The Development of Radiation Oncology Services in Ireland

Foreword

The provision of a high quality radiation oncology service is one of the cornerstones of a modern treatment programme for cancer patients. Timely and equitable access to a radiation oncology service of the highest international standard should be available to all cancer patients in Ireland and it was the achievement of this goal that guided and motivated the group in producing this report and its accompanying recommendations.

There now exists a unique opportunity to provide a national co-ordinated service plan that can capitalise on the development of new state of the art facilities and also address the increasingly complex care requirements of cancer patients and their families. This will be necessary to address the profound deficit in radiation oncology services which we identified.

The developments proposed within this report will create the greatest opportunity to provide all cancer patients within Ireland with access to the highest quality clinical care. In addition the new service will provide a benchmark of quality that will facilitate long term planning within the national radiation oncology service. Critical components of this enhanced service include an investment programme to increase patient treatment capacity, the provision of new treatment equipment, a significant increase in specialist staff, and radiation oncology centres working together in partnership as a co-ordinated national network of supra-regional comprehensive cancer centres.

The expansion of services proposed within this report is a natural development of the enormous contribution to cancer care of many healthcare professionals, support staff, public, voluntary and charitable agencies, whose activities and generosity have been evident since the genesis of radiation oncology services in Ireland. The harnessing and further development of this support and expertise will be critically important, and should provide an indisputable catalyst for the development of the radiation oncology services detailed in this report.

The future scale of new service developments is very significant. There is now a pressing need to plan, implement and resource the report's recommendations if we are to ensure that radiation oncology services in Ireland are to match those available in other western countries.

Finally, I would like to acknowledge the extensive work undertaken by the members of the group in discharging the key remit given to us by Micheál Martin, T.D., Minister for Health and Children. Their contribution both in terms of time and effort was impressive.

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Chairman of the Expert Group

Terms of Reference

The terms of reference of the Expert Working Group on Radiation Oncology Services were the following:

'Having regard to the developments in cancer prevention, diagnosis and treatment in recent years, the provisions of the National Cancer Strategy in relation to radiotherapy services and best practice in the area, the Expert Group are asked:

- To undertake an assessment of need in relation to radiotherapy services, including recommended norms in relation to service provision, planning and staffing for facilities and
- On the basis of the needs identified, to make recommendations on the future development of radiotherapy services, including links with radiotherapy services in Northern Ireland.'

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Members of staff from the National Cancer Registry including Dr Patricia Riordan assisted the Group and were also members of the Sub-Working Group.

Acknowledgments and Meetings of Expert Working Group on Radiation Oncology Services

The Minister for Health and Children established the Expert Working Group on the Development of Radiotherapy Services in May 2000.

The Expert Working Group met on 25 separate occasions. During this time, the Group visited radiation oncology services in St Luke's Hospital and Cork University Hospital. Representatives from the Group also visited the clinical/radiation oncology services at Belvoir Park Hospital in Northern Ireland and an additional second meeting involved a reciprocal visit of Northern Ireland representatives to Dublin.

A Sub-Working Group was established for a period to process information relating to the Expert Group's deliberations. This Sub-Working Group met on six separate occasions.

The Group also requested significant help and assistance from the National Cancer Registry Ireland (NCRI). The latter tasks included a complex series of data analyses, projections and analysis of healthcare models.

The Expert Working Group commissioned two independent research studies to identify additional information on cancer services that was not available in the public domain. The first study, undertaken by the Small Area Health Research Unit (SAHRU)[1] investigated the potential travelling times and distances for patients availing of existing and potential new radiation oncology services. The second study, completed by the Institute of Public Administration (IPA) / Royal College of Surgeons in Ireland (RCSI) investigated patient priorities in the development of new radiation oncology services.

As part of the consultative process, the Expert Working Group invited submissions on three separate occasions from the Health Boards and the Eastern Regional Health Authority on plans to develop radiation oncology services. Each Health Board and Health Authority was also afforded an opportunity to meet with the Expert Group to provide updates or further information on such plans.

[1] SAHRU, Trinity College Dublin.

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The future model and configuration of radiation oncology treatment centres in the Republic of Ireland present a major challenge in providing sustainable solutions that will ensure the highest standards of cancer care for a period of decades. The latter is of critical concern as the forthcoming development of new radiation oncology services, by virtue of their initial costs, construction complexity, and expected duration of working life, will influence the future clinical standard of care for a minimum period of 15-20 years and probably longer. The national solution must therefore not only improve existing standards of care, but perhaps more importantly be configured in a way that provides maximum opportunity to address the anticipated and unrecognised elements of future radiation therapy provision.

The shortfall of clinical radiation oncology services in the Republic of Ireland is of such a magnitude that a major investment programme is required to rapidly develop treatment services to acceptable modern standards. The initial imperative is to provide services of the highest standard to all patients by the development of a clinical network of treatment centres that will establish appropriate outreach services to other hospitals in a partnership model. The Group recommends that the first priority in developing a national radiation oncology service should be the development of a clinical network of large centres that collectively have the staff and treatment infrastructure to permit a rapid increase in patient access to appropriate modern radiation therapy and form the backbone to possible future expansion requirements for radiation oncology. The Group believes that the development of these centres as a clinical network is of paramount importance and will in the shortest timeframe begin to address the profound deficit in radiation therapy services that has been identified. In addition the development of these centres should be expected to provide a benchmark for quality that can be used in considering any additional developments in radiation therapy.

The Expert Group acknowledges that cancer patients expect the provision of rapid access to the highest quality care, along with appropriate communication with healthcare staff, and that these requirements are the top priorities and challenges for healthcare professionals and planners responsible for future radiation oncology care.

Section 1 Background and introduction to radiation oncology services

- Radiation therapy is an important treatment modality used in the management of cancer.
- There is an international consensus that approximately 50-60 per cent of patients will require this form of treatment during their cancer illness.
- Failure to deliver modern radiation therapy can result in a reduced chance of patient cure.
- In cancer patients radiation therapy is used with curative intent or for symptom management and palliation.
- Radiation therapy is used in the clinical management of a limited number of non-malignant medical conditions.
- There is an increasing need to integrate radiation oncology with the other cancer treatment modalities of surgical and medical oncology.
- A wide and increasing range of healthcare professionals is essential for the safe and efficient delivery of modern radiation therapy.
- Two major types of radiation therapy exist: external beam (teletherapy) and brachytherapy.
- A complex range of radiation therapy equipment is used as part of the assessment, planning, delivery, crosschecking of treatment, and in the long-term storage of the large datasets generated for individual patient treatment protocols.

- The treatment process varies enormously from simple protocols to very complex labour and technology intensive treatments.
- It is essential that both hospital-based specialists and general practitioners be regularly informed of developments in radiation oncology. An early introduction to the discipline within the undergraduate medical curriculum and the development of short radiation oncology clinical rotations for hospital physicians and general practice training programmes would aid this process.
- The Group acknowledges the considerable contribution to cancer patient care that has been made possible by a wide range of healthcare professionals and support staff who have delivered the service since its early development and who provide the existing radiation oncology service.

Section 2 Current status of radiation oncology services in Ireland

- Clinical radiation oncology services were under-developed for the period between the early 1960s and the 1990s.
- The existing and short-term planned increase in treatment capacity within the Republic of Ireland is significantly below the equivalent guidelines recommended by international agencies and authorities in other western countries.
- During the late 1990s and the early 2000s major investment in new and replacement clinical treatment services has taken place in Dublin and Galway. During the same period a more limited investment programme in replacement equipment has taken place in Cork.
- The current utilisation of radiation therapy for a number of common adult cancers, as is shown by comparable data, appears significantly less than in a number of EU countries and North America.
- The percentage of new cancer patients who have availed of radiation oncology services during the period 1994-1998 has not increased.
- There is a significant regional variation in the use of radiation oncology treatment services. However, distance from a radiation oncology centre does not completely explain the observed differences in use.
- The existing Dublin-based treatment services are used by a majority of patients from the Eastern Regional Health Authority (ERHA) and other Health Boards with the exception of the Southern Health Board (SHB).
- The existing services at Cork University Hospital (CUH) are used primarily by residents of the SHB. However, additional patient populations attend from the South Eastern Health Board (SEHB) and the Mid-Western Health Board (MWHB).
- A significant variation in the interval between cancer diagnosis and the commencement of radiation therapy was noted among the Health Boards. The reasons for this variation are not evident.

Section 3 Future developments in the clinical practice of radiation oncology

- Important advances in clinical radiation therapy have recently entered routine clinical practice.
- Further technological advances will become part of routine clinical practice in the near future, for example Intensity Modulated Radiation Therapy (IMRT).
- The national implementation of BreastCheck® will result in an increased need for radiation oncology services.
- Recent trends in clinical practice and the recognised standard of care have resulted in an increased need for rapid access pre-operative (neoadjuvant) radiation therapy for certain cancer patients.
- Novel improved fractionation regimens have been identified for specific patient groups that will have significant impact on the co-ordination and logistics of treatment provision, for example when treatment is required on more than one occasion per day (hyper-fractionated treatment).
- Improvements in the biological understanding of cancer and the effect of radiation therapy will undoubtedly modify treatment protocols in the medium to long term.
- Preliminary studies suggest that specialised forms of radiation therapy, for example intravascular brachytherapy, may become more widely used in patients with non-malignant illness such as coronary artery and peripheral vascular disease.

- New forms of radiation treatment and parallel developments in molecular genetics/oncology will be incorporated into radiation oncology practice within the next 1-2 decades, the timeframe being considered by the Expert Group. These advances include the clinical use of systemic targeted radionuclides, targeted radiosensitisers and normal tissue radioprotectants, and novel pharmacological inhibitors of the critical molecular pathways that ultimately determine clinical responses to radiation therapy. Treatment advances will need to be integrated with advanced biological/functional diagnostic imaging modalities (e.g. PET and magnetic resonance spectroscopy (MRS), together with the molecular phenotyping of tumours and normal tissue using tissue, cDNA and other microarray technologies).

- The envisaged developments in molecular and clinical radiation oncology will require a continued provision of highly qualified healthcare professionals, the continued development of related undergraduate and postgraduate training programmes, and in particular the increased integration of these strategic planning goals at a clinical and research level. The envisaged developments in molecular radiation oncology and biological imaging will for the foreseeable future be maximally developed in the context of university-linked supra-regional comprehensive cancer centres.

Section 4 Patient caseload – analysis and projections to 2015

- The total number of new cancer cases is increasing annually. Some of the increase is as a consequence of a growth in population. However, a significant further increase can be attributed to an ageing population.
- Between 1994 and 1998 the increase in incidence of some cancers was above that expected, as a consequence of age-dependent changes in the national population and/or additional demographic changes.
- The national population is projected to increase to 4.3 million in 2015 with the proportion of people over the age of 60 years increasing to 18 per cent.
- A 41 per cent increase in the number of cancers is expected between 1994 and 2015, excluding non-melanoma skin cancer.
- There will be a major increase in the number of patients with the more common adult cancers that require radiation oncology treatment, for example breast, prostate, lung, and non-melanoma skin cancers.

Section 5 Models of service delivery

- A number of different models of radiation oncology service provision exist in Europe, North America and Australia.
- In the last decade comprehensive national reviews of cancer services including radiation oncology have been performed in England and Wales (Calman-Hine Report), Northern Ireland, Sweden, the Netherlands, Canada and Australia.
- The majority of these reports acknowledge the significant increase in the technological and clinical complexity of modern radiation oncology and the critical need to ensure appropriate structures to provide the existing and future standard of care.
- Dr L. Grogan and Mr G. Watson held a different opinion from other members of the Group regarding the conclusions to be drawn from the relative advantages and disadvantages of the models described in section 5.6.
- The predominant view of the Group is that the greatest opportunity for success is through the initial co-ordinated development of larger treatment centres that must provide appropriate outreach services to other hospitals in a partnership model.

- The costs associated with this development will be significant and there are complex cost benefit and cost utility elements that are important in examining the options that will provide the highest quality service for the maximum number of patients.
- Given the magnitude of service development, there is a need to consider an element of prioritisation particularly in regard to short, medium and longer-term objectives. Nevertheless there will be a clear requirement to put in place the major elements of the national service plan within the forthcoming decade.
- The estimated capital costs for constructing and equipping treatment centres range from €34.77m for a 4-linear accelerator treatment centre to €92.12m for a 12-linear accelerator treatment centre.
- The indicative revenue costs for the treatment centres range from €7.36m for a 4-linear accelerator treatment centre to €16.37m for a 12-linear accelerator treatment centre. In addition, the indicative associated patient accommodation costs range from €2.3m for a 4-linear accelerator treatment centre to €8.9m for a 12-linear accelerator treatment centre.

Section 6 Analysis of staffing requirements

- Healthcare professionals involved in the delivery of radiation oncology require appropriate education and training programmes in order to provide the skills and experience that enable radiation oncology services of the highest quality.

Medical staff

- In Ireland the number of consultant radiation oncologists per million population is the lowest in Western Europe. Each consultant radiation oncologist supervises the clinical management of a patient caseload up to four times that suggested in a number of international guidelines published in the mid-1990s.
- Maintenance of existing radiation oncology / medical staffing norms is inappropriate. In the short term the existing medical staffing levels cannot continue to provide modern radiation oncology treatment services.
- The short-term expansion of the postgraduate SpR/fellowship training programme should be considered, to permit an immediate and future planned expansion of consultant numbers.
- Recent national and international recommendations on medical/consultant staffing indicate a need for 8-12 radiation oncologists per million population, permitting an estimated caseload of 200-350 new patients per consultant.

Radiation therapists

- The Report of the Expert Group on Radiography Grades (2001) and the Report of the Radiography Service Review Group (2002) have recently been completed. The reports identify significant issues that relate to radiation therapist staffing, including staff development, grading structure, education and training and areas of specialist skill development.
- Staffing ratios for radiation therapists have historically been based on numbers of staff per treatment unit. However, with the increasing complexity of treatment, revised models for estimating radiation therapist numbers may be developed in the future. This may necessitate a shift from calculations based on treatment units to a patient-centred approach that recognises complex care and patient needs assessment.
- In many countries there is preliminary evidence of an inadequate supply of therapists, with high vacancy rates, increasing rates of staff loss, and insufficient numbers of training programmes for staff replacement.
- Appropriate staffing ratios are essential to reduce the risk of treatment errors and to ensure the optimal quality and safety of treatment.
- Current Irish guidelines on therapist staffing are similar to those in the Netherlands, UK, Australia and other western countries. The general practice is four radiation therapists per linear accelerator with appropriate staffing ratios for other areas of specialised activity.

Physicists, engineering and dosimetry staff

- The need for adequate physicist support for effective and safe use of radiation therapy equipment has been emphasised in Council Directive 97/43/Euratom – Health Protection of Individuals against the Dangers of Ionising Radiation in relation to Medical Exposure.
- Postgraduate training in radiation oncology medical physics, engineering and dosimetry for staff is poorly structured and informal in contrast to most western countries where formal training courses and certification are the norm.
- There are no agreed staffing levels for radiation oncology physicists in Ireland.
- Recommended minimum staffing levels for the provision of physics support have been published by a joint working group from the European Society of Therapeutic Radiation and Oncology (ESTRO) and the European Federation of the Organisations of Medical Physicists (EFOMP).

Oncology Nursing

- Current trends and evidence in radiation oncology indicate the increasing need for highly qualified nursing staff both for the delivery of in-patient care and the more recently developed role in day-care attendance for radiation therapy.
- A range of nursing professional grades are involved in radiation therapy including a number of new positions: oncology nurse co-ordinator, clinical nurse specialist, and advanced nurse practitioner (ANP).
- In Ireland the majority of oncology nursing education training is short education programmes. Higher-level education programmes on radiation oncology exist at a number of third level education institutions including Trinity College Dublin, University College Dublin (UCD) and the National University of Ireland, Galway
- The existing literature suggests that neither activity-based nor dependency-based models are totally reliable in predicting nursing workforce requirements.

Other staff

- A significant number of additional healthcare professionals are essential members of the multidisciplinary team and assist in providing the totality of care that accompanies the radiation oncology treatment process. They include: physiotherapists, dieticians, specialist dentists, psychologists, medical social workers, occupational therapists, speech and language therapists and pastoral care workers.

Section 7 Analysis of radiation oncology infrastructural requirements

- The Group commissioned an independent study of the priorities of Irish patients and their experiences of existing radiation oncology services. The most important aspects of service identified by patients were:
  - Receiving the highest level of patient care
  - Obtaining information about their condition
  - A reduction of the waiting time between diagnosis and treatment
  - Communication with medical and other healthcare staff
  - Proximate geographic access: ranked thirteenth of the examined parameters.
- Patients expect that rapid access to the highest quality care with appropriate communication between the patient and all healthcare staff should be the greatest priority for healthcare professionals and planners in providing future radiation oncology care.
- The development of a modern radiation therapy centre is an extremely complex process which requires the installation and integration of high technology treatment equipment and the parallel appointment of an extensive range of healthcare professionals, particularly in the fields of radiation oncology, radiation therapy / therapeutic radiography[ii], medical physics, engineering and information technology, and oncology nursing.

[ii] Prior to 2002 and the Report of the Radiography Service Review Group the professional descriptor 'Therapeutic Radiographer' was used. The title is now changed to Radiation Therapist.

- Radiation oncology services cannot be simply aligned to the existing regional oncology services as developed by a number of Health Boards, as the population size and other criteria are not sufficient to support the appropriate scale of treatment facility that has been identified by the Group as a critical component of the proposed initial phase of expansion of services in Ireland. The Group developed a series of guidelines to facilitate the future identification of suitable locations for the development of additional radiation therapy facilities.
- There is a significant mismatch between existing national treatment capacity and the estimated need. The Group has estimated a current total national requirement of 25-29 linear accelerators at 50 per cent uptake of radiation therapy. There will be a need for a further phased increase to 38 linear accelerators by 2015.
- In order to adhere to the existing and anticipated guidelines for those patients requiring short waiting times for treatment, the proposed national service plan must have a degree of capacity that exceeds the mean demand.
- In the service development timeframe being considered by the Group there are significant elements of future service development that will require the active partnership of Health Boards. These tasks include the identification and commissioning of appropriate additional treatment support facilities, the development of additional consultant-provided radiation oncology clinics, and the early examination of dedicated transport solutions for patients.
- The North Western Health Board (NWHB) has outlined a number of strategic options for the future provision of radiation oncology services to the north-western area of the country. The development of such services will need to be the subject of additional comprehensive analysis and discussion between the NWHB, the Department of Health and Children (DoHC) and their counterparts in Northern Ireland.
- Galway was proposed as a supra-regional cancer centre location in the 1996 document *Cancer Services in Ireland: A National Strategy*. Construction of the new radiation oncology services at UCHG will be completed in 2003/4. The indicative catchment population for a Galway-based centre was proposed in the 1996 National Cancer Strategy.
- Cork was identified as a supra-regional cancer centre location in the 1996 document *Cancer Services in Ireland: A National Strategy*. The recent investment programme at CUH will not meet the existing or future treatment requirements of the existing patient population within the SHB and adjacent catchment area.
- The population within the Eastern Regional Health Authority is the largest in the country and recent projections suggest that it will continue to be the fastest growing area with an estimated 37 per cent increase in population between 1996 and 2015. Analysis of the projected cancer patient caseload provides an unequivocal case for the development of additional radiation oncology treatment services within the Eastern Region. The patient population residing in the Midland Health Board (MHB), the North Eastern Health Board (NEHB) and part of the South Eastern Health Board (SEHB) will be best served, in the initial phase of radiation oncology expansion, by the development of additional treatment capacity within the Eastern Region.

Section 8 Recommendations – proposed configuration of radiation oncology services

- Equity of access to the highest quality radiation oncology facilities is a right of all cancer patients. In order to provide this, a significant increase in patient treatment capacity achieved by the commissioning of new treatment equipment is urgently required.
- An increased number of radiation oncology treatment units should be established as part of a national clinical network of centres. In the short to medium term this will be best achieved through the development of radiation oncology services in the context of supra-regional cancer centres as originally set out in the 1996 National Cancer Strategy.

