and service improvements and also to deliver capacity increases;

- the 4 tier skills model (a career progression framework for radiographers issued in 1999) should be fully implemented in all radiotherapy departments. In particular, SHA commissioners and service employers should fund the new roles in the model at advanced and consultant level in non-medical radiotherapy professions - where these roles have been introduced they have demonstrated the potential to drive efficiency, reduce waiting times and refocus radiotherapy services around the needs of patients;

- therapeutic radiographer training commissions have increased from 135 in 1997 to 361 in 2005; however with a 35% attrition rate this investment is not being effectively utilised and action needs to be taken to address the negative experience cited as contributing to the high numbers leaving in the first year of training. NRAG recommends that this could be achieved by:

  - introducing at least 2 physical multi-profession skills laboratories by the end of 2008 (equipped with linacs, CT simulators and other equipment) to provide training with patients in a clinical setting – this will reduce the training demands on clinical departments and provide a better quality experience for students at all levels;

  - the introduction of Hybrid Virtual Environments (HVE) into radiotherapy training sites that simulate the radiotherapy equipment and treatment rooms. SHA workforce commissioners and higher education

providers should consider implementing this with immediate effect for clinical skills training of both first year students and assistant practitioners.

c. **Plans to expand and update radiotherapy services in the long term are initiated now** so that:

   i. there are around an additional 90 linacs available to the NHS over the next 10 years;

   ii. replacement programmes are in place locally to:

      – ensure linacs are replaced every 10 years – 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: the current age profile shows that 6-35 linacs will need replacing each year;

      – ensure that software used to plan and deliver treatment is upgraded every three years because it gets out of date quickly, impacting on the efficiency and effectiveness of the service.

   iii. all new and replacement machines are capable of image guided 4D adaptive radiotherapy which can target tumours more accurately and that image storage capacity is procured from linac suppliers as part of each new equipment bid;

   iv. the Department of Health:

      – facilitates the setting up of a clinical reference panel to approve referrals of appropriate NHS patients to proton therapy centre(s) outside the UK in a fair and equitable manner;

      – develops a business case for at least one modern proton treatment facility in England.

d. **Collecting data nationally** so that the NHS, Department of Health and public can see radiotherapy activity and waiting times across the country and push for improvements locally in areas that are slow to progress. NRAG recommend that this could best be achieved by making it mandatory for radiotherapy centres to submit a nationally agreed dataset at agreed times to the Radiotherapy Episodes Statistics project with results fed back to stakeholders at agreed intervals.

e. The Department of Health:

i. considers, as a matter of urgency, the estimated costs of the recommendations in this report, approaches to funding, planning and implementation;
ii. sets up an oversight & implementation group to ensure that progress is made toward the implementation of these recommendations;
iii. clarifies in the Cancer Reform Strategy how the health reforms will be used to ensure that the recommendations in this report are taken forward by the NHS.

10. This report sets out what needs to be done now to improve radiotherapy services and lays out a vision for a world class radiotherapy service in the future. For patients this would mean that all those who could benefit from treatment would access it in a timely way and receive the optimum treatment regimes as used elsewhere in the developed world. This will contribute to improved cancer survival - radiotherapy is estimated to contribute to 40% of cases where a cancer is cured - so action taken now will save lives in the future. Unless action is taken without delay the Government will lose the opportunity to save lives, and services in this country will fall further behind those of other comparable countries.

Purpose of this Report

11. In May 2004 a National Radiotherapy Advisory Group (NRAG) – see ***Annex A*** for membership - was set up, co-chaired by Professor Mike Richards (National Cancer Director) and Dr Michael Williams (Vice President & Dean of the Faculty of Clinical Oncology, Royal College of Radiologists) to advise Ministers:

    a. on the current position of radiotherapy services in England;

    b. how to ensure the current resources are deployed to best effect to reduce radiotherapy waits and improve service delivery in the short to medium term;

    c. how to plan for a world class service in the longer term.

12. This report brings together the key recommendations from NRAG and its subgroups which focused on scenario planning, capacity & demand, workforce, new technologies (including protons) and radiotherapy activity data. It also takes into account views from patient representatives. The full reports of the sub-groups and their detailed recommendations are available separately. It also takes account of the Scottish Executive report *Radiotherapy activity and planning for Scotland 2011 – 2015* which was published in 2005 and the Cancer Services Co-ordinating Group in Wales - *Radiotherapy Equipment Needs and Workforce Implications 2006 – 2016* published in 2006.

13. The report covers radiotherapy for all ages. Paediatric radiotherapy makes up approximately 1% of the radiotherapy workload but children and young people have been included in the modelling on which this report is based. If the recommendations in this report are accepted the additional capacity should ensure that there is sufficient access to radiotherapy for children and young people with cancer. It is important, however, to note that children and young people with cancer should receive age appropriate services. Whilst challenging in radiotherapy where the vast majority of treatment is for adults, an appropriate environment is important and will need to be taken into account locally in radiotherapy centres that treat children and young people.

14. The report does not address brachytherapy (a radiotherapy technique involving the placement of sealed radioactive sources into or immediately adjacent to tumours) – this has been addressed by a separate Royal College of Radiologists (RCR) working party (in press).

Introduction/Context

15. Cancer affects one in three of the population. Radiotherapy (the use of high energy x-rays to treat disease) is a key component of both radical (with the aim of curing a patient) and palliative (for symptom relief in incurable cancer) treatment for cancer. Detailed modelling by Delaney & CCORE[1] [2] indicates that 52% of cancer patients should receive radiotherapy as part of their treatment. Of those cured of their cancer (ie. go on to survive at least 5 years), it is estimated that radiotherapy contributes to that cure in 40% of cases either alone or in combination with other treatments such as surgery.[3]

16. Radiotherapy treatment is often fractionated, ie. given over a number of days. This allows large doses of radiation to be given whilst reducing the unwanted effects on normal tissue. Generally, radical treatments are given in more treatment fractions (15 to 40) than palliative treatments (1 to 10).

17. 15-20 years ago experts predicted that radiotherapy would not have a key role to play in cancer care in the future and that demand would fall. As a result it was not an area that was prioritised by the NHS for development and expansion. However, over recent years it has become clear that, not only does radiotherapy continue to play a key role in both treatment of cancer and palliation, but it will continue to do so for the foreseeable future. There is now a general consensus among experts that the projected need for radiotherapy was significantly underestimated. As a result, provision now is inadequate to meet demand and the problem will get worse as the population ages and cancer incidence increases. The Scottish and Welsh administrations have reached the same conclusions.

18. In 1998 the Royal College of Radiologists (RCR) recommended that 4 linear accelerators (linacs – the machines used to give radiotherapy) per million population would be needed to meet growing demand for radiotherapy. In 2000 the Cancer Plan acknowledged the uneven distribution of radiotherapy facilities across the country and committed to replace linacs over 11 years old and purchase additional machines with the aim of meeting the RCR's recommendation. As a result, over the past 6 years central procurement programmes have invested

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[1] Delaney GP, Jacob S, Featherstone C, Barton NB. Radiotherapy in cancer care; Estimating optimal utilisation from a review of evidence-based clinical guidelines. Collaboration for Cancer Outcomes Research and Evaluation (CCORE). Liverpool Hospital, Sydney Australia, 2003

[2] Delaney GP, Jacob S, Featherstone C, Barton NB. The role of radiotherapy in cancer treatment: estimating optimal utilisation from a review of evidence-based clinical guidelines. Cancer 2005; 104: 1129-37.