- Improved patient access is an integral and critical aspect of the proposed national radiation oncology service and the proposed development plan aspires to address the many factors that influence patient access.
- The group considers that a 4-6 linear accelerator treatment unit with appropriate staffing, and matched support for computed tomography (CT) and non-CT simulation, treatment planning, therapy-based imaging, brachytherapy, and specialist radiation oncology / peri-operative procedures, is the minimum treatment centre configuration for a future radiation oncology treatment centre.
- The following treatment centre configuration and expansion of facilities is recommended:
  - Two treatment centres in the Eastern Region located at supra-regional cancer centres:
    - A single Eastern Region treatment centre serving the southern part of the region and adjacent catchment areas, ultimately providing a 13-14 linear accelerator capacity with appropriate clinical and non-clinical staff
    - A single Eastern Region treatment centre serving the northern part of the region and adjacent catchment areas, ultimately providing an 8-9 linear accelerator capacity with appropriate clinical and non-clinical staff.
  - A treatment centre located at a supra-regional cancer centre within Cork University Hospital, ultimately containing 8-9 linear accelerators with appropriate clinical and non-clinical staff
  - A treatment centre located at a supra-regional cancer centre within University College Hospital Galway, ultimately containing 6 linear accelerators with appropriate clinical and non-clinical staff.
- The precise locations for the proposed service development in the Eastern Region have not been identified. The Group believes that this will require a detailed and sensitive analysis of existing public treatment facilities and the potential resources of specific hospital sites, the existing stage of development of oncology services at individual hospitals, site development plans and issues of patient access. This comprehensive review of the advantages inherent in specific hospital sites should be undertaken rapidly with the assistance of international experts and/or peer review using the guidelines outlined in section 7.3. This will facilitate the earliest possible identification of the preferred hospital location(s) for service expansion.
- The proposed service development plan, treatment centre configuration and equipment commissioning timetable should reach the target 35-38 linear accelerator national treatment requirement by 2010-2014. This resource will provide the expected future treatment requirement as determined from available population and cancer caseload statistics.
- The proposed radiation oncology centres must meet the proposed written standards of the Hospital Accreditation Programme including the proposed assessment of treatment facilities and review of standards of both clinical and management practice.
- Optimal quality assurance (QA) programmes should be developed through the mutual co-operation of the clinical network of radiation oncology centres. The centres should develop risk management procedures/protocols and ensure that these adhere to the highest international standards.
- Telemedicine platforms should be further used to bring specialised radiation oncology expertise closer to patients. The use of new DICOM/DICOM-RT compliant data-transfer technologies should be developed in addition to new enabling communications technologies such as Telesynergy®.
- The development of a national co-ordinating function to facilitate forward planning, co-ordinated integration, new technology assessment and national protocol development is strongly advocated.
- Clinical protocols for the management of the majority of common malignancies should be developed and updated in accordance with evidence-based practice. Further research that addresses clinical, basic science and health-services questions in radiation oncology must be fully supported.
- The future analysis and development of radiation therapy facilities in Ireland will benefit from the development of costing/modelling algorithms that enable more sophisticated quantitative economic assessments of patient care, including societal costs.
- There is an immediate need to develop additional training and education programmes that permit both

continuing medical education (CME) and continuing professional development (CPD) in the key professional disciplines. The development of a national treatment service will in addition require appropriate staffing ratios in the full range of paramedical disciplines including physiotherapy, dietetics, dental sciences, social work, clinical psychology, speech and language therapy, occupational therapy and pastoral care.

- Undergraduate programmes for healthcare professionals should clearly develop the appropriate radiation oncology curriculum content.
- The development of an integrated system of workforce planning within the national radiation oncology service is required.
- A comprehensive information management system should be developed in the context of the proposed Health Information and Quality Authority (HIQA), the proposed national health Internet site, and REACH.
- Intramural Radiation Oncology Information Systems (ROIS), available within individual hospitals, are needed to provide information to the general public, medical and paramedical disciplines, healthcare administrators, and other agencies including policy makers involved in healthcare planning.
- A separate specialist Clinical Radiation Oncology Information Management System (CROIMS) with appropriate links to the National Cancer Registry Ireland (NCRI) will be required at each treatment centre to enable national database development in the areas of quality assurance, risk management, protocol development, clinical research, and the monitoring of patient outcome data.

Section 9 Recommendations – human resources

- The report has confined its proposals on staff requirements within the proposed clinical network of radiation oncology centres to the following professional groups: radiation oncologists, radiation therapists, medical physicists (including clinical engineers, dosimetrists, and technicians), and radiation oncology nurses. A significant increase in consultant radiation oncologists, radiation therapists, medical physicists and oncology nurses is required in the forthcoming decade.
- The Group believes that the optimal estimation of staff numbers should relate to measures of clinical activity associated with patient care, for example attending patient caseload, case complexity, the inpatient and outpatient mix, and for certain professional groups the level, range and complexity of treatment equipment, and treatment planning systems.
- The Group supports the objectives identified in the recently published Health Strategy *Quality and Fairness: A Health System for You* and the *Action Plan for People Management in the Health Service*.
- The staffing of the future radiation oncology treatment service will need to take account of the existing difficulties in staff recruitment, retention, career potential, complex industrial relations issues, and the recent trend for new graduates in all disciplines to travel. Implementation of the proposed action plan in *Quality and Fairness: A Health System for You* may help radiation oncology service planning and staff retention.
- The greatest shortfall of staff is the available number of consultant radiation oncologists and the numbers of non-consultant hospital doctors training in this discipline.
- The DoHC and Comhairle na nOspidéal should take account of the existing international guidelines on the radiation oncologist staffing ratios required for delivery of modern radiation therapy. In the first phase of service expansion there should be an immediate expansion of consultant numbers to enable caseloads of 350 new cases per radiation oncologist.
- Implementation of the Action Plan for People Management in the Health Service report may help radiation oncology service planning, staff retention, and the provision of an optimally trained accredited clinical workforce.
- The Report of the Expert Group on Radiography Grades (2001) has suggested appropriate levels of radiation therapist staff per treatment unit. However, there may be a need to develop additional roles to take account of the evolving complexity of radiation treatment.

- The DoHC, the National Hospitals Office and the Health Services Employers Agency (HSEA) should take account of the ESTRO/EFOMP and IPEM guidelines in the context of future medical physicist staffing.[III] The staffing of individual treatment centres will need to take account of additional areas of physicist activity not addressed in the ESTRO/EFOMP documents.
- Formal training programmes in radiation oncology physics, engineering and dosimetry together with appropriate accreditation mechanisms need to be developed to provide the expanded workforce.
- The configuration of nursing levels should be based on workload measurement taking account of the size and structure of the centre, nursing skill mix and staff turnover, patient dependency, patient length of stay, and changes in category of patient condition. The specific configuration of the staff involved in nursing administration will be dependent on the size and nature of the radiation oncology centre.

Section 10 Recommendations – national co-ordinating mechanisms

- The Group strongly proposes that a National Radiation Oncology Co-ordinating Group (NROCG) be formed to facilitate future treatment centres in the analysis, acquisition and implementation of new technologies and to ensure maximal integration with existing facilities. This Group should report to the Health Information and Quality Authority (HIQA).
- The suggested range of functions and responsibilities to be undertaken by the NROCG in conjunction with HIQA should include the following:
  - The development of national radiation oncology quality assurance programmes, equipment inventory and audit, equipment dosimetry protocols, and national risk management guidelines
  - The co-ordination and tracking of tumour-specific and process-specific treatment protocols and the designation of centres for specialised treatment procedures
  - Facilitating the development of multidisciplinary conferencing systems that utilise telemedicine technology
  - The design of common specifications for the acquisition of new technologies.
- The Group strongly recommends that the proposed National Radiation Oncology Co-ordinating Group be developed rapidly.

[III] European Society of Therapeutic Radiation and Oncology (ESTRO), the European Federation of Medical Physicists (EFOMP), and the Institute of Physics and Engineering in Medicine (IPEM).

Section 1

Background and introduction to radiation oncology services

1.1 Introduction

Cancer is the most frequent cause of premature death in Ireland,[IV] with approximately 7,400 cancer deaths occurring annually. At the present approximately 19,000 new cases of cancer are recorded annually in Ireland, with one in three individuals developing cancer in the course of their lifetime. This represents a major burden for individual patients, their families and relatives, and the health system. Since 1994 mortality rates have decreased but there is a strategic and important requirement for further improvement as outlined in the 1996 National Cancer Strategy.[2]

At the present the principal treatment modalities involved in the management and cure of cancer are surgery, radiation therapy and chemotherapy.[3] The provision of modern clinical radiation oncology services is necessary in order to ensure a definitive treatment programme for cancer patients. This section provides a synopsis of the following areas of radiation oncology practice:

- An overview and introduction to the clinical specialty of radiation oncology
- The suggested international norms for radiation oncology uptake
- A description of the clinical scope of modern radiation oncology practice
- The integration of radiation oncology with other clinical disciplines
- The process of radiation oncology treatment
- An outline of radiation oncology treatment technologies
- An introduction to the healthcare professionals involved in radiation oncology.

1.2 What is radiation oncology? An introduction for non-specialists

The word radiotherapy (radiation oncology) comes from the Greek *radius*, a ray and *therapeia*, cure. It is the use of ionising radiation to treat disease, commonly to cure but also to assist other therapies in curing cancer and to relieve symptoms where cure is not possible. It is most frequently associated with the treatment of cancer but is also used in treating a limited range of benign or non-malignant illness.

Clinicians trained in the use of radiation oncology are known as radiation oncologists, radiotherapists, or clinical oncologists. Because of the dominance of cancer in clinical practice the term radiation oncologist is recognised as the future professional descriptor for clinicians trained in the practice of radiation therapy.[4] The title radiation oncology is also the specific medical division within the list of medical specialties recognised by the Irish Medical Council and Comhairle na nOspidéal.[5]

The contemporary use of radiation therapy in clinical practice (radiation oncology) is a very significant subject. It includes the treatment of over 300 separate malignancies, including the symptoms and complications of these malignancies, and benign disease in both sexes from infancy to old age.[3,6] Treatment may be given by a variety of approaches using different types of machine that deliver controlled amounts of X-rays, or less commonly by using one or more of the many radionuclides available today.[V] It is beyond the remit of this report to exhaustively describe the various forms of radiation oncology. However, the reader is referred to recent comprehensive texts that address this area.[3] The following description is by necessity a brief outline of modern radiation oncology practice.

The commonest type of radiation therapy is called external beam therapy, occasionally called teletherapy.[6] In most western countries the majority of this form of radiation therapy is now delivered using linear accelerator equipment. Linear accelerators provide the greatest versatility and highest precision in the delivery of new and complex treatments that have become the recognised standard of clinical care. The modern sophistication of the linear accelerator, in conjunction with recent developments in treatment planning technology, allows more complex treatments to be performed for individual patients and there is considerable emerging evidence that this is associated with increased patient survival and reduced morbidity.[7-9]

[IV] Premature death is defined as death under the age of 65 years.

[V] Other forms of radiation therapy are infrequently used in clinical practice including the use of charged particle treatment (e.g. proton therapy) and uncharged subatomic particle treatment (e.g. neutron therapy).

Preliminary evidence suggests, however, that the recent development in complex treatment provision has reduced the daily throughput of patients per treatment machine.[10] The latter appears to be a consequence of both the increased time that is necessary to plan and deliver complex treatments and the associated comprehensive quality assurance checks.

The next most common form of radiation therapy is brachytherapy.[6] There are many types of brachytherapy, which use either radioactive nuclides or solid radioactive sources placed on the body surface (moulds), within body spaces (intracavity) and directly into tissue (interstitial). It is most commonly used as part of a combined external beam and brachytherapy treatment plan. Brachytherapy is particularly used as part of the management of cancers arising from the uterus, vagina, rectum, head and neck, lung, oesophagus and prostate.[11-17] Brachytherapy treatment procedures are frequently time-consuming, labour-intensive and may require significant involvement of other medical specialties including anaesthetic care and specialist nursing. It is important to note that when radioactive sources are used in the treatment of patients, staff must be protected from occupational exposure, and a range of remote controlled computerised systems are used to deliver the precise treatment to the designated anatomical treatment area.[18-21]

The complexity of the radiation oncology treatment process necessitates additional requirements relating to patient and staff safety, practitioner training, and rigorous quality assurance requirements.[22] Extensive rules and regulations on health and safety matters exist and are updated through a range of agencies including the Radiological Protection Institute of Ireland (RPII), and local hospital Radiation Protection Committees working together with European and International Advisory Groups.

1.3 Radiation oncology referral rates

Each year an estimated 35-36 per cent of cancer patients receive radiation therapy at some stage of their illness, with 20 per cent of new cancer cases receiving radiation therapy as part of their primary management.[VI] This percentage of patients remained static over the period 1997-2000 and the background to this is further discussed in section 2. Such radiation therapy treatment rates can be contrasted with those in the United States where in some geographic areas an estimated 60 per cent of all cancer patients receive radiation therapy as part of their care.[6]

What is the optimal uptake of a radiation oncology service?

A recent report published under the aegis of the World Health Organisation (WHO)/Pan American Health Organisation (PAHO)(1997) has suggested that 'as a minimum, the coverage of radiation therapy services in any country should be sufficient to treat 50 per cent of the new cases of cancer diagnosed each year.'[23] To this it is necessary to add 15 per cent, which represents the prevalence of cancer cases for which treatment continues from one year to the next.

All recent national and international commentaries on future service delivery refer to the strategic objective of being able to provide radiation therapy services for 50-60 per cent of cancer patients.[3,6,24] The evidence in favour of this is discussed in greater detail in section 2. However, it is important to distinguish between the proportion requiring treatment and the proportion receiving treatment. It is also important to note that no authoritative report has identified a preferred radiation therapy usage rate of less than 50-55 per cent. This should be the minimum benchmark uptake figure for the immediate and future service development plan in the Republic of Ireland.

The reasons for low uptake of radiation therapy have been examined in some countries and appear to be multiple and complex.[25] They include the presence of inadequate treatment equipment infrastructure, delays

[VI] The estimate of 35-36 per cent of patients receiving radiotherapy was derived by the group from caseload figures provided by St Luke's Hospital, and the radiation therapy departments at Cork University Hospital, the Mater Private Hospital and St Vincent's Private Hospital. A national register of patients attending hospitals for radiation therapy does not exist. Further details on this estimate is provided in section 4 of the report.

between referral and commencement of treatment, and a shortage in specialist staff in all the disciplines involved in the delivery of radiation oncology services. In addition, low referral rates from other clinicians may be a consequence of initial deficiencies in undergraduate radiation oncology teaching, early postgraduate education programmes for non-consultant hospital doctors (NCHDs), and insufficient continuing medical education (CME) on the developing role of radiation therapy in cancer treatment.[26]

1.4 Integration of radiation oncology within cancer services

The National Health Strategy *Quality and Fairness: A Health System for You* acknowledges the burden imposed on patients and their families by chronic ill health and recognises cancer as a major contributor to this problem.[27] In addition the report acknowledges that 'the implementation of improved treatment strategies at an earlier stage in the disease may help to reduce morbidity and the self-evident cost to society of this additional burden'.

The strategic goal of improving the clinical management of cancer is the subject of ongoing research and development. At the present, however, the three main treatment modalities in cancer management are surgery, radiation therapy and chemotherapy.[3] If appropriate radiation oncology facilities are not available or are under-utilised, it is clearly evident that outcomes for cancer patients, including survival rates and quality of life indices may be seriously compromised.

International best practice suggests that optimal treatment outcomes are achieved through the close co-ordination of radiation oncology, surgical oncology, medical oncology and palliative care services.[28-33] Effective treatment for patients will often require the different treatment modalities to be combined at the same time or at different stages during the management of the illness. The development of integrated care pathways should facilitate the effective provision, according to the individual patient's needs, of primary care, specialist hospital diagnostic and treatment services and end of life care. It is increasingly evident that the majority of patients will benefit from combined assessment and treatment by integrated teams of specialists.[29-31,34] In addition cancer patients clearly benefit from access to appropriate multidisciplinary clinical teams with expertise in treating specific cancers occurring at particular anatomic sites, for example cancers of the lung, breast, rectum, head and neck, and upper gastro-intestinal and gynaecological systems.[35-40] Radiation oncology has a critical role within this spectrum of care, particularly in the management of specific types of early stage cancer, with an additional major role in the optimal care of locally advanced malignancy and metastatic disease.[3]

The role of radiation oncology in cancer treatment is summarised in a wide range of major texts and in a more limited number of national oncology service reviews, for example those undertaken in Sweden in the mid-1990s.[41,42] In Ireland, guidelines for management of certain cancers are being established, including the recent recommendations on breast cancer, prostate cancer and colorectal cancer management published by the Royal College of Surgeons in Ireland (RCSI).[43,44] Intramural protocols on the use of radiation therapy are also well developed within individual hospitals and increasingly reflect the importance of a multidisciplinary approach to the treatment of all the common adult cancers and paediatric malignancies.[45] Increasingly, radiation oncology services interlink closely with surgical and medical oncology services as part of the management of many common cancers including lung, rectum, breast, prostate, cervix, skin, oesophagus and head and neck. There is an extensive body of literature supporting these strategies for each particular cancer.[3] The range of benefits of radiation oncology services to cancer patients is varied as demonstrated by the following examples:

Radical/curative radiation therapy[VII]

- Single modality radiation therapy is curative in certain situations and offers a conservative treatment alternative to other forms of treatment such as surgery, for example the use of 3D conformal radiation treatment instead of radical prostatectomy in early prostate cancer.[8,9,46] Within certain disease types, it is also used as a single-modality treatment approach for selected 'low-risk' patients, thereby minimising the potential greater toxicity of combined modality treatment programmes, for example in the management of early stage Hodgkin's and low grade Non-Hodgkin's lymphoma.[3,47]
- The option of radiation therapy may also permit more limited surgery including organ preservation approaches to be carried out for selected cancer patients, such as larynx preservation in early stage vocal cord cancer,[48] and breast conservation instead of mastectomy.[49,50]
- Elective or 'prophylactic' post-operative radiation therapy may be used after surgery to achieve cure rates close to 100 per cent, for example as part of the post orchidectomy management of testicular seminoma.[51,52]
- Increasingly radiation therapy is combined with chemotherapy to increase cure rates, for example in the management of intermediate stage Hodgkin's and non-Hodgkin's lymphoma,[53-56] and the management of locally advanced cervical carcinoma.[57]

Combined modality treatment protocols

- Combined modality treatment utilises radiation therapy in combination with chemotherapy, surgery and other treatment modalities.
- Post-operative combined modality treatment is now the standard of care for many common cancers of adulthood and the rarer malignancies that occur in the paediatric population.[45,58,59]
- Pre-operative combined modality treatment is increasingly used before an operation to reduce the physical size and extent of a tumour thereby making surgery more feasible and effective, for example for both rectal cancer and oesophageal cancers.[60,61] Such treatment is frequently referred to as neoadjuvant radiation therapy.

Palliative radiation therapy

- In advanced cancers, and in conjunction with palliative care, palliative radiation therapy frequently offers quick and durable relief from pain and other difficult symptoms.[3] This is particularly important in the late stages of cancer when distressing side effects can be minimised to enhance patient quality of life. [62-64]

Radiation therapy – other clinical uses

Radiation therapy is also used in a more limited number of non-malignant diseases including benign tumours and non-neoplastic disorders. The following examples illustrate this:

- Radioactive iodine (^{131}I) treatment offers rapid and effective therapy for certain common benign conditions, for example thyrotoxicosis.[6]
- In certain circumstances external beam radiation therapy may also be useful, for example as part of the management of dysthyroid eye disease, orbital pseudo tumour, hetereotopic ossification, and siallorrhoea secondary to motor neuron disease.[6,65,66]
- A potential major new use of radiation therapy is in the area of prevention of post-angioplasty/stent narrowing for both coronary artery and medium vessel disease (see section 3).[67,68]

[VII] The term 'radical' is applied to a course of radiation therapy when the clinical intention of the treatment is to attempt to cure the cancer. Radical treatments are therefore usually associated with longer treatment protocols that enable a higher dose of radiation therapy to be given to the patient.

Utilisation of radiation oncology services and the integration of other hospital-based specialties

Prior to the formation of the Expert Group and the completion of this report, concerns were raised in the public domain regarding the extent and levels of radiation therapy resources available to patients in Ireland. The *prima facie* evidence appears to suggest that both patient referral and healthcare professional access to radiation oncology consultation and treatment services have not been appropriately developed for a number of reasons, including the following:

- Limited numbers of consultant radiation oncologists / clinical oncologists / radiotherapists
- Limited radiation oncology treatment facilities
- Limited access to these facilities
- Limited dissemination of the evidence that supports the role of modern radiation oncology within cancer care
- The potential isolation of some elements of the existing radiation oncology services from the acute hospital setting.

The Group believes that the reasons outlined above have resulted in a varied development, uptake and demand for radiation oncology services within Ireland. The utlilisation of radiation therapy for patients also appears to depend to some extent on pre-existing referral patterns as distinct from disease characteristics and/or the implementation of clinical guidelines and protocols.

The majority of Irish patients access radiation oncology services following tertiary referral from other hospital-based physicians or surgeons. The existing limited number of consultant radiation oncologists restricts the capacity of this professional group to partake in the appropriate development of multidisciplinary groups, and as a consequence the selection of clinically appropriate radiation therapy is not always highlighted as an available treatment option for the patient.

The ideal cancer care facility should provide access for all cancer patients to multidisciplinary care on a single site with a range of integrated cancer services including radiation oncology, medical and surgical oncology and other medical and paramedical disciplines.[69] Resource needs are therefore not solely limited to radiation oncology, or to surgical and medical oncology. A close interaction with departments of pathology, radiology and critical support services is clearly required. Facilities for supportive care, pharmacy, pain relief, palliative care, rehabilitation and psychological services within the hospital setting are also necessary with strong links to general practitioners and other primary care professionals working in the community.[70-72]

Integration with general practitioners and primary care

General practice is an integral component of cancer care for both the patient and his/her family. General practitioners are frequently involved at the stage of initial patient presentation and subsequent referral for hospital-based diagnostic tests. Increasingly, general practitioners are also important partners in providing care throughout the treatment programme, and in the longer-term follow-up of patients. In addition general practitioners have a strong supportive, clinical and educational role in relation to their patients attending for radiation therapy.[70] For most patients, however, the initial referral to a radiation oncology department is unlikely to be direct from the general practitioner.

It is important that inter-professional relationships are developed and maintained between general practitioners and radiation oncology specialists, and that the interaction should not be seen as simply a transfer of responsibility for the patient's clinical care on either a permanent or temporary basis. The appropriate level and integration of oncology care with general practice will depend on the stage of the illness and individual patient requirements. Information relating to discharge care plans for individual patients is of special importance particularly for those attending for daily treatment from home and should include details on diagnosis, treatment protocol, drug schedules and the details of appropriate contact personnel. At all stages general practitioners are likely to be called upon for information, advice and support, and

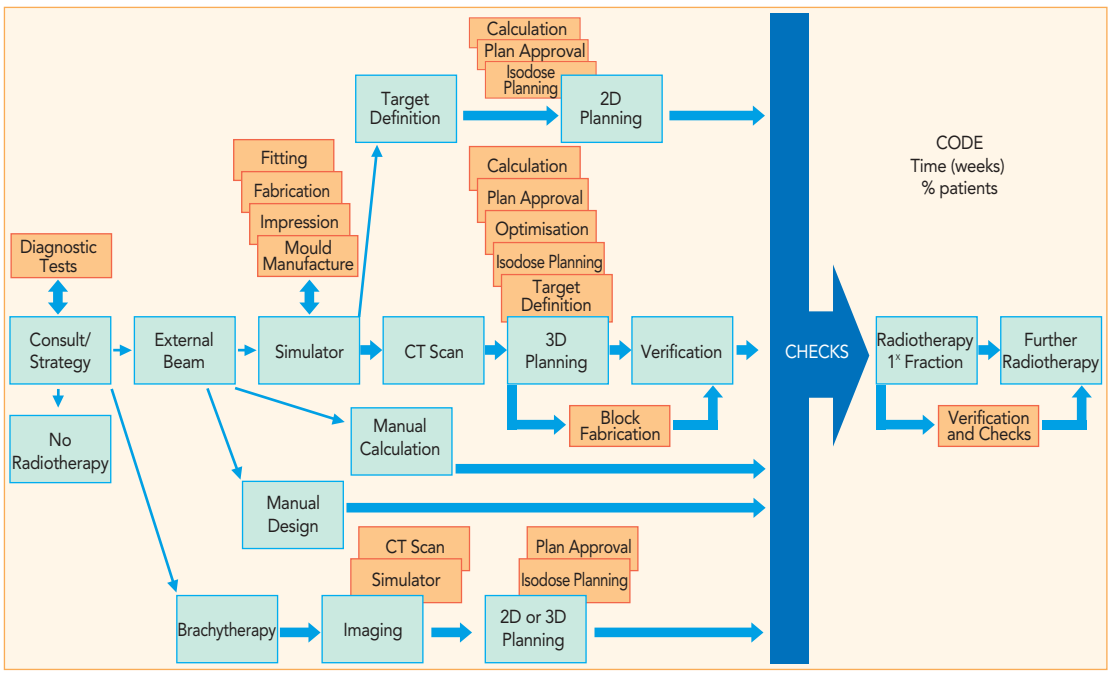
effective communication between all the involved disciplines is imperative for the provision of optimum clinical care. In this respect it is essential that general practitioners have access to updates on new developments within radiation oncology and the implications for individual patients. At present a relatively small number of general practitioners have had an opportunity for clinical training within a radiation oncology department. In both the short and longer terms it will be vital that general practitioners are regularly informed of clinical developments in radiation oncology. An early introduction to radiation oncology within the undergraduate medical curriculum would help address the potential knowledge deficits of future graduates, many of whom will ultimately enter general practice. It will also be important to consider additional practical measures that could help address this area, for example the introduction of short rotations within radiation oncology departments as part of future general practice training programmes.

1.5 The process of radiation oncology treatment

Radiation therapy is a complex process involving many steps, personnel and equipment. This process is summarised in Figure 1.1. The accuracy with which each step is carried out has a major impact on both the prospect of tumour control/cure and the attendant risks of normal tissue complication / patient morbidity. The existing literature suggests that minor changes in the radiation treatment dose of less than 5-10 per cent are clinically detectable in patients in terms of outcome events such as patient survival and local tumour control rates.[7,73] These factors mandate a very high degree of accuracy in the treatment delivery systems. In addition, the treatment has to be given with a very high degree of spatial accuracy. Failure to achieve these aims can result in a reduced chance of patient cure, and a greater chance of the side effects associated with significant normal tissue damage.

Figure 1.1 illustrates the complex range of treatment pathways and some of the decision processes involved at each stage.

Figure 1.1: The range of treatment pathways and some of the decision processes involved in radiation oncology



1.5.1 Diagnosis

Imaging

Imaging technology is a major component of the diagnostic and planning process in radiation oncology and has significantly improved in the past two decades.[74] Each of the imaging modalities demonstrates different anatomical or physiological dimensions of the human body and they are often complementary to each other. These assist in the optimal staging of the tumour and in the more precise targeting of cancer sites. It is critical to accurately visualise the tumour extent[VIII] and the adjacent normal tissues in such a way as to direct the radiation beams to achieve maximum tumour coverage and minimal normal tissue irradiation.

The primary imaging modality for radiation treatment planning is a combination of orthogonal plain imaging, fluoroscopy and computed tomography (CT). There has been a recent significant trend to the greater use of CT-based imaging and CT-simulation. Other modalities, specifically magnetic resonance imaging (MRI) and magnetic resonance spectroscopy (MRS), nuclear medicine (NM), positron emission tomography (PET), and ultrasound increasingly play an important role.[74,75]

Figure 1.2:
Treatment simulator. A simulator is a sophisticated diagnostic x-ray unit that enables the co-localisation of the tumour site and initial optimisation of the radiation beams arrangement that is used in the treatment process. A simulator can mimic the full complement of treatment techniques used on the treatment equipment, ^{60}Co and linear accelerators. Simulators provide a permanent record of the treatment by producing an archive of diagnostic quality images on x-ray film, digital storage format, or video format.

[VIII] Within radiation oncology the local 'extent' of the tumour is described as a 'target volume'. Several different target volumes exist and these have been defined by the International Committee of Radiological Units (ICRU). These include the gross tumour volume (GTV), clinical target volume (CTV) and planned target volume (PTV).

1.5.2 Treatment decision/options

The form of treatment equipment to be used for an individual patient is decided during the consultation session and can include the use of external beam equipment, for example linear accelerators, ^{60}cobalt, or contact X-ray therapy (CXT),[ix] or alternatively using brachytherapy treatment devices. Patients will undergo treatment of varying degrees of complexity depending on clinical intent.[22,74] Not all stages of the treatment process illustrated within Figure 1.1 are necessary for every patient, nor is the order of each stage the same for every patient. Some patients will progress through several of the process routes during the course of their treatment; others will follow only one of the routes outlined in Figure 1.1.

The first clinical task is to obtain information on the tumour size, shape and location and its relationship to the surrounding normal tissues and critical structures. In the simplest case the area for treatment is outlined manually on the skin and the patient proceeds directly to treatment following calculation and checking of the relevant information. In most patients, however, tumour localisation is initially achieved using dedicated imaging equipment, most frequently a simulator or CT simulator.

1.5.3 Mould room and immobilisation devices

Effective radiation therapy depends on the repeated delivery of accurate doses to the same site, often as many as thirty or more times. Accurate immobilisation devices made to measure for individual patients are commonly constructed when treating small volume or complex tumours especially in mobile parts of the body, for example head and neck cancers.[3,6] The immobilisation devices are often called shells or moulds. Specialist radiation therapists take impressions of patients and make these individualised shells. An impressions room and a separate dedicated workshop to make these devices are essential. These immobilisation devices ensure that the sophisticated imaging technology and treatment technology are given with greatest precision and reproducibility.[76]

1.5.4 Simulators and CT-simulators

A simulator is a sophisticated diagnostic x-ray unit that enables the co-localisation of the tumour site and the radiation beams subsequently employed in the treatment process.[3,6] In addition the simulator provides a component of the permanent record (verification) of the treatment plan.[77] It is so named because it is designed to be able to simulate the variety of treatment positions possible with the radiation treatment units. Simulators provide diagnostic quality images on either x-ray film, digital storage format, or in real time on a video monitor when it is used as a fluoroscopy unit.

Direct CT-based tumour visualisation and treatment volume definition has become standard practice for many tumour sites and this requires the use of specialised CT simulators that combine the functions of a conventional simulator and a CT scanner. They consist of a CT scanner, laser positioning systems, and a computer system that has the ability to manipulate images, define target and normal tissue volumes and display the radiation beam geometry in three dimensions (3-D). Optimum planning, and therefore treatment, requires both conventional simulation and CT simulation.

During simulation the patient is positioned on a couch similar to that used on the treatment units.[x] The simulation process helps determine the anatomic tumour area to be treated and may be performed with the aid of x-ray contrast agents. The radiation oncologist identifies the appropriate treatment margin around the visible tumour based on clinical evaluation and other diagnostic investigations that constitute the previous cancer staging process. The location of nearby critical structures, for example the spinal cord in head and neck treatments, is also identified at this stage. Trial placement of a number of beams are simulated using the fluoroscopic mode of the simulator that mimics the geometry of the radiation treatment beams.

[ix] Contact X-ray therapy is also known as superficial X-ray therapy. Deep X-ray therapy (DXT) is seldom used in current practice but was important in the early and recent development and provision of radiation therapy services in Ireland.
[x] If an immobilisation device is required for treatment it may be prepared individually for the patient at the time of simulation or as a separate step beforehand.

The simulation information may be used to set the patient up directly at the treatment units as shown by the manual calculation route in Figure 1.1. More commonly the simulation data, including patient anatomical information and tumour information, are sent directly to the treatment planning system where the dosimetrists modify the beam geometries and calculate the resulting dose distribution for review and approval by the radiation oncologist. For those patients undergoing the more typical complex treatment planning process, the simulation procedure identifies the region of the body containing the tumour and provides a first indication of the tumour extent. Following this process the patient proceeds to CT scanning to generate 3-D views of the relevant anatomic site. In the CT simulator unit the individual procedures of simulation and a CT scan are a one-step process.

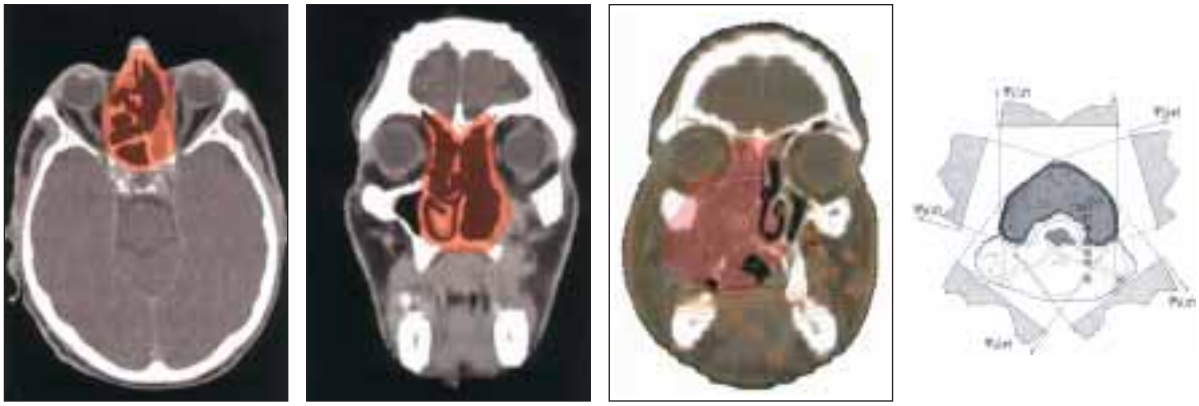
The simulator and CT information are transferred electronically to the treatment planning system where the radiation oncologist identifies tumour and normal tissue on each individual CT image to build up a 3-D view of the shape and extent of the tumour within a 'virtual' patient.[6,77] Using complex computerised treatment planning software, radiation oncologists, dosimetrists and physicists model the placement of radiation beams on the 'virtual patient' and calculate dose distributions for a range of treatment options.[73,77,78]

1.5.5 Treatment planning systems

A treatment planning system is a combination of computer hardware and software components that allow the user to produce and display calculated dose distributions at the particular anatomic area of the body to be treated.[3,6,73,78,79] The increased speed and accuracy of these systems has followed the rapid evolution of computer technology. In the past these systems were restricted to calculating dose distributions in two dimensions (2-D) with associated limited patient anatomic data and a consequent reduced level of accuracy which restricted the treatment options for many patients. Today treatment planning has evolved so that full three-dimensional (3-D) planning capabilities are possible, including the utilisation of human body image data from a variety of different imaging sources to allow accurate localisation of tumour and normal tissues on a patient-specific basis. Virtual simulation of the patient using radiation beams from any geometry is possible, together with information on biological tools for maximum treatment plan optimisation.

The sophisticated dose calculation software, based on information obtained from the hospital's own treatment units, is the most unique, critical and complex piece of software within a computerised treatment planning system. As computer technology improves, this software is becoming more accurate in its ability to model the interaction of radiation therapy with individual organs and tissues within the human body.[74] Further developments in functional imaging and radiobiological predictive assays are ongoing.[7,73] It is likely that these technologies will provide additional information on tumour bulk and microscopic tumour extension and thereby aid the development of improved 3-D treatment planning and altered fractionation schemes. Future developments in these areas are outlined in section 3.

For most 3-D treatment protocols the radiation beams are shaped to reduce the volume of normal tissue included within the treatment. This can be achieved by producing custom-made alloy blocks which are suspended above the patient during treatment delivery or by use of the multileaf collimators, a feature of modern linear accelerators.



a. b. c. d.

Figure 1.3
CT based treatment planning. A treatment planning system is used to optimise the geometric arrangement of the radiation beams that will be used to treat a tumour. The system allows the display of the radiation dose distribution within the anatomic area at both the site of the tumour and the adjacent normal tissues. The radiation dose distribution can be displayed using the diagnostic information received from CT, MRI and PET scanning and a number of technologies that permit the anatomic area to be generated as a three-dimensional model. The figure shows the following: a colour wash target volume of an ethmoid sinus cancer outlined on a single CT slice (in1.3a a transverse plane and in 1.3b a coronal plane), with additional colour wash display of a number of normal tissues and superimposed radiation isodose distribution (1.3c) for a complex head and neck anatomic tumour site. Figure 1.3d illustrates future areas of development in treatment planning with an isodose distribution for an IMRT plan optimised through the use of investigational radiobiological predictive assays. The latter treatment technology is expected to enter clinical practice in the future.

Finally the radiation oncologist reviews the resulting treatment plans before final calculations and checks are performed. In many institutions a separate intra-mural peer review process is used to review the individual patient's treatment plan as part of a combined quality assurance / clinical audit mechanism. When the plan is complete and the patient-specific devices have been constructed, the patient returns to the simulator for a final verification check prior to commencement of treatment.

1.5.6 Treatment units

The appropriate type of radiation used to treat patients can be produced on a wide range of treatment units or through the use of specific radioactive sources.[6] These provide the range of X-ray energies available in a modern radiation oncology facility, the lowest energy being used to treat very superficial tumours, with higher energies generally used to deal with more deep-seated tumours.

Linear accelerators

The major advances achieved in radiation oncology during the past few years have been made possible in the main through advances in linear accelerator technology in addition to sophisticated computer hardware and treatment planning software developments.[6,73]

Linear accelerators currently represent the most important, practical, and versatile source of ionising radiation for use in radiation oncology. A linear accelerator has a compact design that produces a wide range of x-ray energies of the order of a hundred times more energetic than those available from the CXT/DXT units, from low energy (4MV) to high energy (up to 25MV). Linear accelerators are also the major source of electron beam therapy which is frequently used in conjunction with X-ray treatment, for example as part of the management of cutaneous malignancies, breast cancer and head and neck cancer.

a. b. c.

Figure 1.4:
Major advances in radiation oncology have been achieved through advances in linear accelerator technology design in addition to sophisticated computer hardware and treatment planning software developments. A linear accelerator produces a wide range of x-ray energies from low energy (4MV) to high energy (up to 25MV). Linear accelerators are the major source of electron beam therapy. The latest generation linear accelerator treatment units have integrated imaging capacity that allows the patient to have check 'diagnostic imaging' during the same session as treatment. Cobalt treatment units have some of the capabilities of the more complex modern linear accelerator treatment equipment. The principal modern clinical use of this equipment is in the provision of short palliative treatment protocols for patients with advanced cancers. The above figures (a,b,c,) show a) an integrated linear accelerator and cone-based computerised tomography unit (ELEKTA), b) the investigational use of active breathing devices for adaptive radiation therapy, and c) dynamic arc IMRT therapy.

Recent developments in modern linear accelerator technology have improved the ability to collimate and shape the radiation beam to deliver the radiation treatment in an anatomically and geometrically specific fashion. Thus the modern linear accelerator typically includes multileaf collimation (MLC), electronic portal imaging devices (EPID), high dose rate capability for total body irradiation (TBI) and dynamic dose delivery using moving collimators and gantry to produce highly conformal dose distribution patterns.[73] This technology has entered routine clinical practice for a number of cancers and its use is expected to increase in the forthcoming decade as outlined later in section 3.