[3] Bentzen SM, Heeren G, Cottier B, Slotman B, Glimelius B, Lievens Y, van den Bogaert W, Towards evidence-based guidelines for radiotherapy infrastructure and staffing needs in Europe: the ESTRO QUARTS project. Radiotherapy and Oncology 2005; 75: 355-65

substantially in radiotherapy equipment particularly in areas with the lowest provision.

19. According to the National Asset Register, established to support the programmes and now maintained by the Health Protection Agency, a total of 215 linacs and 26 simulators were installed as at August 2006. In addition to replacing obsolete equipment, the total stock of linacs had increased from 140 in 1997 to 215 by August 2006. By the time all deliveries in the current programme have been made, there will be 233 linacs (228 by the end of 2007 and a further 5 in 2008/09) providing 4.6 linacs per million population, exceeding the RCR's 1998 recommendation.

20. In 2003 the RCR updated its advice and recommended that 5.5 – 6.0 linacs per million population were now needed to provide an acceptable radiotherapy service in England. However, increasing the number of machines further will not improve the situation unless the necessary staff are available to operate the machines. Lack of therapeutic radiographers (staff who are qualified to treat cancer using ionised radiation) is the main constraint – there is a worldwide shortage.

21. The number of training commissions for therapeutic radiographers has increased from 135 in 1997 to 361 in 2005. We are now beginning to see the benefits of this and the number of therapeutic radiographers in the workforce has increased from 1,309 in 2000 to 1,629 in 2005 (a 24.5% increase). Forecast FTE (full time equivalent) of radiographers indicates an approximate 30% increase over the next five years. Although, a survey in May 2006 (see workforce subgroup report) showed an 11.7% vacancy rate for therapeutic radiographers in 2006 which equates to 221 vacant posts.

22. Despite this expansion of services (both in terms of equipment and staff), it has not been enough to meet the existing need. Patients requiring radiotherapy can face long waits for treatment – waits of over 16 weeks have been reported in some areas (RCR audit 2005). Long waits need to be addressed as a matter of urgency as cancer can progress and a patient’s prognosis can worsen if they have to wait too long for radiotherapy.

23. In 1993 the Joint Council for Clinical Oncology (a joint group bringing together both the Royal College of Radiologists and the Royal College of Physicians) set good practice standards for radiotherapy waiting times. They recommended 48 hours maximum wait for urgent radiotherapy, 2 weeks maximum wait for palliative radiotherapy and 4 weeks maximum wait for radical radiotherapy.

24. The Government has not set a specific waiting times target for radiotherapy treatment. However, there is a waiting times standard of 31 days between decision to treat and first definitive cancer treatment.

In April 2006, 37 radiotherapy centres in England reported (via the National Cancer Waits Database) treating 98% or more of patients within 31 days. A further 8 radiotherapy centres reported performance between 88% and 98%. However, overall only 15% of patients receive radiotherapy as their first treatment (more often it is given after other treatment such as surgery). When all patients receiving radiotherapy are taken together (ie. those where it is first or subsequent treatment) it is estimated by NRAG that around 50% of patients are not currently receiving treatment within one month of being ready to treat – the good practice standard set by the JCCO.

25. The NHS and Department of Health face a major challenge if they are to achieve the objective set out in the NHS Cancer Plan of providing services which are among the best in Europe. A survey published in 2005 showed the UK as 10th of 13 in terms of the adequacy of radiotherapy equipment provision for the needs of the population, ranking with countries from Eastern Europe, substantially behind Sweden, France, Belgium and Germany[4].

26. The challenge presented by radiotherapy will increase further over the next 10 years as demand increases further due to factors such as:

    a. aging population leading to an increased incidence of cancer and therefore more potential patients needing radiotherapy;
    b. earlier diagnosis increasing opportunities for radical treatment;
    c. unmet need for radiotherapy ie. patients who could potentially benefit from radiotherapy but may not be being offered this choice or may not be receiving optimum fractionation schedules.

27. We do not have sufficient equipment or workforce to meet current demand for radiotherapy within acceptable waiting times and this problem will be exacerbated as demand increases further. Whilst NRAG recognise that this is not a situation of the Government's making and that it has already done a great deal to improve the situation, more needs to be done. This report sets out the current situation and what is expected to happen over the next 5-10 years along with the recommended actions that will be required in the short and long term to improve and expand services further.

[4] Bentzen SM, Heeren G, Cottier B, Slotman B, Glimelius B, Lievens Y, van den Bogaert W, Towards evidence-based guidelines for radiotherapy infrastructure and staffing needs in Europe: the ESTRO QUARTS project. Radiotherapy and Oncology 2005; 75: 355-65

Predicting Future Demand for Radiotherapy

28. The NRAG scenario sub group determined how cancer incidence and demand would change over the next 10 years.

Cancer Incidence

29. The estimates of future cancer incidence are based on population projections (i.e. projections of the future changes to the population profile in terms of age and gender) and trends in cancer incidence projected from historic trends. **Table 1** represents the projected incidence for all cancer types in England between 2006-2016.

Table 1: Cancer incidence by site

Site Description	Incidence 2006	Incidence 2011	% increase 2006-2011	Incidence 2016	% increase 2006-2016
Bladder	9,605	10,468	9	11,551	20
Brain, meninges and CNS	3,874	3,990	3	4,050	5
Breast inc. DCIS	44,074	48,671	10	52,878	20
Cervix uteri	2,169	2,055	-5	2,045	-6
Colon	18,151	18,998	5	20,104	11
Corpus uteri	5,496	6,196	13	6,770	23
Head and Neck	6,540	7,550	15	8,564	31
Hodgkin lymphoma	1,311	1,428	9	1,513	15
Kidney	5,277	5,909	12	6,488	23
Leukaemia	5,900	6,441	9	7,065	20
Lung	29,456	29,462	0	30,321	3
Melanoma of skin	7,484	8,823	18	9,893	32
Multiple myeloma	3,561	4,005	12	4,476	26
Non-Hodgkin lymphoma	9,152	10,381	13	11,537	26
Oesophagus	6,655	7,325	10	8,037	21
Ovary	5,946	6,284	6	6,620	11
Pancreas	6,162	6,592	7	7,176	16
Prostate	26,778	29,625	11	33,026	23
Rectum	11,881	13,050	10	14,410	21
Stomach	6,814	6,678	-2	6,896	1
Testis	1,819	2,025	11	2,205	21
Other and Unspecified (1)	25,643	26,474	3	27,734	8
TOTAL	*243,748*	*262,430*	*8*	*283,360*	*16*

(1) Other and unspecified excludes non-melanoma skin cancer due to the unreliability of data on its incidence

Source: Scenario Subgroup report

30. Overall it is projected that there will be about 262,000 new cancer cases in 2011 and 283,000 in 2016. This represents an increase of around 8% in the next five years and around 16% over the next ten years. As seen in **Table 1**, for many cancer types the projected increase over the next ten years exceeds 20%. However, the number of lung cancer and stomach cancer cases will remain broadly stable and the number of cases of cervical cancer will fall.

Demand for radiotherapy

31. To determine existing and future requirements for radiotherapy services, treatment pathways for each cancer site were developed (see scenario sub-group report) that showed the recommended treatment given a patient's type of cancer, stage of disease and other factors. The recommended number of fractions (ie. optimum treatment based on latest evidence) for each treatment "branch" where radiotherapy was the preferred treatment was then added to the pathways. Cancer incidence projections were then applied to estimate demand for radiotherapy, both now and in the future, if every patient received the optimal treatment compared to the current level of radiotherapy delivered.

32. **Table 2** shows how the growth in population, new cancer cases and fractions required will have increased between 2005/06 and 2010/11 and 2015/16.

Table 2: Growth from 2005/06 to 2010 and 2015

Growth from 2005/06 to …	2010/11	2015/16
Growth in total population	3%	5%
Growth in new cases of cancer p.a.	8%	16%
Total growth in fractions required from growth in new cases	8%	17%

Note that the small discrepancy between the growth in new cases of cancer and fractions required is due to new cases of cancer at different sites (which have different fractionation regimens) growing at different rates.

33. This confirms that new cases of cancer are projected to increase at a far greater rate than crude population growth ie. 16% compared to 5% (mostly due to the ageing of the population) and that significant increases in radiotherapy provision will be required to keep up with the growth in demand over the next 5–10 years.

34. **Table 3** shows how fractions delivered at present compare to those NRAG predicts the NHS should be delivering if all eligible patients are offered radiotherapy and receive optimal fractions as set out in the treatment pathways in the scenario report. It also sets out the future fractions that will be required to treat patients needing radiotherapy over the next 5-10 years based on the incidence projections at **Table1.**

Table 3: Future Fractions Required by 2011 & 2016 compared to current basecase scenario

	Actual 2005 (1)	Required 2006 (2)	Required 2011	Required 2016
Total fractions ('000s):	**1,500**	**2,447**	**2,645**	**2,865**
Fractions per million population:	29,742	48,253	50,900	53,771
Increase from actual	**n/a**	**63%**	**76%**	**91%**

Notes:

(1) The actual number of fractions given in 2005 is estimated from Radiotherapy Equipment Survey. Data was available for 39 out of the 48 Trusts with radiotherapy facilities and the England total was estimated by extrapolating the average fractions per million population to the remaining population of England.

(2) The total fractions required in 2006 were estimated by applying the fractionation regimens set out in the treatment pathways to the estimated cancer incidence in 2006. These estimates were only available for 5 year periods from 2001 and do not give estimates for interim years.

(3) Radiotherapy for skin cancer is excluded as there are no figures for non-melanoma skin cancer incidence making projections impossible.

35. These figures show that there is already a significant gap (63%) between the fractions currently delivered in England and those recommended if the optimal fractions (in line with the treatment trees in the scenario report) were given to each cancer patient who would benefit from radiotherapy. It also shows that demand for fractions will grow to 76% above current provision by 2011 and to 91% above current provision by 2016. **This demonstrates that urgent action needs to be taken both to make up the shortfall (63%) that currently exists and also to build additional capacity to cope with the continued increasing demand that we will see between 2006-2016**.

Action Required to improve Radiotherapy Services

36. The Government and the NHS clearly have to take action to ensure that unmet need for radiotherapy services and excessive waiting times are managed and that there is sufficient expansion in capacity over the coming years in order to cope with the increasing demand for radiotherapy that NRAG expects to see.

37. It is important to ensure that all patients who could benefit from radiotherapy have access to this treatment option and that they can be offered it in a timely manner. Delivering radiotherapy in a timely manner is particularly important because cancer can progress and a patient's prognosis can worsen if they have to wait too long for treatment. **NRAG therefore recommends that, as part of the Government's commitment to go further on cancer waits, the 31 day target from diagnosis to first definitive treatment is extended to include all radiotherapy treatment.**

38. Whether this recommendation is accepted or not, urgent action needs to be taken both to make up the shortfall that currently exists in capacity and also to build additional capacity to cope with the continued increasing demand over the next 5-10 years. In addition, capacity is needed to ensure equity of service provision. Information from the Radiotherapy Equipment Survey 2005 has indicated that there was likely to be a two and a half fold variation in the number of fractions that were provided per million population between cancer networks from April 2004-March 2005 – see **table 4**.

Table 4 - Variation in the number of fractions provided per million population between cancer networks from April 2004-March 2005

	Fractions per million population
Maximum	47,718.67
75th percentile	36,698.06
Median	31,307.67
25th percentile	26,698.06
Minimum	17,512.16

Source: Radiotherapy Equipment Survey 2005

Notes:

1 It should be noted that the figures above are based on incomplete data (including incomplete population data) ie. 39 out of 48 Trusts with radiotherapy facilities and provide a range based on the data submitted rather than an actual position across the country.

39. Although these data need to be treated with caution as they provide a range based on incomplete data rather than an actual position, NRAG advise that this level of variation is likely to be representative of the current national position. Whilst some of these differences may be due to factors including greater burden of disease in networks with an older

population, travel times to the nearest centre, and shortage of resources meaning that not all patients receive optimal radiotherapy treatment in terms of fraction numbers, this is unlikely to account for the entire variation. NRAG therefore considers this level of variation to be unacceptable. This inequity should provide an incentive for PCTs in lower providing areas to commission more fractions for their populations and NRAG makes recommendations on the number of fractions that should be commissioned below.

40. At present, the NHS delivers around 1.5 million fractions annually – that is around 30,000 fractions per million population. However, to achieve optimal treatment levels (as set out in the treatment pathways in the scenario report) NRAG advises that around 2.5 million fractions need to be delivered each year across England – that is around 48,000 fractions per million population. Given the increase in cancer cases predicted over the next 10 years due to the aging population and other factors, NRAG estimate that by 2016, the NHS will need to deliver around 2.9 million fractions across the country – this is around 54,000 fractions per million population.

41. **NRAG strongly recommends that radiotherapy services should be developed to deliver up to 54,000 fractions per million population throughout the country by 2016** - a 91% increase on current activity. However, NRAG acknowledges that, workforce and treatment capacity need to be increased in order to deliver this recommendation. NRAG therefore proposes that the NHS takes a stepped approach towards meeting this requirement with **an interim aim of delivering 40,000 fractions per million population by 2010**. It is estimated that 8 out of 39 cancer radiotherapy departments that provided data as part of the 2005 radiotherapy equipment survey are already achieving this interim aim. **NRAG advises that these health economies should be challenged to go beyond this and deliver up to 54,000 fractions per million population ahead of schedule in line with local population projections**– this should ensure that they have the capacity to provide patients with optimal treatment in a timely manner as soon as possible.

42. NRAG accepts that this cannot be achieved overnight but urges the Government not to delay initiating the necessary action so that progress can be made as soon as possible.

43. The remainder of the report sets out further actions that NRAG recommends need to be taken in the both the short and long term to ensure that DH and the NHS get the best out of existing resources (both equipment and staff) and adequately plans for the future.