Specialised linear accelerators can also produce particle radiation therapy.[XI] Within Ireland the clinical requirement for this form of radiation therapy is limited.[73,80-82,XII] Patients requiring this very specialised service are referred to European or North American reference centres.[80-82]

[XI] Proton beam facilities have been used in the clinical management of pituitary adenomas and rare cranio-facial malignancies. The clinical experience with 'light ion' therapies is limited although ESTRO has recently received EU funding to investigate their potential clinical use.
[XII] The number of patients requiring particle/proton beam treatment per year is extremely small (probably less than 5 patients). The potential future clinical use of particle therapies will be examined as part of a clinical study of light-ion treatments coordinated by the European Society of Therapeutic Radiology and Oncology (ESTRO).

Cobalt-60 – Teletherapy

Cobalt-60 units were initially developed in the 1950s and at that time provided radiation oncologists with greater treatment opportunities than had been available with either the contact X-ray therapy (CXT) or deep X-ray therapy (DXT) units. At present they are used to a limited degree.[XIII] The units use a radioactive isotope/source of Cobalt, which produces radiation with an energy of 1.25MV, similar to that produced by low-energy linear accelerators. The radioactive source decays to about half its original strength approximately every five years so that it must be replaced on a regular basis. Disposal and renewal of the radioactive source raises specific significant health and safety issues. Cobalt-60 treatment units have been largely superseded by the more versatile and higher energy linear accelerators, but because of their economy and reliability they may still have a limited role in a modern facility.[22]

Superficial/Contact X-ray therapy (CXT)

Skin cancer is common in Ireland and for a small percentage of patients is treated with radiation therapy. This requires dedicated radiation therapy equipment. For many patients the simplest and most cost-effective way of treating skin cancer involves the use of a superficial/contact X-ray therapy (CXT) machine.[XIV] However, certain anatomic sites or complex skin cancers will require electron beam therapy delivered by linear accelerator equipment. CXT machines are small and relatively inexpensive machines which require a smaller scale technical and physics back-up when compared to linear accelerator equipment. [83]

Figure 1.5: Contact/Superficial Treatment Unit. This form of radiation therapy is used primarily to treat skin cancers. Treatments are generally quite short and well tolerated. The majority of treatment periods range from five to seventeen days.

[XIII] St Luke's Hospital has one ^{60}Cobalt unit. CUH is decommissioning its single ^{60}Cobalt unit and the new department at UCHG has not specified a ^{60}Cobalt unit as part of the proposed equipment procurement.

[XIV] The penetrating beams that make linear accelerators so useful for deep cancers are too energetic and the field size is too large to treat small superficial skin lesions that may be only a few millimetres in diameter.

1.5.7 The radiation therapy treatment process – clinical examples

The duration of treatment for an individual patient depends on the specific cancer type and the treatment intent. Palliative protocols tend to be short and typically consist of one to ten treatments,[XV] whereas complex radical (curative intent) treatments may require up to 40 treatments.[XVI]

For each patient the first treatment includes setting the patient in the correct treatment position and capturing the relevant information on the 'record and verify' system for subsequent treatments.[XVII] The first treatment may include taking additional portal images of the tumour site using the treatment beam and hard copy X-ray film or more recently the use of electronic portal imaging devices (EPIDs).[84,XVIII] Portal images are compared to the original simulator / verification images during the treatment programme. The patient attends for treatment for the required number of treatments, each treatment generally being given on a separate day.[XIX]

As in all steps of the process, quality assurance is crucial.[85,86] Treatment checks involve different categories of staff including dosimetrists, physicists, radiation therapists and medical staff with each performing independent checks of the preceding steps to ensure the minimum risk of error.[87]

The following examples of existing treatment protocols are used to illustrate the treatment process and the overall duration of time involved in receiving radiation treatment. It is important to note that additional activities that relate directly to the patient's care are also completed during the attendance including clinical review by members of the multidisciplinary team and where necessary appropriate interaction with specialist services including nutritional support / dietetics, medical social work, dental services, stoma care, lymphoedema care, psychological medicine, palliative care / symptom control team and selected complementary care activities.

Examples 1: Palliative treatment (e.g. for bone metastases)

	Radiation Dose	Duration	No. of visits/treatment(s)
Treatment	**6-8 Gray[XX]**	**1 day**	**1 visit**

The single process of treatment simulation (20-30 minutes), treatment planning (20-60 minutes) and the treatment (10-20 minutes) is generally completed on a single day. Patients may attend as outpatients, from another hospital or as inpatients, depending on their medical and nursing care requirements. Additional requirements on the single visit include clinical assessment by the radiation therapist and/or nurse, review by the medical team, selected interaction with the multidisciplinary team indicated above and appropriate communication with the referring medical team and general practitioner.

Examples 2: Palliative treatment (e.g. for advanced lung cancer)

	Radiation Dose	Duration	No. of visits/treatment(s)
Treatment	**6-20 Gray**	**1-7 days**	**1-5 visits**

[XV] Palliative protocols with 1-10 treatments (fractions) take 1 to 10 days to complete. The majority of such protocols are completed within 1 week.
[XVI] Investigational treatment protocols are at present examining new forms of treatment with considerably larger numbers of fractions.
[XVII] The record and verify (R&V) system is increasingly incorporated within comprehensive electronic radiation oncology information management systems.
[XVIII] A record of all treatment fields is generally completed during the patient's first week of treatment. In addition an International Commission on Radiological Units (ICRU) guideline has suggested that each treatment field be checked by in vivo dosimetry and some departments routinely undertake this task as an important component of quality assurance and risk management.
[XIX] In hyperfractionated treatment protocols two or three treatments may be given per day (see section 3).
[XX] A Gray is a unit of radiation dose that is prescribed by the radiation oncologist.

The initial components of treatment are similar to that mentioned above. Each of the prescribed treatments will take 15-20 minutes. The patient will generally have completed the treatment simulation and planning on the same day as the first treatment. Significant computer-based treatment planning will typically be required before the initiation of treatment. Additional requirements on the single or subsequent visit(s) include clinical assessment by the radiation therapist and/or nurse, review by the medical team and interaction with the multidisciplinary team indicated above. Patients may attend as outpatients, from another hospital or as inpatients, depending on their medical and nursing care requirements.

Examples 3: Radical treatment (e.g. for early breast cancer)

	Radiation Dose	Duration	No. of visits/treatment(s)
Treatment	**45-50 Gray**	**28-35 days**	**20-25 visits**

This form of treatment is an example of a less intensive treatment protocol that is curative in intent. The patient should in most circumstances be able to complete treatment as an outpatient/day case. The patient will have attended the radiation therapy department before commencing treatment for the initial treatment simulation. Each treatment will take 15-20 minutes. Where patients are not able to attend as outpatients many are suitable for low dependency 5-day hotel accommodation.[xxi] Additional requirements on the single or subsequent visits include clinical assessment by the radiation therapist and/or nurse, review by the medical team and interaction with the multidisciplinary team indicated above. Patients may attend as outpatients, from another hospital or as inpatients, depending on their medical and nursing care requirements.

Examples 4: Radical treatment (e.g. for early head and neck cancer)

	Radiation Dose	Duration	No. of visits/treatment(s)
Treatment	**60-70 Gray**	**42-49 days**	**30-35 visits**

This form of treatment exemplifies intensive treatment where the patient may initially commence treatment as an outpatient/day case, but where a planned admission of the patient during the latter part of the treatment course will be required for medical and nursing reasons. In addition to the significant computer-based treatment planning that will typically be required before the initiation of treatment, many of these patients require complex multidisciplinary input for example nutritional, dental, speech and language, rehabilitation and other support prior to the commencement of radiation treatment.

Each treatment will take 20-25 minutes. Specific chemotherapy regimens are frequently administered in conjunction with the daily radiation therapy requiring the patient to attend a day ward adjacent to the radiation therapy department. Additional requirements on each visit include clinical assessment by the radiation therapist and/or nurse, with periodic review by the clinical team and interaction with the multidisciplinary team, especially nutritional support /dietetics, medical social work and dental services, as indicated above.

1.5.8 Patient information management systems

Significant developments have taken place in the computer systems designed to manage and co-ordinate clinical databases associated with radiation oncology care, particularly in regard to data acquisition, storage, and transfer.[21,88] Very large datasets are generated as part of the patient treatment process and manual transfer of data is widely accepted as a significant source of the actual and potential treatment errors that may occur within radiation oncology departments.[87] The development of computerised information management

[xxi] The provision of low dependency accommodation for patients and their partners/spouses has been successfully piloted at the hostel facility at St Luke's Hospital. The findings of the Institute of Public Administration (IPA) and Royal College of Surgeons in Ireland (RCSI) patient study, reported in section 5 and the Appendices, strongly support the provision of accommodation of this type.

systems has enabled the introduction of new tools that help reduce the incidence of errors by facilitating the direct electronic transfer of complex information between different areas within radiation oncology departments. These newly developed, sophisticated, networked computer systems have the capacity to carry out the following range of functions:[89]

- Patient registration and HL7-compatible linkage to hospital patient administration systems (PAS)
- Storage of simulation information including the transfer and archive of patient diagnostic/planning images from conventional or CT-simulators, and magnetic resonance / other imaging devices
- Transfer of patient treatment information, including the record and verify system for the treatment machines, to enable accurate, reproducible set-up of patients and a log of all treatment events
- Patient charting, including electronic charts, electronic patient records (EPR) and electronic health records (EHR)
- Department scheduling, including resource scheduling
- Administrative and quality assurance tasks, including generation of management reports, links to cancer registries and implementation of hospital clinical protocols.

1.5.9 Brachytherapy

The treatment of cancer with brachytherapy involves the placement of radioactive isotopes/sources in or near a tumour-bearing tissue. The sources can be placed over the tissue (surface mould), in the tissue (interstitial implant), in a lumen (intraluminal insertion), or in a cavity (intracavity insertion). An external applicator is used to deliver the radioactive sources to the correct position and may contain the sources at the time of implant (live loading) or after the applicator is positioned either by hand (manual afterloading) or by machine (remote afterloading). The radioactive sources may be positioned within the particular anatomic site for a few days (low dose rate), a few hours (medium dose rate) or a few minutes (high dose rate).

The brachytherapy treatment planning process follows a pathway somewhat similar to the external beam therapy process outlined earlier in this section, including image acquisition, treatment planning, calculation checking and treatment delivery.[6,20,90] Patients may be treated in a single session when either low dose rate (LDR) or medium dose rate (MDR) treatment techniques are used (for example Selectron® treatment), or alternatively will attend for a number of treatments when either high dose rate (HDR) or pulsed dose rate (PDR) techniques are employed (for example Microselectron® treatment).[6]

Brachytherapy has been used to treat an extensive range of tumour sites in the body and is a well established technique for the treatment of gynaecological malignancy, head and neck cancers, and soft tissue sarcomas.[91-94] In recent years permanent interstitial implants for early stage prostate cancer using palladium or iodine isotopes have entered clinical practice particularly in the United States.[11,46]

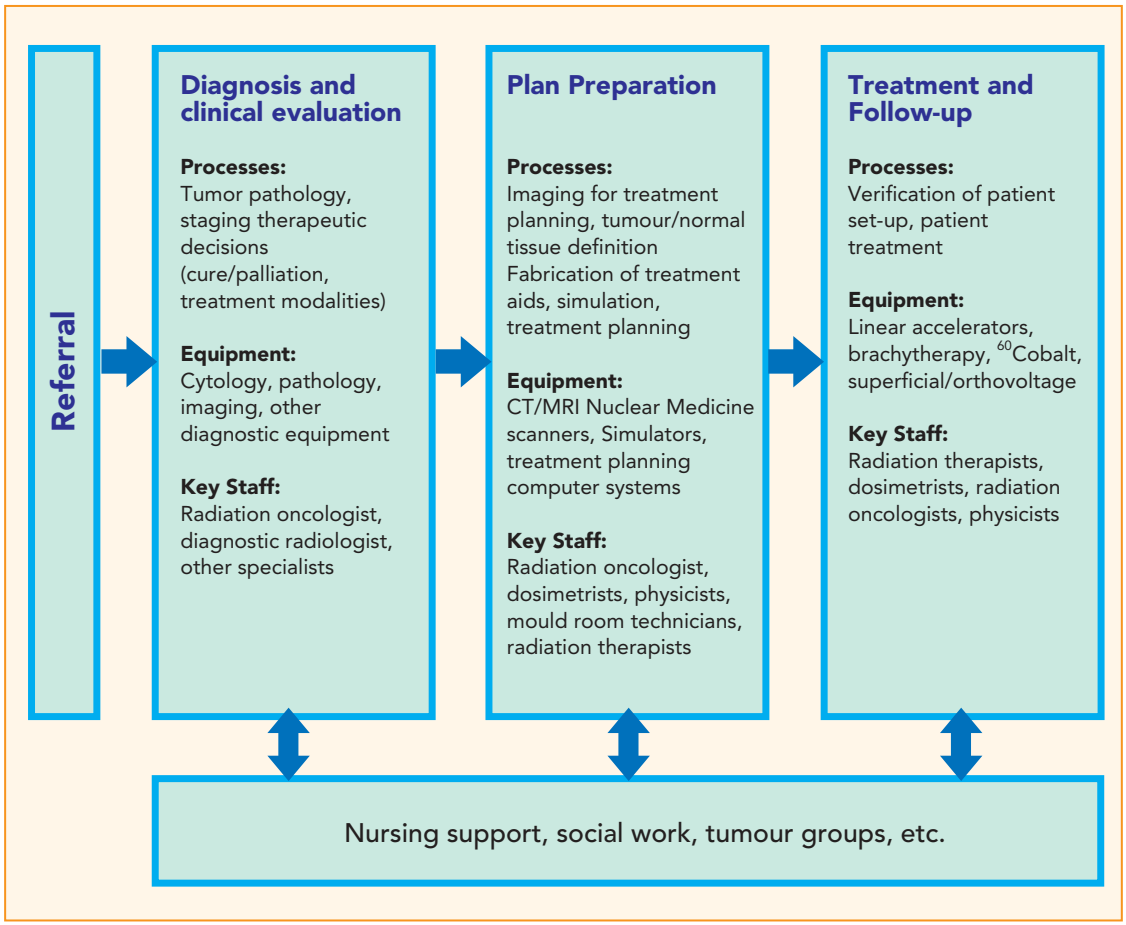
1.6 Specialised treatment procedures

There are a number of specialised radiation oncology techniques that follow slightly different processes, for example those patients undergoing total body irradiation for adult and paediatric haematological malignancies, rare childhood malignancies and certain inherited disorders presenting in the paediatric population.[3,95] Other specialised techniques include stereotactic irradiation for malignant tumours, benign tumours or vascular abnormalities in the brain, and the emerging use of specialised radioisotope and radio-immunoisotope treatments (see section 3).[55,96-100]

1.7 Radiation oncology personnel

Radiation oncology practice depends on a multidisciplinary team approach combined with the use of best practice guidelines that ensures the safe application of sophisticated and high technology treatment techniques.[3,6] Some of the key personnel and their associated involvement in the treatment process are summarised in Figure 1.6. It is important to note that while Figure 1.9 illustrates key healthcare professionals central to the practical delivery of modern radiation therapy, there are many other staff involved in providing essential patient care during radiation therapy protocols (see sections 6 and 9).

Figure 1.6: Schematic illustration of staff involved in the radiation therapy process



- The consultant radiation oncologist is trained in the use of external beam radiation therapy and brachytherapy and the more specialised forms of radiation oncology including radionuclide treatment.[4] The consultant radiation oncologist has the responsibility of selecting the optimum management plan for each particular patient.
- The radiation therapist shares responsibility for the verification and delivery of the prescribed treatment and for providing clinical care to the patient during treatment.[78,101,102]
- The medical physicist ensures that the patient treatment plan is technically accurate and that the radiation treatment equipment delivers what the physician prescribes.[103]
- The dosimetrist is involved in using complex treatment planning software to develop treatment plan options that permit the individualisation of treatment for each patient.[103-106]
- The oncology nurse has an active role in patient clinical care particularly during treatment delivery, patient recovery, rehabilitation and post-treatment follow-up.[107-110]
- A variety of skilled personnel including electronic engineers and technicians are critical for the maintenance of equipment and the implementation of statutory and additional intramural quality assurance / maintenance programmes.[103]
- Additional healthcare professionals are also essential members of the multidisciplinary team and assist in providing the totality of care that accompanies the radiation oncology treatment process. This includes other clinicians (particularly surgical and medical oncologists), physiotherapists, occupational therapists, dieticians, medical social workers, specialist dental surgeons, psychologists, medical social workers, occupational therapists, speech and language therapists and pastoral care workers.

Finally, at this early stage of the report, the Expert Group wishes to fully acknowledge the considerable contribution to cancer patient care that has been made by a wide range of healthcare professionals and support staff since the earliest development of the service. It is clear that despite the documented constraints of equipment provision and human resources, many individuals have striven to deliver a quality service and within the existing radiation oncology service continue to provide high standards of clinical care to cancer patients.

1.8 Summary

- Radiation therapy is an important treatment modality used in the management of cancer.
- There is international consensus that approximately 50-60 per cent of patients will require this form of treatment during their cancer illness.
- Failure to deliver modern radiation therapy can result in a reduced chance of patient cure.
- In cancer patients radiation therapy is used with curative intent or for symptom management and palliation.
- Radiation therapy is used in the clinical management of a limited number of non-malignant medical conditions.
- There is an increasing need to integrate radiation oncology with the other cancer treatment modalities of surgical and medical oncology.
- A wide and increasing range of healthcare professionals is essential for the safe and efficient delivery of modern radiation therapy.
- Two major types of radiation therapy exist: external beam (teletherapy) and brachytherapy.
- A complex range of radiation therapy equipment is used as part of the assessment, planning, delivery, crosschecking of treatment, and in the long-term storage of the large datasets generated for individual patient treatment protocols.
- The treatment process varies enormously from simple protocols to very complex labour and technology intensive treatments.
- It is essential that both hospital-based specialists and general practitioners be regularly informed of developments in radiation oncology. An early introduction to the discipline within the undergraduate medical curriculum and the development of short radiation oncology clinical rotations for hospital physicians and general practice training programmes would aid this process.
- The Group acknowledges the considerable contribution to cancer patient care that has been made possible by a wide range of healthcare professionals and support staff who have delivered the service since its early development and who provide the existing radiation oncology service.

Section 2

Current status of radiation oncology services in Ireland

2.1 Introduction

The Group has provided a synopsis of the following areas:

- The history and development of clinical radiation oncology services in the Republic of Ireland
- The existing equipment configuration of treatment units in the country
- The total number of new radiation oncology patients seen in the four Irish hospitals with radiation oncology facilities
- Radiation oncology rates of newly diagnosed cancer patients including a comparison to international rates of radiation oncology utilisation
- Regional variations in radiation oncology rates
- Radiation oncology uptake per health board
- Radiation oncology use at major tumour sites
- Radiation oncology use at major tumour sites per health board.

2.2 History of radiation oncology services in Ireland

The Polish chemist and Nobel Prize winner Marie Sklodowaska Curie isolated radium in 1896 and the earliest recorded clinical use of radiation therapy in Ireland followed the donation by Marie Curie of a radioactive sample to Professor John Joly at the Geology Department, Trinity College Dublin. In the early 1900s Dr Walter Stevenson, a surgeon and radiologist at Dr Steeven's Hospital, collaborated with Professor Joly, and was one of the early pioneers in the use of radium to treat cancers of the cervix. In 1914 Dr Stevenson participated in setting up the Radium Institute at the Royal Dublin Society, which for many years supplied Irish hospitals with the earliest form of radiation therapy (radium needles) in Ireland.[xxii]

This early work in clinical radiation oncology was sustained during the initial half of the twentieth century principally through the development of a radiation oncology service at St Anne's Hospital in Dublin. In 1952 a hospital exclusively dedicated to oncology care and radiation oncology was opened in Dublin – St Luke's Hospital.