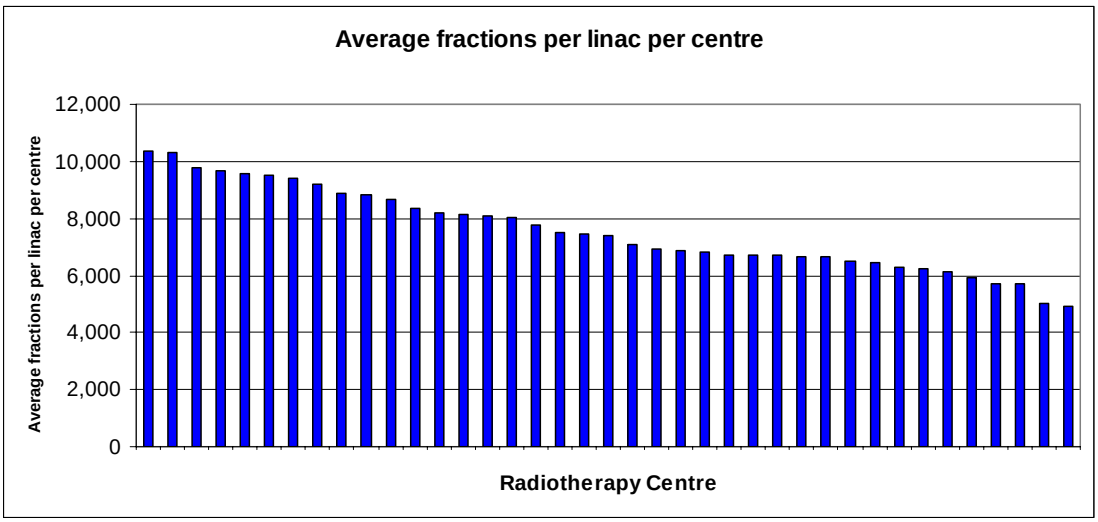
Short term action – Improving productivity from the existing service

44. The immediate priority should be to ensure that the NHS is making the best use of the resource it already has. This section sets out what the optimal productivity of a radiotherapy department should be and how this could be achieved. However, it should be noted that the rate limiting step in improving productivity will be the number and type of staff available.

Fractions per linac per year

45. Existing linacs must deliver an acceptable number of fractions per year to ensure that they are providing a sufficient contribution to the capacity needed to treat all patients that might benefit from radiotherapy. **Figure a** shows the range of productivity in terms of average fractions per linac in 39 out of 48 Trusts with radiotherapy facilities in England that responded to the radiotherapy equipment survey in 2005:

Figure a – Range of productivity across 39 Radiotherapy facilities in England



46. This chart indicates a considerable range of productivity across the radiotherapy departments in England for which data was available in terms of fractions per linac averaged across a radiotherapy department. It shows that the median radiotherapy centre gave 7,400 fractions per linac and that 16 out of the 39 centres delivered more than 8,000 fractions per linac on average. However, the issue about sustainability at para 49 should be noted.

47. **NRAG recommends that**

    a. **all departments have as an immediate aim to deliver at least 8,000 fractions per linac per year averaged across all the linacs in the department;**

b. **by 2010/11 all departments should aim to deliver at least 8,300 fractions per linac per year averaged across all the linacs in the department;**

c. **by 2016 all departments should aim to achieve at least 8,700 fractions per linac per year, averaged across all the linacs in the department.**

48. The immediate and 2010/11 productivity aims have been determined using approximately the 60th & 70th percentiles for the 39 radiotherapy departments that provided data respectively. The long term (2016) aim is based on modelling set out in the productivity report.

49. It is assumed that those centres already exceeding these targets will continue at their current productivity levels, although it may be that some of the departments providing higher levels of fractions are not doing so in a sustainable way for the long term ie. they may have implemented short term crisis management arrangements to manage local difficulties. Supposing that the centres with highest fractions per linac can sustain their current levels and all centres improved to the minimum target of linac productivity, the average productivity levels across England would be as set out in **Table 5**.

Table 5 – Estimated Fractions per linac per annum in future years

Fractions per linac p.a in future years	**2006**	**2001**	**2016**
Recommended minimum linac productivity	8,000	8,300	8,700
Average linac productivity if recommendation is met	8,342	8,635	8,869

50. It will be for local health economies to determine how best to achieve these recommended levels but NRAG advises that some actions that could facilitate this would be to:

a. **ensure that each linac delivers between 4 and 4.5 fractions (ie. patient treatments) on average per hour** - most patients can be treated within a 10-15 minute appointment slot, however, the treatment of some patients will take longer, for example children, the old or infirm and those requiring complex set-ups prior to treatment.

b. **ensure linacs within a radiotherapy department work an average of just over 9 hours per day with a minority of the machines in the department running for an extended day (e.g.11.5 hours)** – the total hours per day that radiotherapy treatment can be delivered will be constrained by the number of staff directly available to deliver the treatment and the willingness of patients to attend outside traditional opening times. Workforce is addressed in more detail at paras 57-69.

c. **radiotherapy departments operate 239 days per year** – this would be:

   i. ***a 5 day week*** - internationally radiotherapy practice is based on a 5 day working week and recommended fractions for radical treatment have been developed and proven over the years on this basis. Alterations in the working week to include Saturdays for radical treatment would therefore pose complex scheduling problems. Only a 7 day week would avoid this but NRAG advise that this is unlikely to be feasible given the national and international shortage of specialist staff needed to run the service. It is also not clear that a 7 day service would be popular with patients or that it would be attractive to radiography or physics staff (once numbers have increased) - leading to further recruitment and retention difficulties.
   ii. ***departments operate all but 3 Bank Holidays*** (Christmas Day, Boxing Day and Good Friday or Easter Monday) – not all patients are likely to be willing to attend on bank holidays – NRAG has therefore assumed in its modelling that a radiotherapy department would not do more than 50% of standard working on a Bank Holiday.
   iii. ***individual machines should not be out of action during normal working hours for servicing and quality assurance (QA) for more than 19 days per annum*** - although servicing and QA are essential to maintain high levels of pinpoint accuracy on which treatment planning and delivery are based, this should take place outside normal working hours wherever possible.

d. In addition radiotherapy departments could:

   i. ***use Saturdays for single palliative treatments*** depending on local demand;
   ii. ***use Saturdays and Sundays for CHART*** depending on local demand – this is a 7 day radiotherapy schedule for certain lung cancers recommended in NICE's clinical guideline on the diagnosis and treatment of lung cancer.

   Where departments open on a Saturday, Sunday or bank holiday NRAG recommend that a full service should be operated – this does not mean that all linacs in a department need to be in operation. However, there should be appropriate support for patients available including reception staff and the ability to obtain refreshments. In addition to the therapeutic radiographers delivering the treatment, physics and medical staff would also need to be available to support treatment.

Additional Capacity

51. **NRAG recommends that radiotherapy services consider the introduction of a service efficiency machine** – such machines are likely to be in use for at least 50-75% of the time and bring real benefits to a radiotherapy department ensuring that it has the capacity to cope with breakdowns and servicing of other machines without impacting on a patient's treatment programme. It would also enable a department to cope with variations in demand without impacting on patient waiting times. This is particularly important as there is strong evidence that unplanned interruptions to therapy (ie because machines are not available to give fractions on certain days) allow tumour repopulation with an increased rate of local recurrence and death (see productivity report for more details).

52. In addition to a service efficiency machine, **NRAG recommends that radiotherapy services plan so that they operate at 87% capacity ie. so that they are capable of delivering 13% more activity than is actually required**. This covers:

    a. 10% to ensure additional capacity to cope with variation in demand and enable the NHS to deliver radiotherapy within the JCCO good practice standards (see para 23), or any subsequent targets that the government might introduce as part of its commitment to go further on cancer waits. This would be consistent with the general approach taken on bed occupancy in the NHS ie. that bed occupancy needs to run below 100% (for example 85-90%) if the acute medical needs of the population are to be dealt with in a timely way.

    b. a minimum of 3% to test new techniques and to train staff - as with all technologies, radiotherapy is constantly changing and if the NHS is to keep up, time must be set aside for this.

53. Efficiency measures for other parts of the radiotherapy process other than linacs/treatment should also be considered. Priority should be given to determining measures for pre-treatment activities such as planning times which may impact on treatment waiting times. **NRAG recommends that a group should be established to consider all the elements involved in the pre-treatment of patients and set appropriate throughput /efficiency benchmarks to ensure there is no bottleneck to treatment.**

Size of Department

54. NRAG also considered the optimum size of a radiotherapy department taking into account factors such as back-up facilities to maintain clinical services to patients when machines break down, the range of services

that need to be delivered, and how best to ensure a good working environment for staff. Based on consensus, **NRAG recommends that**

a. **the minimum size for providing a radiotherapy department should be 2 linacs** ie. 1 linac only services are not supported given the potential impact on patient treatment if the machine was unexpectedly out of action. This is consistent with recommended practice and measure 3E-106 in the 2004 Manual for Cancer Services which sets out the minimum complement of equipment for a radiotherapy department including simulators and treatment planning computers;

b. **the maximum size of a department should not be much in excess of 8 linacs** – this was based on views from those working in larger centres who advised that communication and cohesiveness issues can arise as centres become larger.

Productivity constraints

55. 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. This is addressed in more detail at paras 57-69.

Long term action - expanding radiotherapy services and keeping them up to date

56. Given the long lead time for increasing radiotherapy capacity in terms of both new equipment and staff urgent action is needed to ensure plans are in place to expand capacity over the next 5-10 years to keep pace with the predicted increases in demand.

Workforce

57. The main limiting factor for achieving increased service capacity is workforce. Approximately 3400 FTE staff are involved in delivering radiotherapy services and these include therapeutic radiographers, medical physics staff, clinical oncologists, nurses and related support staff. However, there is an approximately 8% vacancy for staff involved in radiotherapy services. This can be attributed to a number of factors including an inability to recruit due to a shortage of qualified staff.

58. Modelling current supply and potential demand to 2015 (as set out in the workforce subgroup report) has indicated that by maintaining current levels of training, and addressing high attrition rates, a 30% to 50% increase in radiographer workforce numbers could be achieved by 2015. This does not take into account variables that can influence achieving these levels such as attracting sufficient students into training, reduced commissions due to pressures on the National Multi-Professional Education & Training levy (MPET) budget and retention of existing staff. Better use of skill mix can also result in greater efficiencies and improve recruitment and retention. However the NRAG recommendations will require an increase in workforce across all radiotherapy professions (ie. not limited to radiographers) exceeding 30% and this cannot be achieved within the current predicted future workforce supply rates.

59. **NRAG therefore recommends that the Department of Health, working with the NHS and other key stakeholders, develops as a matter of urgency 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 services in line with NRAG recommendations.** The strategy will need to identify the feasibility, risks and timeframe for delivery in workforce resource terms and needs to be undertaken with SHA Commissioners, Higher Education Institutions, the Workforce Review Team, Professional Bodies, service managers and leaders.

60. As part of the strategy, development of the true shortfall in workforce capacity (ie. after predicted growth and changes in skills mix) needed to deliver the NRAG recommendations needs to be determined. This will be achieved by addressing existing issues in each of the radiotherapy professions (as set out in the workforce sub group report),

and considering the impact of effective skills mix to deliver new and extended roles across the professions.

Developing new roles

61. Radical workforce redesign focussing on skills (rather than job titles) is required to address shortages and recruitment difficulties. On average 20% of radiotherapy practice is complex and requires the higher-level skills of the clinical oncologist, the remaining 80% of practice could be managed by non-medical advanced/ consultant practitioners who have the necessary knowledge and skills and are based entirely within the radiotherapy centre. The RCR support this, with the proviso that it is essential that clinical oncologists are involved actively in the process of job and work planning for any other professional who may take on the responsibilities that have been previously carried out by a clinical oncologist[5].

62. A 4 tier skills mix model, a career progression framework for radiographers was developed in 1999 to address this (details are set out in the workforce sub-group report). Introduction of this model across the NHS has the potential to make more effective and efficient use of skilled professionals. It offers the potential for more streamlined care re-focussing the radiotherapy service around the needs of the patient rather than around the traditional uni-professional models of service delivery.

63. Implementation of the 4 tier skills mix model has been patchy – this is disappointing as centres that have implemented it have demonstrated that it can reduce waiting times for patients, aid the recruitment and retention of staff and increase capacity. **NRAG strongly recommends that all radiotherapy centres should have timetabled plans in place to implement the 4 tier model.**

64. Although NRAG understands that the Department of Health is reducing the number of central budgets it holds, they note that targeted funding (as was made available in Scotland) would stimulate the full uptake of the 4 tier model – particularly the high level posts. If such investment cannot be secured, **NRAG recommends that SHA commissioners and service employers fund the fast track career progression required to develop the higher-level skills required as part of this model as a priority** – this is an 'invest to save' initiative.

Therapeutic Radiographers

65. Therapeutic radiographers make up approximately 56% of the radiotherapy workforce and the numbers in post have grown from 1275

[5] Board of the Faculty of Clinical Oncology, The Royal College of Radiologists, The Society and The College of Radiographers, The Royal College of Nursing, The Institute of Physics and Engineering in Medicine (2002). Breaking the Mould: roles, responsibilities and skills mix in departments of clinical oncology. Royal College of Radiologists, London, 2002

FTE in September 1997 to 1309 FTE in 2000 to 1629 FTE in September 2005, an increase of 354 FTE since 1997 (28%). However, there is currently an 11.7% vacancy rate. Reasons vary locally but will include an inability to recruit to posts due to the lack of staff available.

66. As part of the NHS Cancer Plan the number of training commissions for radiographers has increased from 184 in September 2000 to 361 in September 2005 – a 96% increase. Since 1997 when the number of students training were only 135, the overall increase to September 2005 was 167%. However one of the key limiting factors for continued growth in therapeutic radiographers numbers is the high attrition rate (35%) from training.

67. There is no one cause for attrition, which has increased with the growth in training commissions, but pressures on clinical departments have led to a 'poor experience' for some students on placements and is known to have contributed to the high attrition. It is estimated that there will be 1094 additional FTE radiographers by 2015 taking into account a 35% attrition rate and assuming current funding levels (from the National Multi-Professional Education & Training levy - MPET) for training are sustained. However, modelling has shown that if attrition was reduced to 15% an additional 490 FTE on top of the 1094 could be in post by 2015. **NRAG recommends that addressing attrition should be seen as a priority for commissioners and providers of education.**

68. One way to reduce attrition rates is to improve the training experience for trainees and increase the training capacity to reduce pressure on existing clinical services. **NRAG recommends that two projects are pursued to support this:**

    a. **the development of at least 2 multi professional skills laboratories** by the end of 2008 (equipped with linacs, CT simulators and other equipment) – to provide a quality training experience involving patients within a clinical setting and reduce pressure on clinical departments for training advanced students and continued development for existing staff.

    b. **the introduction of Hybrid Virtual Environment (HVE) skills training facilities from 2007** - these simulate the radiotherapy equipment and treatment rooms. SHA workforce commissioners and higher education providers should roll this out across the 10 educational providers and 52 clinical sites from 2007 to support first year students and Assistant Practitioners. This would be a relatively quick solution to increasing clinical training capacity and reducing pressure on service departments whilst providing learning for students in a "safe" environment. Further detail is in the workforce sub-group report.