In 1958 the Irish Cancer Association opened St Agatha's Clinic at St Finbarr's Hospital, Cork funded by the Irish Hospital Sweepstakes. Responsibility for this service was transferred to the Southern Health Board in 1979 and relocated to Cork Regional Hospital, now known as Cork University Hospital (CUH).

From the mid-1960s to the late 1990s there was limited investment in radiation oncology services particularly in regard to capital infrastructure. Radiation oncology services, heavily dependent on strategic investment, fell significantly behind the existing international standards of care available at this time. A more detailed chronology of service development in Dublin and Cork is provided in Table 2.1.

In the mid to late 1990s a number of developments and public sector investment significantly enhanced the available national radiation therapy services including the re-equipping and upgrade of St Luke's Hospital, the initial phases of equipment upgrade and redevelopment at the CUH treatment unit, and the approval of a new radiation oncology centre at University College Hospital Galway (UCHG). In addition private sector funds enabled the development of two small private treatment centres at the Mater Private Hospital and St Vincent's Private Hospital.

[xxii] Dr Walter Stevenson's contribution to the early development of clinical oncology services in Ireland was acknowledged through the dedication and naming of the new oncology ward at St James's Hospital.

Table 2.1: Chronology of radiation oncology service provision, 1899-2002

Date	Development
1899	Radiation therapy first practised in Ireland.
1903	Skin and Cancer Hospital at Beresford Place founded by Christopher O'Brien. The Hospital is relocated to Brunswick Street (1904). Brunswick Street lease expires and the City Hospital for Skin and Cancer moves to Holles Street. The City of Dublin Skin and Cancer Hospital is established in Hume Street (1911).
1915	Publication by Dr Walter Stevenson in the *British Medical Journal* on the use of radium needles.
1916	The City of Dublin Skin and Cancer Hospital is reorganised and receives a Royal Charter.
1919	Orthovoltage unit purchased by the Hume Street department.
1921	The Coombe Hospital establishes radiation oncology and Dr Walter Stevenson is appointed as a radiotherapist to the Coombe Hospital.
1925	St Anne's Hospital, Northbrook Road, is established.
1927	A radiation oncology unit is set up in the Royal City of Dublin Hospital with two orthovoltage treatment units.
1947	Dr Noel Browne, Minister for Health, establishes the Cancer Association of Ireland (CAI) to provide an efficient and co-ordinated National Cancer Service.
1952	St Luke's Hospital opens.
1953	The CAI establishes the superficial X-ray therapy unit in St Finbarr's Hospital Cork. A system of external clinics to serve cancer patients outside the Dublin area is developed from St Luke's Hospital.
1961	The Cancer Association of Ireland ceases to exist and St Luke's Hospital becomes an Establishment under the Health Act, 1961.
1968	A ^{60}Cobalt unit is installed in Cork, funded by the Irish Hospital Sweepstakes.
1979	The ^{60}Cobalt unit is transferred to Cork University Hospital.
1985	An 8MV linear accelerator is installed in St Luke's Hospital.
1988/89	A 4MV linear accelerator is installed in St Luke's Hospital. St Luke's and St Anne's Hospitals merge.

1990	The first linear accelerator outside Dublin is installed in Cork. The unit is the first dual mode (photon and electron) facility in the country.
1996	3-D treatment planning is introduced into St Luke's Hospital.
1997–2002	A major renovation and replacement of old equipment commences at St Luke's Hospital including the provision of 6 new linear accelerators, a ^{60}Cobalt unit, a high dose-rate brachytherapy unit and a new orthovoltage / superficial X-ray unit with accompanying ward and outpatient upgrades.
1999	A radiation oncology centre for UCHG is approved.
2001– present	Two new linear accelerators are agreed for Cork University Hospital, one of which is fully funded by local charity Aid Cancer Treatment (ACT).

2.3 St Luke's Hospital, Dublin

St Luke's Hospital was opened in 1952, and in 1988 amalgamated with St Anne's Hospital under a single Board of Management appointed by the Minister for Health, with both hospitals remaining in their existing locations. During the 1980s and early 1990s treatment facilities at St Luke's Hospital were significantly under-funded and the range of modern treatment facilities was very limited. The ability to deliver complex treatment protocols was equally limited. Certain patients, for example paediatric patients requiring total body irradiation (TBI) as part of the national bone marrow transplant programme, obtained this form of treatment at radiation oncology centres in the United Kingdom until 2001.

In 1994 a major investment programme commenced at St Luke's site, with the closure and transfer of services available at St Anne's Hospital being completed in 1997. Over recent years, St Luke's Hospital has seen a significant upgrade in clinical and treatment facilities through an extensive building and refurbishment programme costing in excess of €25 million to date. The hospital is now a well-equipped radiation oncology centre and provides advanced treatment for patients with cancer through an extensive range of new radiation oncology treatment machines and planning facilities, as summarised in Table 2.2. The additional financial support from the Friends of St Luke's has contributed significantly to the funding of radiation oncology service developments at St Luke's Hospital.

St Luke's Hospital – the radiation oncology department

The radiation oncology department has six matched linear accelerators with multileaf collimation, portal imaging and a range of electron energies. There is one orthovoltage DXT/CXT unit, a single ^{60}Cobalt unit, a stereotactic treatment system, and both high-dose rate (HDR) and medium-dose rate (MDR) brachytherapy facilities. The department has one CT scanner and two simulators (see Table 2.2). All treatment units are networked to the treatment planning department and a record and verify system (Visir)® is in place to which all treatment units except Cobalt are currently connected. The treatment-planning department has five workstations for external beam planning (Helax TMS), a single brachytherapy planning system (Plato), and a separate stereotactic planning system (Leibinger).

In recent years St Luke's Hospital has treated over 4,000 new patients per year, encompassing the full spectrum of tumour sites and radiation oncology treatment techniques. This equates with 70,000 treatments per year or approximately 1,350-1,400 treatments per week. It is important to note that this treatment

capacity has incorporated a significantly extended treatment day on two linear accelerator units, which has effectively enabled the hospital to provide an additional two linear accelerator capacity. The average duration of treatment per patient is currently 15-18 daily fractions. However, this figure does not give an indication of the recent increase in complexity of many of the radiation oncology treatment procedures involved.

In conjunction with the commissioning of updated treatment facilities, development of the following patient areas has also been completed:

- 130 beds inclusive of 20 day beds, 2 brachytherapy treatment rooms, and a dedicated single-bedded ^{131}I radio-iodine treatment suite.[xxiii]
- A 30 bed hostel / low dependency unit (Oakland Lodge). This was piloted at the hospital and is particularly suitable for patients who have to travel long distances and are not physically debilitated from their cancer.[xxiv] The unit facilitates privacy and independence for patients undergoing treatment.
- A new day-care centre provides a number of services including chemotherapy and caters for patients from both regional and local hospitals.
- A new support and rehabilitation centre provides facilities including pain management, palliative care and complementary care.

Multidisciplinary teams have been developed at St Luke's and consist of radiation/clinical oncologists, medical oncologists, specialists in diagnostic radiology and nuclear medicine, and a range of attending consultant physicians/surgeons, medical physicists, radiation therapists and nurses. Medical social workers, dieticians, physiotherapists, palliative care physicians, pastoral care workers, a clinical psychologist and complementary and diversional therapists provide further support. Other areas under development include occupational therapy and dental support services.

The St Luke's Institute of Cancer Research (SLICR) was established in 1992 to support cancer research. Existing areas of research cover a spectrum of radiation therapy, chemotherapy, surgery and paramedical care projects. In 2002 SLICR was the second largest non-governmental funding agency for cancer research in Ireland.

2.4 Cork University Hospital (CUH)

In 1968 the Irish Cancer Association opened St Agatha's Clinic as a treatment unit providing services for the southern region of the country, through a ^{60}Cobalt teletherapy treatment unit, purchased by the Irish Hospital Sweepstakes. Responsibility for this service was transferred to the Southern Health Board in 1979 with relocation to Cork Regional Hospital now known as Cork University Hospital (CUH).

The single ^{60}Cobalt treatment unit provided all treatment services within the catchment area until 1989. In 1989 the unit became unserviceable resulting in the daily transfer of patients and staff from Cork to St Luke's and St Anne's Hospitals in Dublin in order to maintain continuity in treatment programmes. A replacement ^{60}Cobalt machine was provided from public exchequer funds. The development of additional treatment capacity through the purchase of a new linear accelerator in 1989 proceeded on the basis of 50 per cent of the cost being provided by the local charity Aid Cancer Treatment (ACT).

CUH – the radiation oncology department

The CUH unit treats approximately 1,600 new referrals per year. A 12-year-old Cobalt unit and a linear accelerator of similar age have until recently (2002) provided the existing treatment capacity at CUH. Both units are significantly older than the internationally recommended replacement age and collectively cannot treat the number of patients that could be expected to attend from the CUH catchment area.

[xxiii] The total bed complement for St Luke's and St Anne's hospitals was reduced with the closure of St Anne's hospital in 1997.
[xxiv] Significant funding support for this pilot development and other support services developed at St Luke's hospital was provided by the Friends of St Luke's.

In 2002 the CUH department commissioned the first of two new linear accelerators. This most recent purchase was made possible by funding from the DoHC with the capital costs of one of the accelerators being fully funded by the local charity Aid Cancer Treatment.

2.5 University College Hospital Galway (UCHG)

The potential development of an additional radiation oncology unit at University College Hospital Galway was initially identified in the National Cancer Strategy (1996).[2] The approval of a new department was announced in 1999, prior to the formation of the Expert Group, and work on the construction of the unit commenced in September 2001. The anticipated building completion date is 2003/4. However, the physical and clinical commissioning will require additional time before clinical services can be provided.

UCHG – the radiation oncology department

The radiation oncology department has provision for three dual-energy linear accelerators, a HDR facility, mould room, superficial x-ray therapy, CT simulation and full 3D treatment-planning capacity. All but the most specialised/complex treatments will be carried out in this department.

It is envisaged that the Galway unit will provide radiation oncology services to the population of the Western Health Board, part of the North Western Health Board, and part of the Mid Western Health Board – North Clare.[xxv] It is anticipated that the new centre will enable 1200-1500 patients to be provided with treatment per year.

2.6 Mater Private Hospital

A single linear accelerator and simulator treatment facility was opened at the Mater Private Hospital in 1996. Recently a second linear accelerator has been commissioned and a HDR brachytherapy unit entered clinical service in 2002 (see Table 2.2).

2.7 St Vincent's Private Hospital

A single linear accelerator, simulator treatment and HDR brachytherapy facility was opened at St Vincent's Private Hospital in 1996. A second bunker was provided for future equipment expansion but is not currently in use (see Table 2.2).

[xxv] National Cancer Strategy 1996

Table 2.2: Summary of existing and planned radiation oncology facilities in Ireland (2001-2002)

Radiation Oncology Department	Facilities 2002	Additional and planned facilities 2003
St Luke's Hospital [xxvi]	6 linear accelerators 1 ^{60}Cobalt unit 1 HDR microselectron unit 1 MDR microselectron unit 1 orthovoltage unit 2 simulators Dedicated CT unit (half-time) **Special services** Stereotactic radiosurgery Total body irradiation ^{131}I treatment suite	
Cork University Hospital	1 linear accelerator 1 ^{60}Cobalt 1 Superficial X-ray unit 1 simulator **Special services** ^{131}I treatment suite	3 linear accelerators (2003) Funding for replacement units for the decommissioned Cobalt and linear accelerator unit is being pursued. A new selectron brachytherapy unit will become operational in 2003.
University College Hospital Galway[xxvii]	Not commissioned	3 linear accelerators 1 HDR unit 1 orthovoltage unit 1 CT/simulator unit Access to on-site MRI
Mater Private Hospital	2 linear accelerators 1 simulator 1 HDR microselectron unit	Not known
St Vincent's Private Hospital	1 linear accelerator 1 HDR unit (part-time use) 1 simulator	Not known

Table 2.2 shows the availability of radiation oncology services on a national basis. Data from the National Cancer Registry indicate that the majority of the national population (76 per cent) receive radiation therapy in Dublin.

[xxvi] During recent years St Luke's Hospital has operated an extended working day where two linear accelerator units operated an effective double shift. This means that the hospital effectively has an 8-linear accelerator capacity. Recent research undertaken at St Luke's Hospital has also suggested that the number of patients treated per hour is among the highest of a wide range of treatment centres surveyed in Europe.

[xxvii] Recent revisions of the clinical commissioning for Galway suggest that the full operation of the new facility will not take place until 2004/5.

2.8 Utilisation of radiation oncology treatment services – international guidelines

Europe

Limited published information exists on the rates of national radiation therapy use for cancer patients within European countries.[111,112]

In 1997 the Swedish Council on Technology Assessment in Health Care (SBU) report noted that in some western countries radiation therapy was part of the cancer treatment programme for 50-60 per cent of patients.[113] A summary of radiation therapy utilisation during the 1980s and early 1990s was provided for a number of countries (Table 2.3).

Table 2.3: Utilisation of radiation therapy for cancer treatments in different countries

Country	Year	Percentage of cancer patients receiving radiation therapy	Source of information
Australia	1986 1990	36 44	National survey State survey
Canada	1975 1987	48 54	Survey Estimate
The Netherlands	1983	44	5 reports, some regional (33-55 per cent)
Great Britain	1979	45 53	Survey Estimate
USA	1983 1985 1990	46 50-60 57	Survey Estimate of need Estimate
Sweden	1992	<30-33	SBU Survey

In 1997 the Dutch Health Council Committee estimated that 50-55 per cent of new cancer patients would require radiation therapy services. This compared to a previous estimate of 44 per cent of patients receiving radiation therapy in the 1980s (see Table 2.3) and 47 per cent of patients in a national study completed in 1990.

United States

Perez and Brady have stated that approximately 60 per cent of all cancer patients in the United States receive radiation therapy.[6] The report of the Inter-Society Council for Radiation Oncology (ISCRO)[xxviii] (1991) indicated that radiation therapy was used in the management of 50-60 per cent of all patients with cancer.[24] This estimate is supported by ongoing analyses under the aegis of the Patterns of Care Study Facilities Surveys.[101,104,114–117] In one of the studies the proportion of patients treated with radiation therapy in the nine census divisions of the United States was examined.[118] This study found that in 1989 the use of radiation

[xxviii] ISCRO is a consortium of the American Association of Physicists in Medicine (AAPM), American College of Medical Physics (ACMP), American College of Radiology (ACR), American Radium Society (ARS), American Society for Therapeutic Radiology and Oncology (ASTRO), North American Hyperthermia Group, Radiation Research Society (RRS), Radiological Society of North America (RSNA) and Society of Chairmen of Academic Radiation Oncology Programs.

therapy varied between 42 and 56 per cent. In three census divisions with an aggregate population of 96 million there was a usage rate of 52-56 per cent. Importantly these data relate to 1989 and it was anticipated that the usage rates would increase with time. Using more recent separate databases from the American College of Radiology (ACR) (1990-1995) it has been estimated that the proportion of cancer patients requiring radiation therapy would increase on an annual basis by 0.5 per cent for a further period of time. This projection is consistent with the trends in the United States between 1990 and 1995 and earlier ACR projections for the period 1981-1990. In addition the potential for new indications for treatment was also recognised as a factor that would continue to increase demands and the proportion of patients requiring treatment.

Wils *et al* have reported the findings of the USA Graduate Medical Education National Advisory Committee (GMENAC)[xxix] of the Department of Health, Education and Welfare where an estimate of the proportion of patients requiring treatment was derived from estimates of the appropriate radiation therapy rates for a wide number of tumour types.[xxx] By 1990 the GMENAC estimated that 57 per cent of new patients with major cancers would require radiation therapy.

Australia and New Zealand

The proportion of patients requiring radiation therapy and the published literature relating to this issue have been the subject of extensive recent analyses in Australia and New Zealand.[25,26,98,119-129] In part this stems from the professional and public awareness of significant under-provision of treatment services in the respective countries.[129]

The Australian Health Ministers Advisory Council (AHMAC), National Health and Medical Research Council (NHMRC), Australian Health Technology Advisory Committee (AHTAC), the Australian Medical Workforce Advisory Committee (AMWAC), and the Government Health Departments in New South Wales, Victoria and South Australia have all accepted the validity of the 50 per cent treatment rate for radiation oncology as a basis for healthcare planning and the ability to provide patients with appropriate radiation therapy services.[10,25,130-132]

In an analysis similar to that undertaken by the GMENAC in the United States, Australian authorities estimated that, of a total of 53 cancer sites reviewed in 1994, 62 per cent should have radiation therapy as part of the treatment plan.[25,26]

2.9 Current cancer caseload and use of radiation therapy in Ireland

As part of the evaluation process the Group requested the National Cancer Registry to compile the following datasets which reflect the existing use of radiation oncology in Ireland:

- The total number of new cancer patients treated with radiation therapy in the four Irish hospitals with radiation oncology facilities
- Radiation oncology utilisation rates for newly diagnosed cancer patients
- Regional variations in radiation oncology utilisation rates
- Radiation oncology uptake per health board
- Radiation oncology use at major tumour sites
- Radiation oncology use at major tumour sites per health board.

[xxix] An alternative method of determining the proportion of patients requiring radiation therapy is to examine the actual experience in various geographical regions and countries. However, there is considerable concern that in most situations this would underestimate requirements by failing to distinguish between the proportion requiring treatment and the proportion receiving treatment.

[xxx] With the increasing availability of data on clinical practice in the early 1990s, GMENAC's successor, the Council on Graduate Medical Education (COGME), adopted the Demand-Utilization Model for workforce planning. Rather than relying on epidemiologic data, this model assessed the requirements for physicians based on actual measurements of services provided. For this, it drew upon the resources of national databases, such as the National Ambulatory Medical Care Survey, the National Hospital Discharge Survey and Medicare claims data. The Council on Graduate Medical Education (COGME) was authorised by Congress in 1986 to provide an ongoing assessment of physician workforce trends, training issues and financing policies, and to recommend appropriate federal and private sector efforts to address identified needs. COGME advises and make recommendations to the Secretary of the US Department of Health and Human Services (HHS), the Senate Committee on Health, Education, Labor and Pensions, and the House of Representatives Committee on Commerce.

Between 1994 and 1998, the National Cancer Registry registered approximately 19,400 new cancer cases each year (Table 2.4); 89 per cent of these (17,194) were histologically proven invasive cancers. Using figures provided by the existing four radiation oncology centres in the Republic of Ireland, it is estimated that an annual average of approximately 6,700 patients received radiation therapy.[xxxi] This represents 33 per cent of all cancer patients (*in situ* and invasive) diagnosed within the same period and 39 per cent of those with invasive cancer.[xxxii] This figure includes all patients having radiation therapy at any stage during their illness and is an estimate of total caseload. It includes patients having radiation therapy as part of their primary treatment course, and also those having radiation therapy for recurrence of their disease or for palliation.[xxxiii] More detailed patient and/or population-based information on these estimates is not available at present.

Of the 6,735 treated patients, the data available for analysis by the NCR suggest that 3,341 patients (see Table 2.4), or 19 per cent of the total invasive cancer patient population, appear to have received their radiation therapy as part of a primary treatment programme where radiation therapy typically follows the initial diagnostic and cancer staging process. The remaining patients who attend each year for radiation therapy appear to have received treatment for a later recurrence of their cancer, or as part of a palliative treatment programme for advanced cancer on initial presentation. The analysis of this area and its comparison to international data is complex. There are significant difficulties in comparing the patient estimates between different countries and these caveats are elaborated in greater detail in the next section. Nevertheless when compared to the international recommendations noted above, the existing analysis suggests that the current level of radiation therapy utilisation within Ireland is significantly less and possibly different in nature than the potential and optimal target that has been identified in other jurisdictions.