Although radiographers would be key beneficiaries of these initiatives, other staff involved in the radiotherapy service could also be trained in these facilities.

69. Other issues related to all staff groups delivering radiotherapy services are set out in the workforce subgroup report and also need to be addressed.

Equipment

70. The equipment used in a radiotherapy department includes:

a. linear accelerators (linacs) - the primary external beam treatment machines used in radiotherapy;
b. simulators (approximately 1 per 3 linacs) - used to localise the area to be treated and to verify that the treatment plan is correct prior to giving radiotherapy;
c. planning computers - used to plan radiotherapy treatments;
d. radiotherapy bunkers – a linac must be housed in a thick high density bunker in order to protect staff and the public from the radiation produced by the machines. The availability of decant bunkers minimises down time experienced as older equipment is decommissioned and replaced.

Additional equipment

69. As at August 2006 there were 215 linacs in England. By the time all deliveries in the current equipment programme have been made in early 2008/09 there will be 233 in operational use that will be less than 10 years old. This is on the proviso that all the machines currently funded are procured and delivered.

70. The number of linacs required in the longer term will depend on whether the productivity recommendations in terms of fractions per million population (see para 41) and average fractions per linac in a radiotherapy department (see paras 47 & 49)are accepted and delivered.

71. Assuming that all 233 linacs are in place and fully operational (in line with the productivity recommendations at paras 41, 47 & 49) then the total number of additional linacs required is set out in **table 6**:

Table 6 - Addition linacs required over the next 10 years in England

Year	2006	2011	2016
Total fractions ('000s)	2447	2645	2865
Estimated Fractions per linac p.a in future years	8,342	8,635	8,869
Total linacs required	293	306	323
Equivalent linacs per million population	5.8	5.9	6.1
Total additional linacs[1] (on top of 233 planned by 08/09)	60	73	90

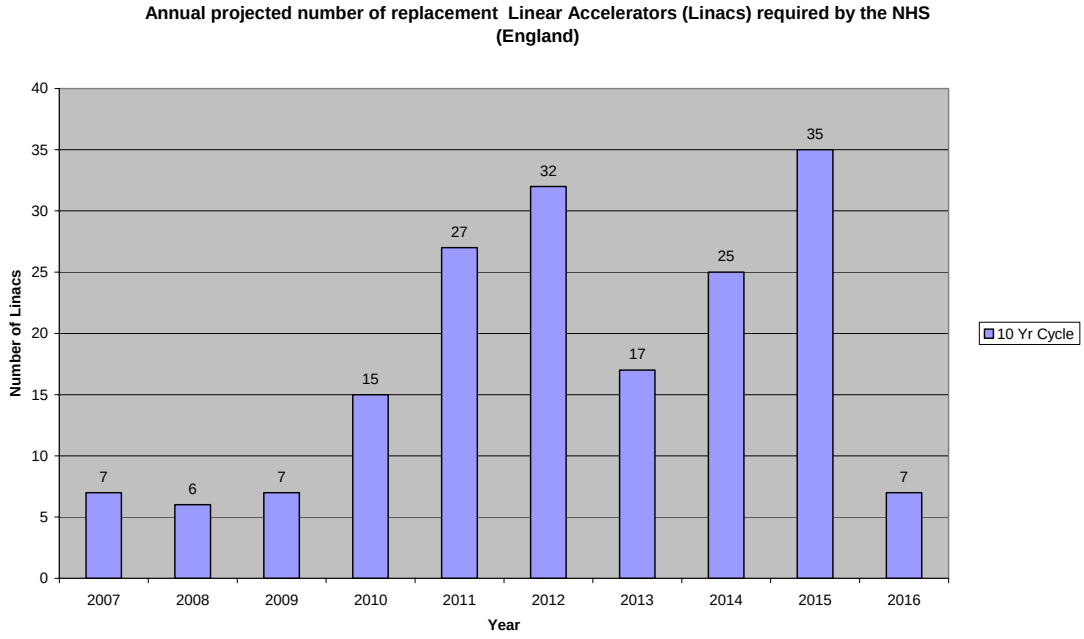
Note: 1 - The total additional linacs needed have been calculated based on the assumption that the 233 linacs expected to be operational in the NHS by 2008/09 are in routine clinical use ie. machines used on a daily basis and also that those departments with the highest productivity will be able to sustain this in the long-term rather than as a short term crisis measure. If either of these assumptions is not the case the number of additional linacs will need to increase.

72. Based on current technology and estimates of future demand therefore, NRAG estimates that around 90 extra linacs need to be available to the NHS over the next 10 years with over 60 needed now. Clearly it will not be possible to deliver this number of machines immediately as there is a lead in time of about 18-24 months for a new machine and the NHS also needs to expand the workforce to support these machines. **NRAG therefore recommends that the Department of Health sets out a trajectory of the number of new linacs it would expect to see coming into use over the next ten years, as the workforce expands, to deliver a national increase of 90 machines. The NHS should take action to expand services in line with this trajectory and NRAG recommends that the Department of Health monitors local action to ensure that progress is in line with the trajectory.**

73. The associated supporting equipment (as set out in para 70) that ensures departments can deliver the required number of fractions will also be required. It will be for local health economies to ensure that the necessary supporting equipment is introduced as they increase the number of linacs available locally.

Replacement linacs

74. The recommended working life of a linac is 10 years – after this time they become technically out of date and there is mechanical wear so that they are less accurate and less reliable. In addition, manufacturer support is usually withdrawn after about 10 years**. Figure b** below shows the projected number of linacs in the current stock that will require replacement from 2007 to 2016 – this is in addition to the new linacs required set out in **Table 6**.



73. **Figure b** shows that 6-35 linacs will need replacing each year across the country and it is the responsibility of local health economies to ensure that this happens. **NRAG strongly recommends that local health economies have robust capital replacement programmes in place** to ensure the stock of machines retains an appropriate age profile ie. no more than 10 years.

74. In addition to replacing linacs, NRAG notes that software used to plan and deliver treatment gets out of date very quickly (more quickly than the linacs themselves), impacting on the efficiency and effectiveness of radiotherapy departments. **NRAG therefore recommends that local health economies ensure that software is upgraded at least every three years.**

Location/Siting of linacs

75. The location of the new linacs will be for local determination and will depend on a number of factors including:

a. ensuring that departments have a sufficient workload to make them viable to run;

b. equity of access ie. ensuring that there is a sufficient spread of linacs across the country – one issue to consider in relation to this is travel times. Participants at a patient workshop about choice indicated that up to 45 minutes travelling time was acceptable (although less would be preferable). No more than 45 minutes should therefore be seen as good practice although it is recognised that this is not achievable in all areas. A drive time analysis for radiotherapy has shown that 87% of the population already live within 45 minutes of a radiotherapy centre.

76. **NRAG recognises that location of additional linacs is for local determination, however, they strongly recommend that the Cancer Action Team maintains a national overview of location plans to advise providers and commissioners on geographical spread and travel times.**

New Technology

77. A 3D based environment for imaging, planning and radiotherapy delivery is the current baseline for linacs. However, 4D radiotherapy takes into account tumour volume in three dimensions but also takes into account changes with time (the 4th dimension). Adaptive therapy also allows the treatment set-up and dose delivered to be verified and then changed as necessary during a course of treatment. NRAG advises that image guided four-dimensional (4D) adaptive radiotherapy is the future standard of care for radical radiotherapy treatment that the NHS should aspire to. **NRAG therefore recommends that all replacement and newly installed machines are capable of image guided four-dimensional (4D) adaptive radiotherapy.** There is evidence (set out in the technology report) that these processes will become more time-efficient as the technology becomes standard practice.

78. **NRAG also recommends that image storage capacity is procured from linac suppliers as part of each new equipment bid.** This is necessary to ensure that the supplier commits to expanding the storage capacity as needed rather than a locality having to buy add-ons as and when required which would be more expensive.

79. Lack of resources, in particular staffing, has limited some departments ability to exploit fully the capabilities of some equipment leading to variable use of optimal treatment. It will be important to ensure that the introduction of further new technology is properly planned with sufficient training for all appropriate staff – the recommendation set out at para 68 will support this.

79. Intensity modulated radiotherapy (IMRT), which conforms the dose more closely to the shape of the tumour target, is likely to be used in conjunction with 4D adaptive radiotherapy. This, and other new technologies, are discussed further in the technology sub-group report.

Particle (Proton) Therapy

80. Proton therapy is a form of radiotherapy that has the ability to focus precisely on the tumour even if it is very close to critical structures. It is used in the UK for patients with tumours of the eye. However, the UK has no modern high energy proton treatment facility for other patients with deeply situated tumours who would benefit from this technology. This contrasts with most European countries where such centres are either already available or are being commissioned or planned.

81. A small number of cancer patients in England (15-20 per annum) are being referred for proton treatment to centres outside the UK, for example in France and America. This trend will undoubtedly grow if no UK facility becomes available. However, obtaining funding for treatment abroad is complex, time consuming and pursued only where patient and clinician motivation is strong – this will lead to unacceptable inequalities in provision of this treatment.

82. NRAG considers that the world wide literature is now sufficient to justify the use of proton treatment for a number of indications (as set out in the proton sub-group report) amounting to 8-31 patients per million population per year. A substantial proportion of these are children in whom important improvements in treatment and reduced long term side effects can be achieved. It is estimated that there is an immediate need for 400 patients per annum to receive this treatment.

83. **NRAG therefore recommends that the Department of Health facilitates the setting up of a clinical reference panel in the short term to review clinical cases on behalf of PCTs and recommend/ approve referrals to centre(s) outside the UK to ensure appropriate and equitable access to proton therapy**.

84. In the longer term, **NRAG recommends that at least one modern proton treatment facility is set up in England and that the Department of Health develops a business case for this.** The centre should be sited appropriately to allow reasonable geographical access for patients from Wales, Scotland, Northern Ireland and the Republic of Ireland.

83. It should be noted that there is significant interest and potential funding from academic engineering and applied physics bodies within the UK and partnership with equipment manufacturers has been productive in setting up clinical facilities in other countries. There are

also significant industrial uses such as component testing, and semiconductor production that would attract income to a major centre. It is therefore possible that the introduction of such a facility for the NHS could be done in partnership with industry, academic institutions and possibly the health services from the devolved administrations. **NRAG advises that the Department of Health should explore these partnerships further.**

Data Collection/Audit

Radiotherapy Episodes Statistics (RES)

84. The RES project was set up to collect information on a voluntary basis from radiotherapy centres and to analyse and link this data with Hospital Episode Statistics (HES) data and patient activity. The purpose was to provide comparative information back to radiotherapy centres to drive service improvement.

85. The RES subgroup was established to oversee the continued development of the project, to define its medium and long term strategy and to advise on matters relating to data protection, data access and data presentation.

Data Collection

86. 49 out of 52 radiotherapy centres in England are providing some form of data to the RES project on a voluntary basis. However, data are not always complete or accurate, and there is no formal timetable either for submitting data or producing comparative information for the NHS.

87. Data on radiotherapy activity need to be collected in order to provide information on the usage of radiotherapy machines and radiotherapy waiting times to drive up service improvement. To achieve this **NRAG recommends that radiotherapy centres are encouraged to submit a nationally agreed dataset to the National Cancer Service Analysis Team (NatCanSat) at quarterly intervals from April 2007 and that this data collection becomes a mandatory return to the NHS Health and Social Care Information Centre by April 2008.**

Reports

88. If submission of data is placed on a more formal basis, the production of timely and informative reports back to clinical teams will be possible. These will help them to benchmark their service against others which will act as a driver to improve services . Ultimately it will also be possible to link this data to other databases and develop outcome indicators for radiotherapy services. **NRAG recommends that NatCanSat or the NHS Health and Social Care Information Centre analyse the data and feedback to radiotherapy departments, PCTs, Networks, SHAs and the community on a regular basis**.

Implementation

89. Current service provision varies considerably between cancer networks. **NRAG recommends that the Cancer Action Team carries out a formal benchmarking exercise involving all networks/ radiotherapy centres and that individual cancer networks should then set out trajectories, with associated actions, to achieve the recommended interim and long term activity levels (40,000 by 2010/11 and up to 54,000 fractions by 2016 per million population respectively) and to reduce waiting times**. These trajectories and associated actions should be approved by the relevant SHA in association with the Cancer Action Team.

90. Detailed proposals regarding the implementation of these recommendations are beyond the scope of this report. NRAG recognise, for example, that decisions will need to be made on the role of independent sector providers in helping to deliver the recommended increases in capacity. Any independent sector involvement will need careful planning to ensure continuity of care for patients and efficient use of scarce resources (both machines and staff). **NRAG recommends that additional work is undertaken by the Department of Health to look at estimated costs of the recommendations, approaches to funding, commissioning and planning.**

91. In addition, **NRAG recommends that the Department of Health sets up an oversight & implementation group to ensure that progress is made toward the implementation of the recommendations set out in this report.**

92. Finally, NRAG welcomes the development of the Cancer Reform Strategy recently announced by the Secretary of State for Health and **recommends that it sets out how the health reforms will be used to ensure that the recommendations in this report are taken forward by the NHS**.

Conclusion

93. This report sets out what needs to be done now to improve radiotherapy services and lays out a vision for a world class radiotherapy service in the future. For patients this would mean that all those who could benefit from treatment would access it in a timely way and receive the optimum treatment regimes as used elsewhere in the developed world. This would improve outcomes by preventing tumour progression and would also allay patient anxiety. Increased capacity would also address the problem of interruptions to treatment which inconveniences patients and, more importantly, can be detrimental to their treatment outcome. Over the next decade, image guided radiotherapy will become the standard of care and it is expected that such targeted treatment will reduce side-effects, expand possible uses (indications) of radiotherapy and improve outcomes further.