Table 2.4: Summary of radiation therapy use in Ireland, 1994-1998

	Patient number	Percentage of all newly diagnosed cancers	Percentage of all newly diagnosed invasive cancers
Number of newly diagnosed cancers per year	19,399	100	-
Number of newly diagnosed invasive cancers	17,194	89	**100**
Total number of patients receiving radiation therapy	6,735*	35	**39**
Number of patients receiving radiation therapy as part of primary treatment	3,341**	17	**19**

* The total number of patients receiving radiation therapy was calculated on the basis of patient number provided by the four radiation oncology units in the Republic of Ireland.[xxxiv] This number includes patients attending for treatment of non-melanoma skin cancer (NMSC). The NMSC patient caseload in Ireland is substantial (see Table 2.7), particularly for CUH catchment area (see Table 2.8). The use of radiation therapy for the NMSC patient group appears to be less in some other countries and as a consequence is excluded from some modelling algorithms used to calculate treatment capacity/requirements (see section 5).
** The number of patients receiving radiation therapy as part of primary treatment was provided by the NCR (for explanation see subsequent text of section 2.8 below).

[xxxi] St Luke's Hospital, Cork University Hospital, Mater Private Hospital and St Vincent's Private Hospital
[xxxii] A subset of patients with pre-invasive cancers are suitable for treatment with radiation therapy, for example patients with ductal carcinoma *in situ* (DCIS) of the breast, and less commonly carcinoma *in situ* of the larynx.
[xxxiii] Each patient has been counted only once in the course of his/her illness at each centre, but there may be some small degree of double counting for patients who had radiotherapy treatment in more than one centre.
[xxxiv] St. Luke's Hospital, Cork University Hospital, Mater Private Hospital and St Vincent's Private Hospital.

Patients having radiation therapy as part of their primary treatment – international comparison
International cancer registry-based data on radiation therapy utilisation by cancer patients is limited, and it can be difficult to distinguish between radiation therapy given as part of the initial treatment plan and the data which include all episodes, regardless of treatment intent. The information collected by cancer registries such as the National Cancer Registry and the Surveillance, Epidemiology and End Results (SEER) registries in the USA is almost always based on initial treatment. The definition of initial treatment also varies between registries, some using the expressed intention in medical records, others using a fixed cut-off time, usually four or six months, to exclude treatments given after a certain period. In Table 2.5 additional data from a number of cancer registries have been collated. It should be noted that almost all of these reports describe regional populations or other subsets of the applicable national data and so may not be nationally representative (see footnotes in Table 2.5). It appears that all of these data refer to radiation therapy as part of the initial treatment plan and will be substantially less than all radiation therapy.

The Irish data are taken from the database of the National Cancer Registry, which has registered treatments for all new cancer cases in Ireland since January 1994. This is the only national source of such data, but is limited to 'primary' radiation therapy, that is, treatment given or planned at the time of initial diagnosis. By international convention, only this type of treatment is recorded by cancer registries. No differentiation is made between 'curative' and 'palliative' treatment, as long as the intention is to reduce tumour bulk. Each treatment episode is registered separately, but the data in this report count only a single episode of radiation therapy per new cancer case, so 'treatments' and 'cases treated' are synonymous.

The operation of a fixed cut-off point has a significant effect on recorded radiation therapy rates in Ireland, as the existing data from the National Cancer Registry suggest that approximately one-third of primary radiation therapy treatments are given more than four months after diagnosis. A rigid use of any time cut-off would potentially under-estimate radiation therapy rates, and therefore all registered primary radiation therapy treatment is included in the existing analyses discussed further in sections 2.9-2.10. In general the utilisation of radiation oncology services for patients in Ireland is less than in the USA and a number of European countries, especially in relation to prostate cancer, where our level of radiation therapy appears considerably lower.

It appears that, for some patients, this deferral of the time of commencement of radiation therapy is intentional and part of the initial treatment plan, but such has not been verified on a case-by-case basis. Further data are required for future analysis of the specific reasons for such deferrals/delays and any variations in this time pattern that may exist between heath boards, hospitals and international guidelines. These data will permit a more comprehensive and objective analysis of waiting times for treatment and provide important information for future analyses such as those identified within *Quality and Fairness: A Health System for You.*[27]

Table 2.5: Percentage population-based radiation therapy uptake in a sample of international locations: primary radiation treatment only

	Breast	Rectum	Lung	Prostate	Non-Hodgkin's lymphoma	Hodgkin's lymphoma	Bladder
Ireland	**31**	**17**	**26**	**4**	**13**	**16**	**6**
USA[1]	36	28	41	28	22	40	4
Geneva[2]	54	33	37	19			7
Netherlands[3]	49	12	29	26	18		9
Finland[4]	41	17	23	6	19	30	
Denmark[5]	33	5	9				
UK (Mersey)[6]	35		18				
UK (Yorkshire)[7]	47		30				
S Australia[8]		11		22			18

In order to permit cross comparison with data from other regional or national registries, the Irish primary radiation therapy data in this table excludes those patients where treatment was given more than four months after the date of diagnosis. The identified rates of radiation therapy for Ireland are therefore lower than those discussed in subsequent tables in this section (eg Table 2.7) where no exclusions were made. In this table the documented percentage population-based uptake for Ireland can be cross-compared to other countries and regions.

1. SEER registries — population 18.4 million[xxxv]
2. Canton of Geneva — population 388,000
3. Eindhoven district — population 968,000
4. Finland — national population
5. Denmark — national population
6. Merseyside and Cheshire — population 2,412,000
7. Yorkshire — population 3,600,000
8. South Australia — population 1,487,000

2.10 Current patterns of radiation oncology use in Ireland – Irish data and time trends

The number of cases treated with radiation therapy as part of primary treatment increased slightly from 1994 to 1999,[xxxvi] but remained constant at approximately 19 per cent as a percentage of all cancers registered (Table 2.6).

[xxxv] The SEER database is not a national measure of radiation therapy but rather a measure of a number of regions and hospitals that provide cancer treatment statistics.
[xxxvi] See section 2.9 for a discussion of the concept of primary radiation therapy and its measurement.

Table 2.6: Time trends in primary radiation therapy, 1994-1999

	New invasive cancer cases	Number having primary radiation therapy	Percentage having primary radiation therapy
1994	**17,039**	**3300**	**19.4**
1995	**16,815**	**3370**	**20.0**
1996	**17,308**	**3463**	**20.0**
1997	**17,530**	**3356**	**19.1**
1998	**17,653**	**3534**	**20.0**
1999	**17,606**	**3627**	**20.6**
1994-1999 (average)	**17,325**	**3442**	**19.85**

The cancers listed in Table 2.7 accounted for 86 per cent of new cancers and 75 per cent of all recorded radiation oncology treatments in the period 1994-1999. Patients with breast cancer accounted for the largest percentage of a particular cancer type to receive radiation therapy (48 per cent) followed by rectum (35 per cent), brain (35 per cent), lung (34 per cent), oesophagus (31 per cent), and lymphoma (28 per cent). Non-melanoma skin cancer accounted for the largest absolute number of cancers and the second largest number of patients treated. However, the percentage of all skin cancer patients requiring radiation therapy (9.8 per cent) was much lower than for most other common tumour sites.

Table 2.7: Number and percentage of cases treated by radiation therapy, 1994-1999 – the fifteen most common tumour sites

Cancer type	New invasive cancer cases per year	Number of cases having primary radiation therapy	Percentage having primary radiation therapy
All cancers	17,194	3,341	19.4
All except non-melanoma skin	11,930	2,826	23.7
Non-melanoma skin	5,265	515	9.8
Breast	1,598	762	47.7

Cancer type	New invasive cancer cases per year	Number of cases having primary radiation therapy	Percentage having primary radiation therapy
Lung	1,479	495	33.5
Prostate	1,150	139	12.1
Colon	1,084	57	5.3
Rectum	486	121	24.8
Lymphoma[xxxvii]	478	135	28.2
Stomach	469	24	5.2
Bladder	456	58	12.7
Melanoma of skin	375	20	5.4
Pancreas	323	16	4.8
Ovary	312	13	4.2
Oesophagus	289	90	31.0
Brain	247	87	35.4

The Irish primary radiation therapy data in this table includes those patients who received treatment both before and after the four month cut-off (see Table 2.5). The rates of radiation therapy are therefore higher than those discussed in Table 2.5, where a cut-off of radiation therapy commencing within four months of diagnosis was used to permit cross comparison with data available from other regional and international registries.

2.11 Regional variations in radiation oncology rates

Overall rates of radiation therapy ranged from 15 per cent for residents of the WHB to 24 per cent for those living in the SHB (Table 2.8). If skin cancers were excluded, the lowest levels of radiation therapy were in the MWHB (18 per cent), and WHB (19 per cent) and the highest in the Eastern Region (27 per cent). There was significant variation between health board areas in radiation therapy rates, with no consistent geographical pattern to this variation. Although radiation therapy rates for most common cancers were above average for residents of the Eastern Region and the SHB area, there is no consistent relationship between radiation therapy use and the distance of a respective health board from the existing radiation oncology treatment facilities. Distance from a radiation oncology centre may be one of the contributing factors but it does not explain the consistent differences in radiation therapy usage, for instance between the NEHB and SEHB rates. It is likely therefore that some of the documented variation is a consequence of local clinical practice and subsequent referral patterns and that access in geographical terms is only one of a number of factors influencing uptake.

The regional variations in the uptake of radiation therapy for five of the most commonly treated malignancies (see Figures 2.1 to 2.5) and for which radiation therapy has evidence-based guidelines for use, are further discussed.

[xxxvii] The overall group of lymphoma patients is significant but contains a number of lymphoma subtypes with different indications for primary radiation therapy.

Table 2.8: Percentage radiation therapy uptake by health board of residence, 1994-1998 – primary radiation treatment only

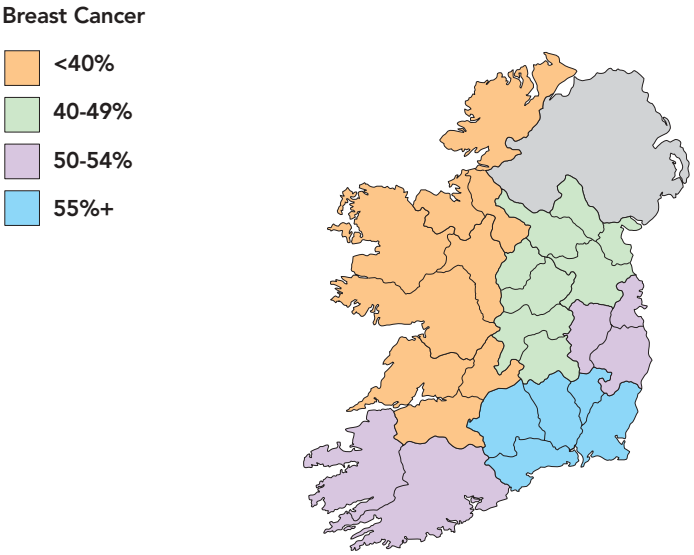
	All	EHB	MHB	MWHB	NEHB	NWHB	SEHB	SHB	WHB	p
All cancers	19	**20**	19	**16**	**16**	19	20	**24**	**15**	<0.001
All cancers excluding non-melanoma skin	24	**27**	23	**18**	**20**	**20**	24	26	**19**	<0.001
Non-melanoma skin	10	**5**	**7**	10	**6**	**16**	**12**	**21**	**6**	<0.001
Breast	48	**52**	49	**37**	46	**38**	**56**	50	**33**	<0.001
Lung	33	**37**	34	**24**	28	31	28	**40**	**25**	<0.001
Prostate	12	14	13	9	8	11	10	15	11	0.001
Colon	5	6	6	3	5	5	6	5	4	0.524
Unknown primary site	13	**17**	13	9	8	7	13	15	11	<0.001
Rectum	25	**31**	26	**13**	16	26	23	21	28	<0.001
Lymphoma	28	27	23	26	23	17	30	**43**	21	<0.001
Stomach	5	**8**	3	5	3	3	3	3	4	0.002
Bladder	13	11	19	7	8	7	11	**24**	12	<0.001
Melanoma skin	5	6	9	4	5	4	6	3	6	0.275
Pancreas	5	**9**	3	2	4	4	4	3	2	<0.001
Ovary	4	5	2	2	3	4	5	5	1	0.427
Oesophagus	31	**40**	19	20	28	30	27	21	39	<0.001
Brain	35	41	39	26	35	31	34	31	33	0.039

Note: Figures in bold text denote that the rate indicated was significantly different ($p<.05$) from the average rate.

Regional variations in radiation oncology rates – breast cancer

Radiation oncology rates for breast cancer were particularly low for residents of the WHB (33 per cent, compared to the national 48 per cent) and high for those living in the SEHB (56 per cent). Although distance from radiation oncology centres may be a factor, this does not explain the differences between, for instance, the NEHB and the SEHB, which may be due to clinical practice or referral patterns (see Figure 2.1).

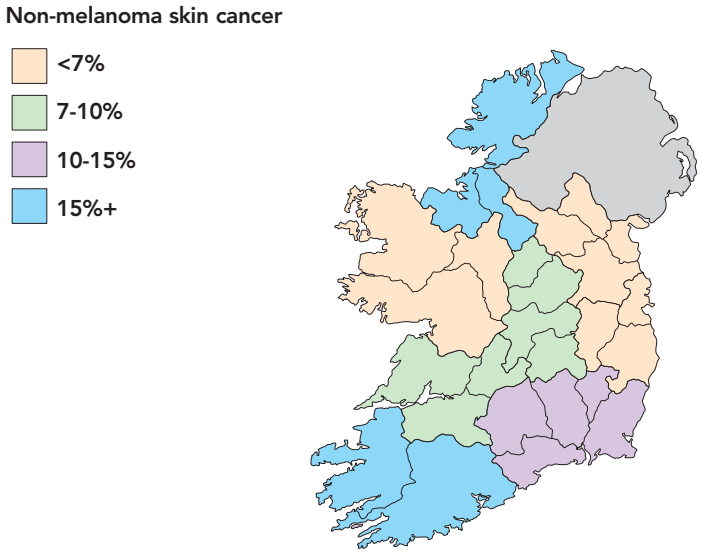
Figure 2.1: Percentage of patients with breast cancer receiving radiation therapy, 1994-1998



Regional variations in radiation oncology rates – non-melanoma skin cancer (NMSC)

The national caseload of patients with NMSC who had radiation therapy is approximately 500 per year (see Table 2.7). This patient number represents less than 10 per cent of the total national NMSC caseload. It appears that radiation therapy is used relatively infrequently for NMSC and is most probably used in advanced cases, elderly patients, or in patients with significant co-morbidities. Radiation therapy for NMSC was used more frequently and for a larger percentage of patients in the SHB and adjacent geographic areas accessing the CUH unit. Preliminary information suggests that this usage may in part reflect the fact that there is only one publicly funded dermatology service in the CUH radiation oncology unit catchment area.

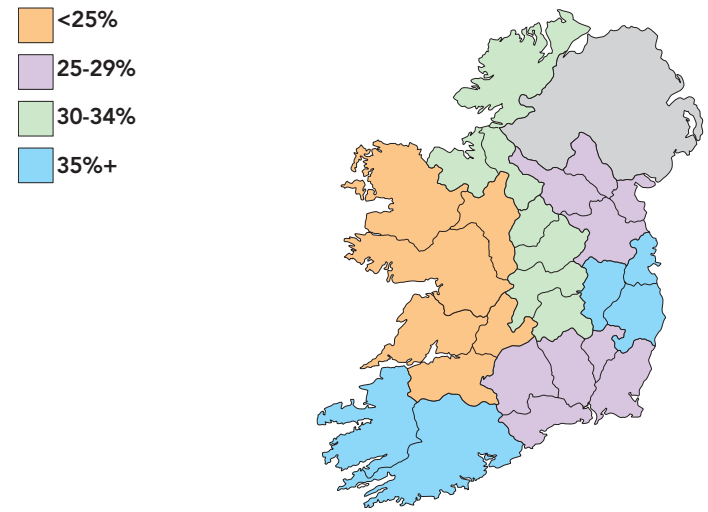
Figure 2.2: Percentage of patients with non-melanoma skin cancer receiving radiation therapy, 1994-1998



Regional variations in radiation oncology rates – lung cancer

Radiation oncology rates for lung cancer were highest for residents of the SHB and EHB (see Figure 2.3). These are the areas where both radiation oncology services and thoracic surgery units are located.

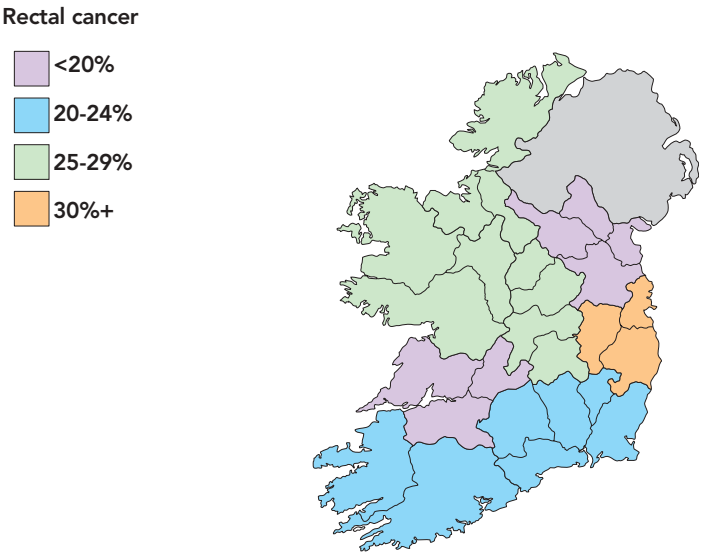
Figure 2.3: Percentage of patients with lung cancer receiving radiation therapy, 1994-1998



Regional variations in radiation oncology rates – rectal cancer

Radiation oncology rates for rectal cancer were highest for residents in the EHB and some areas adjacent to the WHB (see Figure 2.4).

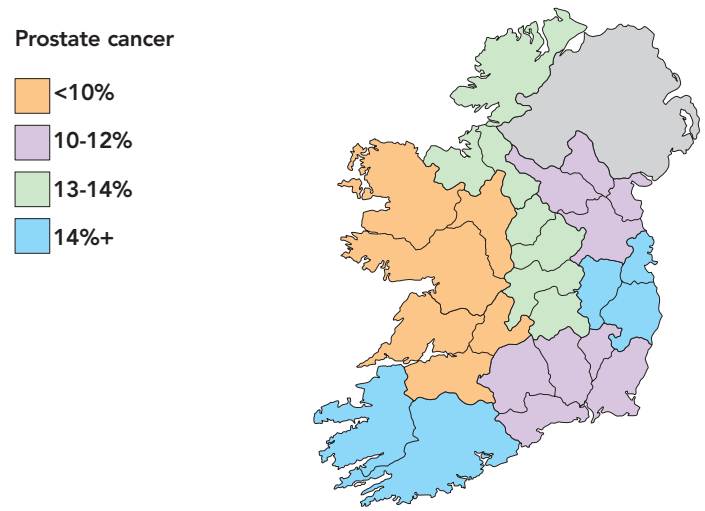
Figure 2.4: Percentage of patients with rectal cancer receiving radiation therapy, 1994-1998



Regional variations in radiation oncology rates – prostate cancer

The use of primary radiation therapy for this cancer was uncommon in the time period examined (1994-1998), with little regional variation (see Figure 2.5). This low frequency of usage is also demonstrated in Tables 2.3-2.4 where Ireland has the lowest use of all examined datasets in the UK, Europe (with the exception of Finland), North America and Australia. The range of reasons contributing to this are not clear but may include under-referral of patients, and the use of other treatments including hormonal manipulation and surgery. Although confirmatory data are not yet available, the clinical use of radiation therapy may now be greater, particularly since the development of 3-D conformal treatment programmes at a number of the radiation oncology units in recent years. In addition the low utilisation figure may be partly due to differences in the definition of primary radiation therapy for prostate cancer.[xxxviii]

Figure 2.5: Percentage of patients with prostate cancer receiving primary radiation therapy, 1994-1998



[xxxviii] In this context primary radiation therapy is radiation treatment with curative intent in the absence of radical prostatectomy.