94. These developments will permit a modern service delivered to the highest standards, equitably and in a timely way to all who could benefit. This will contribute to improved cancer survival - radiotherapy is estimated to contribute to 40% of cases where a cancer is cured - so action taken now will save lives in the future. In addition, for those who cannot be cured, symptoms would be relieved faster and with fewer side effects significantly improving quality of life.

95. If action is not taken, waiting times for radiotherapy will continue to grow - it is already estimated that only around half of patients receive radiotherapy treatment within one month. It is clear that, for some of the patients that wait longer, their prognosis will worsen over this time with cancers that were potentially curable becoming incurable.

96. Unless action is taken without delay the Government will lose the opportunity to save lives, and services in this country will fall further behind those of other comparable countries. **It is therefore vital that the recommendations set out in this report (summarised at Annex B) are implemented by the Department of Health and the NHS** to ensure that England has adequate radiotherapy services in the short term and world class services in the future.

Annex A

National Radiotherapy Advisory Group: Membership

Adrian Crellin	Consultant clinical oncologist, Leeds
Alan McKenzie	Medical Physicist, Bristol
Angie Craig	CSC National Manager for Radiotherapy
Ann Barrett	Consultant clinical oncologist, Norwich
Anne Shaw	Society & College of Radiographers
Brian Cottier	National Cancer Services Analysis Team
Caroline Lowdell	Cancer Lead, NW London SHA
Carolyn Morris	User representative
Cathy Williams	Radiotherapy Service Manager, Mount Vernon
Charlotte Beardmore	Society & College of Radiographers
Chris Ward	Management director, North London cancer network
David Spooner	Consultant clinical oncologist, Birmingham
Geoff Lambert	Medical Physicist, Newcastle
Jane Barrett	Consultant clinical oncologist, Reading
Margaret Abraham	Radiotherapy Service Manager, Lancashire
Margaret vanDaesdonk	Radiotherapy Service Manager, Shropshire
Michael Williams (co-chair)	Consultant clinical oncologist, Cambridge Vice president, Royal College of Radiologists
Mike Richards(co-chair)	National cancer director
Mike Vincent	User representative
Noelle Skivington	Radiotherapy workforce development lead - England
Peter Hoskin	Consultant clinical oncologist, Mount Vernon
Peter Kirkbride	CSC national radiotherapy lead
Robin Hunter	Consultant clinical oncologist, Manchester
Simon Thomas	Medical physicist, Cambridge
Trevor Roberts	CSC national radiotherapy lead
Teresa Moss	Cancer Action Team

Annex B

Summary of NRAG Recommendations

Action Required to improve Radiotherapy Services

1. NRAG recommends that, as part of the Government's commitment to go further on cancer waits, the 31 day target from diagnosis to first definitive treatment is extended to include all radiotherapy treatment.

2. NRAG strongly recommends that radiotherapy services should be developed to deliver up to 54,000 fractions per million population throughout the country by 2016 with an interim aim of delivering 40,000 fractions per million population by 2010.

Short term action – Improving productivity from the existing service

Fractions per linac per year

3. NRAG recommends that

    a. all departments have as an immediate aim to deliver at least 8,000 fractions per linac per year averaged across all the linacs in the department;
    b. by 2010/11 all departments should aim to deliver at least 8,300 fractions per linac per year averaged across all the linacs in the department;
    c. by 2016 all departments should aim to achieve at least 8,700 fractions per linac per year, averaged across all the linacs in the department.

Additional Capacity

4. NRAG recommends that, where a radiotherapy department opens on a weekend or bank holiday, it operates full service.

5. NRAG recommends that radiotherapy services consider the introduction of a service efficiency machine.

6. NRAG recommends that radiotherapy services plan so that they operate at 87% capacity ie. so that they are capable of delivering 13% more activity than is actually required.

7. NRAG recommends that a group should be established to consider all the elements involved in the pre-treatment of patients and set appropriate throughput /efficiency benchmarks to ensure there is no bottleneck to treatment.

8. NRAG recommends that:

   a. the minimum size for providing a radiotherapy department should be 2 linacs;
   b. the maximum size of a department should not be much in excess of 8 linacs.

Long term action - expanding radiotherapy services and keeping them up to date

Workforce

9. NRAG recommends that the Department of Health, working with the NHS and other key stakeholders, develops as a matter of urgency 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 services in line with NRAG recommendations.

10. NRAG strongly recommends that all radiotherapy centres should have timetabled plans in place to implement the 4 tier model.

11. NRAG recommends that SHA commissioners and service employers fund the fast track career progression required to develop the higher-level skills required as part of this model as a priority

12. NRAG recommends that addressing attrition should be seen as a priority for commissioners and providers of education and that two projects are pursued to support this:

    a. the development of at least 2 multi professional skills laboratories;
    b. the introduction of Hybrid Virtual Environment (HVE) skills training facilities from 2007.

13. NRAG recommends that the Department of Health sets out a trajectory of the number of new linacs it would expect to see coming into use over the next ten years, as the workforce expands, to deliver a national increase of 90 machines. The NHS should take action to expand services in line with this trajectory and NRAG recommends that the Department of Health monitors local action to ensure that progress is in line with the trajectory.

14. NRAG strongly recommends that local health economies have robust capital replacement programmes in place

15. NRAG recommends that local health economies ensure that software is upgraded at least every three years.

16. NRAG strongly recommends that the Cancer Action Team maintains a national overview of location plans for linacs to advise providers and commissioners on geographical spread and travel times.

New Technology

17. NRAG recommends that all replacement and newly installed machines are capable of image guided four-dimensional (4D) adaptive radiotherapy.

18. NRAG recommends that image storage capacity is procured from linac suppliers as part of each new equipment bid.

Particle (Proton) Therapy

19. NRAG recommends that the Department of Health facilitates the setting up of a clinical reference panel in the short term to review clinical cases on behalf of PCTs and recommend/ approve referrals to centre(s) outside the UK to ensure appropriate and equitable access to proton therapy.

20. In the longer term, NRAG recommends that at least one modern proton treatment facility is set up in England and that the Department of Health develops a business case for this and explores possible partnerships with industry, academic institutions and possibly the health services from the devolved administrations.

Data Collection/Audit

21. NRAG recommends that radiotherapy centres are encouraged to submit a nationally agreed dataset to the National Cancer Service Analysis Team (NatCanSat) at quarterly intervals from April 2007 and that this data collection becomes a mandatory return to the NHS Health and Social Care Information Centre by April 2008.

22. NRAG recommends that NatCanSat or NHS Health and Social Care Information Centre analyse the data and feedback to radiotherapy departments, PCTs, Networks, SHAs and the community on a regular basis.

Implementation

23. NRAG recommends that the Cancer Action Team carries out a formal benchmarking exercise involving all networks/ radiotherapy centres and that individual cancer networks should then set out trajectories, with associated actions, to achieve the recommended interim and long term activity levels (40,000 by 2010/11 and up to 54,000 fractions by 2016 per million population respectively) and to reduce waiting times.

24. NRAG recommends that additional work is undertaken by the Department of Health to look at estimated costs of the recommendations, approaches to funding, commissioning and planning.

25. NRAG recommends that the Department of Health sets up an oversight & implementation group to ensure that progress is made toward the implementation of the recommendations set out in this report.

26. NRAG recommends that the Cancer Reform Strategy sets out how the health reforms will be used to ensure that the recommendations in this report are taken forward by the NHS.