2.12 Catchment areas of the radiation oncology units in Dublin and Cork

On a national basis, of those who received radiation oncology services, 76 per cent of cancer patients accessed radiation oncology services in Dublin and 23 per cent in Cork, although this percentage depended somewhat on cancer type (see Tables 2.9 and 2.10). An estimated average of 30 patients per year may have availed of or required additional or specialist radiation oncology services outside the country. For example, prior to 2001 paediatric patients requiring total body irradiation (TBI) as part of the national allogeneic bone transplant programme attended treatment centres in the UK. In recent years (2001-2002) some of these specialist services including adult and paediatric TBI have been commissioned within Ireland enabling patients to have the entirety of their care at Irish treatment centres.

In the time period examined, 1994-1998, the vast majority of patients resident in the MHB (98 per cent), WHB (98 per cent), NWHB (97 per cent), and former EHB (98 per cent) who received radiation therapy accessed radiation oncology services at treatment centres in Dublin. The majority of patients from the MWHB (78 per cent) and SEHB (77 per cent) also attended treatment centres in Dublin (see Table 2.9). The overwhelming majority of patients from the SHB area (96 per cent) attended Cork University Hospital for radiation oncology treatment services.

Table 2.9: Location of radiation oncology uptake by health board of residence (annual average, 1994-1998)

Referring region		**Patients receiving RT in Dublin**		**Patients receiving RT in Cork**	
		Number per year	Percentage	Number per year	Percentage
Ireland		**2493**	**76**	**764**	**23**
Eastern region		**1194**	**98**	**1**	**0**
	Dublin city	573	99	1	0
	Dublin county	438	97	0	0
	Kildare	98	98	0	0
	Wicklow	84	97	0	0
MWHB		**162**	**78**	**44**	**21**
	Clare	48	89	6	11
	Limerick city	28	79	8	21
	Limerick county	50	66	25	33
	Tipperary NR	36	85	6	13

Referring region		Patients receiving RT in Dublin		Patients receiving RT in Cork	
		Number per year	Percentage	Number per year	Percentage
NEHB		**215**	**98**	**0**	**0**
	Louth	69	97	0	0
	Meath	72	99	0	0
	Cavan	41	99	0	0
	Monaghan	32	99	0	0
MHB		**177**	**98**	**1**	**0**
	Longford	31	98	1	1
	Laois	42	97	0	0
	Offaly	51	99	0	0
	Westmeath	53	99	0	0
NWHB		**200**	**97**	**0**	**0**
	Donegal	99	97	0	0
	Leitrim	33	98	0	0
	Sligo	68	98	0	0
SEHB		**267**	**77**	**75**	**22**
	Carlow	30	97	0	0
	Kilkenny	50	94	1	2
	Tipperary SR	27	36	47	63
	Waterford city	39	97	1	2
	Waterford county	31	54	26	45
	Wexford	90	98	0	0

Referring region		Patients receiving RT in Dublin		Patients receiving RT in Cork	
		Number per year	Percentage	Number per year	Percentage
SHB		**24**	**4**	**641**	**96**
	Cork city	3	2	166	98
	Cork county	7	2	330	98
	Kerry	14	9	145	91
WHB		**254**	**98**	**2**	**1**
	Galway city	32	96	1	2
	Galway county	92	97	1	1
	Mayo	84	99	0	0
	Roscommon	46	100	0	0

If examined on a county-by-county basis, within the SEHB it can be seen that 94-100 per cent of patients from counties Carlow (97 per cent), Kilkenny (94 per cent), Wexford (98 per cent), and Waterford city (97 per cent) attended Dublin treatment services. When compared to other areas within the SEHB a higher percentage of cancer patients from Tipperary South Riding (63 per cent) and Waterford County (45 per cent) attended Cork University Hospital for radiation therapy rather than Dublin centres (see Table 2.9).

Within the MWHB the great majority of patients from the areas of Clare (89 per cent), Limerick city (79 per cent), and Tipperary North Riding (85 per cent) attended Dublin, with a somewhat lower percentage attending from Limerick County (66 per cent) (see Table 2.9).

The majority of patients (84 per cent) using the radiation oncology services at CUH resided within the SHB. However, a smaller number of patients from other counties also attended CUH. These were: Tipperary South Riding (6 per cent of the CUH attendance), Waterford County (3 per cent), Limerick County (3 per cent), Limerick County Borough (1 per cent), Tipperary North Riding (1 per cent), and Clare (1 per cent) (see Table 2.9).

There is also preliminary evidence that for some regions the location of radiation oncology services accessed by patients is dependent on the particular cancer type (see Table 2.10). For example, while 76 per cent of all patients requiring radiation therapy attended treatment services in Dublin, only 56 per cent of those with non-melanoma skin cancer did so. In Tipperary South Riding, for example, 30 per cent of patients with rectal cancer had radiation therapy at CUH (with 70 per cent attending Dublin centres) whereas 47 per cent of patients with breast cancer attended CUH (with 53 per cent attending Dublin centres). Variations in the relative percentage of patients accessing 'local services' were also noted for other cancer types. For example, the proportion of patients from the area with non-melanoma skin cancer and lung cancer attending Cork was much lower. This is an important observation and may reflect different patterns of referral for different cancer

types by general practitioners and community-based services in contrast to hospital-based clinical disciplines, although if this is the case there may be additional variation of referral pattern within the tertiary referral mechanism operated by hospitals within the region.

The Group has not undertaken a detailed analysis of the respective case-mix and tumour stage of patients attending the respective treatment locations in Dublin and Cork. However, further examination of this area will be important in providing information for the future development of treatment services.

Table 2.10: Percentage of patients having primary radiation therapy in Dublin hospitals, 1994-1998

Area of residence		Cancer type			
		Non-melanoma skin	Rectum	Lung	Breast
Ireland		**56**	**82**	**79**	**80**
Eastern region		100	100	100	100
	Dublin city	99	100	100	100
	Dublin county	100	100	100	100
	Kildare	100	100	100	100
	Wicklow	100	100	100	100
MWHB		**81**	**74**	**73**	**76**
	Clare	100	100	**77**	**95**
	Limerick city	**85**	**0**	**71**	**80**
	Limerick county	**66**	**64**	**61**	**60**
	Tipperary NR	**97**	100	**87**	**81**
NEHB		100	100	100	100
	Louth	100	100	100	100
	Meath	100	100	100	100
	Cavan	100	100	100	100
	Monaghan	100	100	100	100

Area of residence		Cancer type			
		Non-melanoma skin	Rectum	Lung	Breast
MHB		**98**	100	100	100
	Longford	100	100	100	98
	Laois	**95**	100	100	100
	Offaly	100	100	100	100
	Westmeath	**96**	100	100	100
NWHB		100	100	100	99
	Donegal	100	100	100	100
	Leitrim	100	100	100	100
	Sligo	100	100	100	98
SEHB		**59**	**81**	**71**	**86**
	Carlow	100	100	100	100
	Kilkenny	100	100	93	100
	Tipperary SR	**17**	**30**	**21**	**47**
	Waterford city	**97**	100	**94**	100
	Waterford county	**19**	**50**	**57**	**69**
	Wexford	100	100	100	100
SHB		**0**	**3**	**2**	**3**
	Cork city	**1**	**0**	**1**	**1**
	Cork county	**0**	**7**	**1**	**0**
	Kerry	**1**	**0**	**5**	**11**

Area of residence		Cancer type			
		Non-melanoma skin	Rectum	Lung	Breast
WHB		**99**	100	100	100
	Galway city	100	100	100	97
	Galway county	**97**	100	100	100
	Mayo	100	100	100	100
	Roscommon	100	100	100	100

Bold text above indicates population sources that used treatment centre locations outside Dublin.

2.13 Interval from diagnosis to radiation therapy

There is evidence of considerable variation in practice throughout the country in the time that elapses between diagnosis, which is usually the time of surgery or other definitive investigation, and the first date of radiation oncology treatment.

Tables 2.11 shows that 8 per cent of patients having radiation therapy for breast cancer had their first treatment within a month if they lived in the MWHB, compared to only 3 per cent in the MHB and WHB. In the case of lung cancer, 43 per cent of patients living in the EHB had radiation therapy within a month, compared to 16 per cent in the WHB. The numbers having radiation therapy within a month for prostate cancer were low in all areas, but were lowest in the NWHB.

At two months after diagnosis, the picture is broadly similar (Table 2.12). The highest percentage having radiation therapy for breast cancer was in the MWHB and the lowest in the WHB. At four months from diagnosis, the differences between health boards were less, but patients in the WHB still appeared to have a longer interval from diagnosis to treatment (Table 2.13).

These time intervals should not be viewed in all cases as 'delays'. In some patients radiation therapy may not be scheduled until a surgical site has healed, or until chemotherapy has reached a certain stage or been completed. Nevertheless it is clear that for patients with a number of common adult cancer types, there is significant variation between health board regions on the particular treatment protocols and the timing of commencement of radiation therapy. This may reflect the availability and clinical recommendation of treatment programmes that have an appropriate defined deferral of radiation therapy. It will remain absolutely essential, however, to ensure that these deferrals are not a consequence of lack of patient access, non-referral of patients, or other invalid reasons.

Table 2.11: Percentage of primary radiation oncology treatment given within one month of diagnosis, 1994-1998

Area of residence	Cancer site			
	Breast	**Skin**	**Lung**	**Prostate**
Ireland	**5**	**61**	**36**	**7**
EHB	6	59	43	8
MHB	3	44	33	7
MWHB	8	54	32	9
NEHB	6	47	28	8
NWHB	7	40	24	0
SEHB	5	49	28	5
SHB	5	79	37	9
WHB	3	41	16	7

Table 2.12: Percentage of primary radiation oncology treatment given within two months of diagnosis, 1994-1998

Area of residence	Cancer site			
	Breast	**Skin**	**Lung**	**Prostate**
Ireland	28	76	57	15
EHB	30	74	62	13
MHB	25	62	57	7
MWHB	36	71	61	19
NEHB	26	65	46	8
NWHB	34	68	51	7
SEHB	30	68	49	12
SHB	22	87	59	19
WHB	19	66	34	28

Table 2.13: Percentage of primary radiation oncology treatment given within four months of diagnosis, 1994-1998

Area of residence	Cancer site			
	Breast	**Skin**	**Lung**	**Prostate**
Ireland	66	74	87	31
EHB	64	75	85	27
MHB	65	76	78	13
MWHB	73	75	84	47
NEHB	60	69	78	16
NWHB	71	77	84	16
SEHB	73	71	81	20
SHB	71	78	94	38
WHB	54	60	80	57

2.14 Summary

- Clinical radiation oncology services were under-developed for the period between the early 1960s and the 1990s.
- The existing and short-term planned increase in treatment capacity within the Republic of Ireland is significantly below the equivalent guidelines recommended by international agencies and authorities in other western countries.
- During the late 1990s and the early 2000s major investment in new and replacement clinical treatment services has taken place in Dublin and Galway. During the same period a more limited investment programme in replacement equipment has taken place in Cork.
- The current utilisation of radiation therapy for a number of common adult cancers, as is shown by comparable data, appears significantly less than in a number of EU countries and North America.
- The percentage of new cancer patients who have availed of radiation oncology services during the period 1994-1998 has not increased.
- There is a significant regional variation in the use of radiation oncology treatment services. However, distance from a radiation oncology centre does not completely explain the observed differences in use.
- The existing Dublin-based treatment services are used by a majority of patients from the Eastern Regional Health Authority and other Health Boards with the exception of the SHB.
- The existing services at CUH are used primarily by residents of the SHB. However, additional patient populations attend from the SEHB and the MWHB.
- A significant variation in the interval between cancer diagnosis and the commencement of radiation therapy was noted among the Health Boards. The reasons for this variation are not evident.

Section 3

Future developments in the clinical practice of radiation oncology

3.1 Introduction

The Group has provided a synopsis of the following areas:

- Recent technological and clinical developments in radiation oncology
- Potential short-term changes in the utilisation of radiation therapy services in Ireland
- Expected medium and longer term developments in radiation oncology.

The late 1990s has witnessed the significant advances in radiation oncology equipment and treatment planning technology previously described in section 1. Over recent years there has been an initial clinical experience of using new radiation oncology technology in conjunction with advances in surgery and chemotherapy within Ireland. It is essential nevertheless to highlight some additional areas of change in clinical practice that will involve radiation oncology personnel and services. Consideration of such change is particularly important given the significant response time that is required to commission new radiation oncology services, and the need for forward planning of future financial investment in treatment infrastructure, human resources and clinical services.

3.2 Future developments in clinical radiation oncology

Technical developments

Developments in computer technology and linear accelerator design combined with refinements in imaging of tumours have enabled the establishment and widespread clinical implementation of three-dimensional conformal radiation therapy (3-DCRT).[105] The latest development of this approach has been the early clinical use of intensity-modulated radiation therapy (IMRT).[9,78,133,134] Initial clinical studies strongly suggest that 3-DCRT and IMRT technologies can result in a reduction in short and long-term patient morbidity and thereby improve the therapeutic ratio of radiation therapy for many cancers.[7,8] Furthermore, there is now evidence that cancer relapse rates are reduced by the application of higher doses of radiation therapy that are only possible using 3-D and IMRT technologies.[9]

Stereotactic radiosurgery is closely related to the technologies of 3-DCRT and IMRT and additionally encompasses the fusion of stereotactic neurosurgical techniques, linear accelerator technology, and computerised treatment planning.[96] Conditions previously untreated by radiation, such as benign brain tumours and arteriovenous malformations, are now increasingly being treated with this approach following the clinical commissioning of this service at St Luke's Hospital.

Clinical developments

Along with other oncology disciplines, radiation therapy has witnessed a number of significant clinical advances in recent years that have collectively resulted in major advances in the management of many cancers. The following are examples of recent advances in the practice of radiation oncology:

- Improvements in the clinical assessment of disease particularly with the development of sophisticated diagnostic imaging technologies of CT, MRI and PET and the preliminary use of image fusion technologies as part of the radiation oncology treatment planning process.[74] These have enabled the more appropriate identification of patients for different radiation oncology treatment options
- Considerably expanded knowledge of the fundamental mechanisms that underpin both tumour and normal tissue response to radiation. As a consequence there is now a greater ability to prospectively examine novel radiation therapy approaches,[135,136] for example:
    - Shortened (accelerated) radiation treatment programmes, as in the use of continuous hyper-fractionated accelerated radiation therapy (CHART) and late concomitant boost techniques for selected lung and head and neck cancers[137-155]

- Hypo-fractionated radiation therapy for bone and brain metastases and spinal cord compression as examined in the Medical Research Council (MRC) and other clinical trials[156]
- The early clinical use of hypoxic radiation sensitisers as part of the management of head and neck cancer[154,157-167]
- Developments in brachytherapy technology which have also increased its usefulness in clinical practice, for example as part of the management of prostate, lung, oesophageal, anal canal, and gynaecological malignancy.[3,75] This expansion has resulted from the introduction and clinical examination of complex 3-D treatment planning software and the use of remote control high-dose-rate afterloading techniques that improve the design and optimisation of treatment.[11,168-170]

In addition brachytherapy technology has recently been demonstrated to reduce the incidence of re-stenosis following coronary artery and large vessel angioplasty.[68] There is a significant prospect that this technology will have an increased use in vascular surgery and interventional cardiology in the future. However, the implications of this radical evolution of clinical practice are difficult to detail at present.[67]

3.3 Advances in radiation oncology – areas of change in Ireland

In addition to the general developments described earlier, it is highly probable that a number of current developments in Irish healthcare will also contribute to a rapid and significant increase in additional patient groups being referred to radiation oncology services for consideration of treatment. These include, for example:

- The increased use of radiation therapy as part of the management of pre-invasive forms of breast cancer. This has been identified with the initial phase 1 component and future implementation of the National Breast Cancer Screening Programme, BreastCheck®.

A number of changes in oncology management guidelines have also impacted on current radiation oncology practice in Ireland. In particular, some of the new approaches require the rapid implementation of radiation therapy within 1-2 weeks of initial diagnosis and staging (neoadjuvant treatment), which at the present time has placed considerable pressure on existing services. Examples of this recent modification in clinical practice include:

- The increased use of pre-operative chemo-radiation strategies for specific gastro-intestinal cancers including rectal and oesophageal cancers.[58,60,171-174]

In addition, recent evidence-based guidelines have advocated the greater use of radiation treatment for a number of common cancers that have previously had low referral rates for radiation therapy.[175] By virtue of the size of national patient caseload, change in clinical practice of this type will have a significant effect on the infrastructural and staffing requirements of a future radiation oncology service. Recent changes in clinical management guidelines that exemplify the expanded role of radiation therapy for common adult cancers include:

- The expanded use of post-operative radiation therapy and combined-modality approaches for additional cancers including stomach cancer[175-178]
- The rapid increase in the use of external beam and interstitial brachytherapy treatments for intermediate and high-risk prostate cancer patients.[11,169]

Ongoing clinical research has provided significant preliminary evidence that may also alter and increase radiation oncology practice in the near future, for example:

- The increased use of total body irradiation (TBI) as part of non-myeloablative bone marrow transplant treatment protocols for diseases such as multiple myeloma[3]

- The use of novel radiation protocols including CHART and CHARTWEL[xxxix] with or without concomitant chemotherapy for selected lung and head and neck cancers[141-143,149-151,161]
- The development of organ sparing radiation therapy approaches for patients with complex head and neck cancers using IMRT technologies.[179]

Ultimately these and other evolving approaches will continue to be examined through the additional clinical research studies undertaken by international and Irish co-operative research groups and will enter future evidence-based clinical practice. Clinicians and other healthcare workers in Ireland will be involved in the continued examination of these new therapeutic approaches and their impact on future practice and treatment capacity requirement.

3.4 Advances in radiation oncology – the future

It is likely that future significant developments in radiation therapy will involve a move to the integration of treatment-planning and treatment-delivery technologies with additional biological predictors of treatment outcome.[75,180] The Human Genome Organisation (HUGO) project has, for example, provided the initial inventory of genes that regulate the complex biological processes that fundamentally underpin the sensitivity and response of patients to all forms of cancer treatment.[181-186] Future radiation oncology practice will need to embrace and utilise this core knowledge to further maximise radiation effect for clinical benefit.[74,75,100,187,188]

A number of novel radiation treatment technologies and developments in biotechnology are also at an early stage of clinical investigation and these are highlighted to indicate the additional range of possible future clinical developments within the next 1-2 decades. Potential future radiation treatment technologies include the following:

- The development of systemic targeted radionuclide technologies to harmonise with external beam radiation oncology protocols. For example, the US Food and Drug Administration (FDA) has recently approved (2002) the first radiolabelled monoclonal antibody therapy (Zevalin™) for use in low grade non-Hodgkin's lymphoma[189-195]
- The increased development and implementation of biological/functional diagnostic imaging, e.g. PET and magnetic resonance spectroscopy (MRS) and the integration of this with existing cross-sectional imaging technologies of CT and MRI[74]
- The development of novel radiosensitisers and novel normal tissue radio-protectants[75,157]
- The identification and selection of patients for radiation therapy on the basis of molecular phenotyping of both tumour and normal tissue, particularly through the use of new developments in biotechnology, for example the use of tissue, cDNA and other microarray technologies[186,196-200]
- The development of novel pharmacological inhibitors that target the critical molecular pathways that ultimately determine whether they respond to radiation and other anti-cancer therapies.[7,75,100,135,136,187,188,201]

It is clear from the recent evidence and trends examined by the Group that the development, resources and support for all of the above will require a continued provision of highly qualified healthcare professionals, a planned expansion and development of related undergraduate and postgraduate training programmes, and the increased integration of these strategic planning goals at a clinical and research level.[75]

[xxxix] CHART: continuous hyper-fractionated accelerated radiation therapy; CHARTWEL = CHART with treatment at weekends excluded.

3.5 Summary

- Important advances in clinical radiation therapy have recently entered routine clinical practice.
- Further technological advances will become part of routine clinical practice in the near future, for example intensity-modulated radiation therapy (IMRT).
- The national implementation of BreastCheck® will result in an increased need for radiation oncology services.
- Recent trends in clinical practice and the recognised 'standard of care' have resulted in an increased need for rapid access pre-operative (neoadjuvant) radiation therapy for certain cancer patients.
- Novel improved fractionation regimens have been identified for certain patient groups that will have significant impact on the co-ordination and logistics of treatment provision, for example when treatment is required on more than one occasion per day (hyper-fractionated treatment).
- Improvements in the biological understanding of cancer and the effect of radiation therapy will undoubtedly modify treatment protocols in the medium to long term.
- Preliminary studies suggest that specialised forms of radiation therapy, for example intravascular brachytherapy, may become more widely used in patients with non-malignant illness such as coronary artery and peripheral vascular disease.
- New forms of radiation treatment and parallel developments in molecular genetics/oncology will be incorporated into radiation oncology practice within the next 1-2 decades, the timeframe being considered by the Expert Group. These advances include the clinical use of systemic targeted radionuclides, targeted radiosensitisers and normal tissue radioprotectants, and novel pharmacological inhibitors of the critical molecular pathways that ultimately determine clinical responses to radiation therapy. Treatment advances will need to be integrated with advanced biological/functional diagnostic imaging modalities (e.g. PET and magnetic resonance spectroscopy (MRS), together with the molecular phenotyping of tumours and normal tissue using tissue, cDNA and other microarray technologies).
- The envisaged developments in molecular and clinical radiation oncology will require a continued provision of highly qualified healthcare professionals, the continued development of related undergraduate and postgraduate training programmes, and in particular the increased integration of these strategic planning goals at a clinical and research level. The envisaged developments in molecular radiation oncology and biological imaging will for the foreseeable future be maximally developed in the context of university-linked supra-regional comprehensive cancer centres.

Section 4

Patient caseload – analysis and projections to 2015

4.1 Introduction

The total number of new cancer cases in Ireland is increasing annually. As cancer predominantly affects older people, much of the increase can be attributed to our ageing population. However, between 1994 and 1998 the incidence of some cancers has increased independent of significant age-related changes in the population (see Table 4.1).[XL] In particular, prostate cancer, lymphoma and melanoma in men have increased annually over the five-year period. For a number of other cancers, such as lung, breast and lymphoma in women, there appear to be upward trends in incidence. However, these trends are not definite enough to allow for unequivocal predictions.

Table 4.1: Cancer incidence between 1994 and 1998 – annual percentage increase in age-standardised rate (invasive malignant cancers only)

Cancer	Females	Males
All malignant cancers	0.4	-0.5
All malignant cancers, excluding non-melanoma skin	0.5	0.2
Non-melanoma skin	-0.1	0.9
Colorectal	-0.2	0.3
Breast	1.4	
Lung	2.7	-2.0
Prostate		**3.3**
Lymphoma	2.4	**5.2**
Stomach	0.1	-1.1
Bladder	-7.5	-4.3
Leukaemia	3.0	1.1
Melanoma of skin	**-1.8**	4.7

Note: Figures in bold show statistically significant changes ($p<0.05$)

[XL] For the majority of cancers, no significant upward or downward incidence trend was observed between 1994 and 1998 (see Tables 4.1 and 4.3). For these cancers, case projections are based on demographic change only, assuming no underlying trend in cancer incidence. The 95 per cent confidence limits given are those expected from a Poisson distribution of case numbers. Using the population predictions, the predicted number of cases was calculated for these sites. The 95 per cent confidence limits given are those of the log-linear regression. Such cancer rate projections are based on several assumptions and five-year data. They are intended to give a general, rather than specific prediction of cancer numbers and radiotherapy requirements and cannot be relied on in detail. This is reflected in the increasing width of the confidence intervals with time.

4.2 National population projections to 2015

Data from the National Cancer Registry Ireland (NCRI) and population data from the Central Statistics Office (CSO) have been used to estimate the future changes in cancer incidence and the expected increase in cancer cases in Ireland to the year 2015.[202] This has a major impact on the appropriate forward planning of radiation oncology treatment services, and is particularly important because of the significant period of time needed to plan and commission either expanded or new radiation therapy services. Without appropriate and accurate future estimates it is difficult to ensure that the proposed service development will match the eventual patient caseload.

Table 4.2 shows the national population projections for Ireland up until 2015. The population is projected to increase from just over 4 million in 2005 to 4.3 million in 2015. The proportion of people over 60 years in the population is projected to increase from 15 per cent to just over 18 per cent. The change in age profile represents a further potential source of increase in cancer incidence over the 2002-2015 time period. Attention is drawn to the assumptions made by the CSO in relation to fertility and immigration when interpreting the population statistics.[202] These assumptions may not hold true over the next 20 years.

Implementation of the recent National Spatial Strategy (NSS) plan may also impact on future population distribution within Ireland. The Group has noted that the intention of the NSS is 'to provide for the first time an explicit overall national framework for dealing with spatial issues, within a sustainable national economic and budegtary context and within an island of Ireland perspective, which can contribute to the enhancement of national competitiveness and a high quality environment'.[XLI] The NSS also aspires 'to improve the effectivenes of public investment in infrastructure and other relevant services around the country'.

Table 4.2: Projected national population for the years 2005, 2010 and 2015 (M1F1 model)

CSO projection	2005			2010			2015		
Age class	Females	Males	Total	Females	Males	Total	Females	Males	Total
0-4	146,291	155,323	301,614	154,559	164,084	318,643	153,740	163,199	316,939
5-9	135,471	144,057	279,528	151,529	160,900	312,429	158,504	168,266	326,770
10-14	133,866	140,827	274,693	139,280	147,279	286,559	154,373	163,260	317,633
15-19	144,336	150,478	294,814	133,200	139,461	272,661	138,520	146,013	284,533
20-24	156,775	161,350	318,125	135,085	138,498	273,583	123,774	128,227	252,001
25-29	164,944	167,159	332,103	160,402	163,216	323,618	136,028	138,112	274,140
30-34	156,831	158,566	315,397	171,184	172,294	343,478	164,515	166,081	330,596
35-39	140,250	138,792	279,042	160,237	161,963	322,200	173,403	174,123	347,526
40-44	139,844	134,406	274,250	142,067	139,831	281,898	161,317	162,215	323,532

[XLI] The National Spatial Strategy – Public Consultation Paper

CSO projection	2005			2010			2015		
Age class	Females	Males	Total	Females	Males	Total	Females	Males	Total
45-49	130,769	127,882	258,651	141,049	135,809	276,858	142,775	140,540	283,315
50-54	120,047	120,713	240,760	130,976	128,122	259,098	140,895	135,655	276,550
55-59	110,090	111,129	221,219	119,633	119,130	238,763	130,222	126,388	256,610
60-64	85,366	84,710	170,076	108,588	106,811	215,399	117,871	114,666	232,537
65-69	71,833	68,025	139,858	82,380	78,322	160,702	104,530	98,579	203,109
70-74	60,367	52,669	113,036	66,074	57,804	123,878	76,049	66,992	143,041
75-79	52,161	36,890	89,051	52,382	39,559	91,941	57,974	44,041	102,015
80-84	39,575	22,491	62,066	40,094	23,144	63,238	41,207	25,354	66,561
>85	30,253	12,831	43,084	34,961	14,289	49,250	38,174	15,535	53,709
Total	**2,019,069**	**1,988,298**	**4,007,367**	**2,123,680**	**2,090,516**	**4,214,196**	**2,213,871**	**2,177,246**	**4,391,117**

Assumptions used in projecting future populations

a. Total fertility rate to increase from its 1998 level to 2.0 by 2010 and remain constant thereafter (F1)

b. Immigration to continue as follows:
   - 15,000 per annum in 2001/2006;
   - 10,000 per annum in 2006/2011;
   - 5,000 per annum in 2011/2031 (M1)

4.3 Patient population projections – 2000 to 2015

The projected numbers of cases were calculated using the CSO population projections to 2015. Projected numbers of cases and of radiation oncology treatments have been calculated for all age groups and separately for those less than 65 years. A number of alternative projections are available, based on predictions of migration and fertility. There is little to choose between these at present in terms of the validity of the predictions and the Group's choice of a projection has been based on the following two factors:

- The difference in numbers of predicted cancer cases as a result of using the different population projections is small, of the order of 2 per cent between the minimum and maximum projections. This is by far the smallest source of uncertainty in the predictions of radiation oncology caseload.
- Given that there was little to choose between projections, and for the purposes of estimating future caseload, the Group used the population projection M1F1, which maximises the predicted number of cases.

Combining the projections for both cancer rates and national population, it is possible to estimate the future cancer burden. Several assumptions have been made in providing this estimate. Three factors contribute to changing cancer patient numbers:

- The absolute numbers of persons in the population
- The age structure of the population
- Individual cancer risk.

Despite the potential limitations, a reasonable assumption is that current trends can be extrapolated a short time into the future. However, the impact of new developments in diagnosis and screening for cancer cannot be easily predicted with the existing modelling algorithms.

4.4 Patient caseload projections

The number of projected future cancer cases has been calculated up to 2015 for a number of selected sites, which are important in relation to the need for radiation oncology services. These include the following:

- All cancer sites combined, +/- non-melanoma skin cancer (NMSC)
- Breast cancer
- Prostate cancer[XLII]
- Rectal cancer
- Lung cancer.

All cancer cases

Table 4.3 shows the expected caseload for all sites combined. A significant increase in the total number of cancer cases is expected, with a 40 per cent increase on a national basis between the period 1994-1998 and 2015. This expected increase is the same whether or not non-melanoma skin cancer or non-malignant cases are included. These expected increases are based on demographic change only, with no expectation of a change in the underlying risk of cancer to the population.

Table 4.3: Estimated future cancer incidence

	New cases 1994-1998					New case projection		
	1994	**1995**	**1996**	**1997**	**1998**	**2005**	**2010**	**2015**
All cancers	19,068	18,683	19,527	19,871	19,846	21,997-22,582	24,175-24,788	26,772-27,417
All malignant cancers	16,964	16,654	17,132	17,342	17,383	19,348-19,898	21,315-21,891	23,713-24,320
All malignant cancers excluding NMSC	11,834	11,534	11,850	12,096	12,324	13,468-13,927	14,833-15,314	16,491-16,998

Note: The ranges provided are the upper and lower limits of the estimates

[XLII] For prostate cancer, a significant incidence trend was noted in the 1994-1998 analysis (see Table 4.1). The annual percentage change in incidence rate for this cancer was applied to the age-specific rates, and a predicted rate for each age group for 2005, 2010 and 2015 was calculated.

When all cancers for all age groups are considered, case numbers are projected to increase by about 7,500-8,000 between 1994-1998 and 2015. The percentage increase in patients is similar when one considers all cancers (invasive and *in-situ*), all invasive malignant cancers, or malignant cancers excluding non-melanoma skin cancer (NMSC) (Table 4.3). After excluding NMSC, for all age groups between 1994-1998 and 2015, the number of cancer cases is projected to rise by just under 5,000 (40 per cent).

Breast cancer

For all age groups the number of cases of breast cancer is projected to increase by approximately 700 patients by 2015 (43 per cent) (Table 4.4). These projections do not take into account any additional effect on breast cancer incidence that may be detected or identified by the national breast-screening programme, BreastCheck®.

Table 4.4: Expected cancer cases 2005 to 2015: breast cancer

Year	Cases	95 per cent confidence limits of estimate	
	Females	Lower limit	Upper limit
1997	1,584		
2005	1,880	1,804	1,974
2010	2,071	1,991	2,170
2015	2,277	2,194	2,382

Prostate cancer

In 1994-1998 there were 1,150 cases of prostate cancer per year (Table 4.5). Prostate cancer is the only major cancer for which incidence rates have increased significantly between 1994 and 1998 (see section 4.0), so the expected increase is larger than would be expected on demographic grounds alone. The number of cases is projected to increase to approximately 1,600 patients in 2015, an increase of 38 per cent.

Table 4.5: Expected cancer cases 2005 to 2015: prostate cancer

Year	Cases	95 per cent confidence limits of estimate	
	Males	Lower limit	Upper limit
1994-1998	1,150		
2005	1,284	1,211	1,351
2010	1,421	1,336	1,483
2015	1,612	1,512	1,669

Rectal cancer

In 1994-1998 there were 487 cases annually of rectal cancer (Table 4.6). By 2015 this is projected to increase to almost 700 cases, an increase of 43 per cent.

Table 4.6: Expected cancer cases 2005 to 2015: rectal cancer

Year	Cases			95 per cent confidence limits of estimate	
	Males	Females	Both sexes	Lower limit	Upper limit
1997	173	314	487		
2005	198	362	560	513	606
2010	219	403	622	572	669
2015	243	454	697	643	746

Lung cancer

In 1994-1998 there were 1,479 cases annually of lung cancer (Table 4.7). By 2015 this is projected to increase to approximately 2,100 cases, an increase of 42 per cent.

Table 4.7: Expected cancer cases 2005 to 2015: lung cancer

Year	Cases			95 per cent confidence limits of estimate	
	Males	Females	Both sexes	Lower limit	Upper limit
1997	507	972	1,479		
2005	570	1,110	1,680	1,598	1,758
2010	626	1,238	1,864	1,775	1,944
2015	704	1,403	2,107	2,009	2,188

4.5 Summary

- The total number of new cancer cases is increasing annually. Some of the increase is as a consequence of a growth in population. However, a significant further increase can be attributed to an ageing population.
- Between 1994 and 1998 the increase in incidence of some cancers was above that expected, as a consequence of age-dependent changes in the national population and/or demographic changes.
- The national population is projected to increase to 4.3 million in 2015 with the proportion of people over the age of 60 years increasing to 18 per cent.
- A 41 per cent increase in the number of cancers is expected between 1994 and 2015, excluding non-melanoma skin cancer.
- There will be a major increase in the number of patients with the more common adult cancers that require radiation oncology treatment, for example breast, prostate, lung, and non-melanoma skin cancers.

Section 5

Models of service delivery

5.1 Introduction

This section of the report provides a synopsis of the group's analysis and consideration of different strands of information that collectively impact on the present and future requirements for radiation oncology services at a national level. These include:

- A review of different models of radiation oncology delivery and the recent experience of other European and western countries in developing radiation oncology services
- A summary of previous recommendations for the development of radiation oncology services in the Republic of Ireland
- The potential generic models of future radiation oncology care delivery as they relate to Ireland
- An initial estimation of the probable capital and staff costs associated with different radiation oncology service models
- An analysis of models as applied to Ireland.

Earlier sections of the report have documented the development of radiation oncology services in Ireland (section 2) and have identified the estimated future patient caseload that may avail of new enhanced services (section 4). It is clear from this initial analysis that a significant expansion of both treatment infrastructure and trained staff will be the cornerstone of the proposed new service.

A number of critical challenges face the development and organisation of such services, in particular the requirement to address the potentially conflicting needs of delivering sustainable highest quality treatment services and the aspiration to have 'local' rapid access services. Recent developments in radiation oncology technology and clinical practice highlight the trends towards increased sub-specialisation within the discipline. These trends also support the need to develop comprehensive multidisciplinary clinical teams that can address the many aspects of integrated care that cancer patients require. The future development of such teams will depend on appropriate resource allocation and organisational structures that ensure the development of clinical teams with an appropriate critical mass of core healthcare professionals and treatment infrastructure.

5.2 Models of delivery of radiation oncology services – the recent experience of other countries

The following is a short review of the international experience of different models of care. There is considerable variation among European countries, North America and Australia in the national or regional models of radiation therapy delivery.[25,41,42,101,111,112,115,203-206] This is undoubtedly influenced by the historical development of radiation oncology services in individual countries, the geography and specific population distribution of the particular country, a wide range of healthcare management structures, and the public-private balance.[207,208] It is important to note that in certain countries radiation oncology services have been developed for low-density populations, for example in Canada and Norway, living at very significant distances from a major population base, and that in most cases this does not compare with the population density and demographics of Ireland.[88,209,210]

In the last decade many countries have undertaken analyses of international, national or regional radiation oncology requirements.[111,112] A number of authoritative and comprehensive analyses of national requirements have been performed particularly in Sweden, The Netherlands, England and Wales, and Australia.[25,41,42,206,211] In addition certain geographic regions within individual countries have also undertaken analyses of needs, for example two regions within Australia (Western Australia and Victoria).[212] Within Europe, a limited number of systematic analyses of radiation oncology services have attempted to examine the specific relationship

between patient outcome and treatment centre parameters. In addition a number of professional bodies have drafted reports on existing and recommended service provision in their respective jurisdictions, for example the Royal College of Radiologists (UK), the National Health Service (NHS) Executive, the College of Radiographers (UK), and the Association of Cancer Physicians (UK).

5.2.1 United Kingdom (England and Wales)

In 1999 the population of England and Wales was approximately 48 million with a complement of 150 linear accelerators divided over 29 regions. There was a wide variation in the numbers of linear accelerators per centre and the equipment/population ratio.

A comprehensive analysis of cancer care in England and Wales was completed in 1995 under the direction of Dr Kenneth Calman and Dr Deirdre Hine, leading to the publication of the *Calman-Hine Report – A Policy Framework for Commissioning Cancer Services*, and the subsequent formation of several advisory and implementation authorities.[205] The Expert Advisory Group on Cancer (EAGC) was established by the chief medical officers of England and Wales to develop a network of care which would enable the patient, wherever he or she lives, to receive a uniformly high standard of treatment and care.[XLIII] Prior to this report there had been considerable concern in the UK about the potential factors that had contributed to poorer clinical outcomes including the survival rates of certain patient groups.[213] One of the possible contributing factors was a poorly developed and inadequate non-specialist, hospital-based cancer treatment service including radiation oncology. Over a number of decades the quality, range and level of radiation oncology services at many hospitals and regions had declined considerably below that available in other European countries.

The Calman-Hine Report recommended a new structure for cancer services based on 'a network of expertise in cancer care reaching from primary care through cancer units in district hospitals to cancer centres'.[205] Three levels of care were proposed:

- Primary care teams
- Designated cancer units to be created in district general hospitals. These would be of a size to support clinical teams with sufficient expertise and facilities to manage the commoner cancers. It recommended that ideally radiation oncology services should not be sited in these units
- Designated cancer centres which would provide expertise in the management of all cancers, including common cancers, within their geographical locality and less common cancers by referral from cancer units.

The report supported the principle that 'services should be planned to minimise travelling times whilst maintaining the highest standards of specialist care'. One criterion was that in an ideal situation patients should be within one hour's travelling time of their treatment centre where possible/practicable, once this was within the context of the other criteria which had been defined.

Importantly the report also recognised the existing and future complexity of radiation oncology and the recommendations specified that cancer centres rather than cancer units should be the preferred location for the provision of radiation oncology services.[205] The guidelines noted that 'in localities remote from a centre, purchasers would need to consider the case for existing cancer units continuing to provide limited radiation oncology services in close collaboration with a centre'. The report provided additional guidelines for the recognition and classification of a cancer centre. Firstly, the hallmark of a cancer centre was the high degree of specialisation and comprehensive provision of all facets of cancer care necessary for modern cancer management. Critically it noted and supported the earlier recommendation of the London Implementation Group (1993) that:[214]

- Cancer centres be defined as those with eight or more non-surgical specialists to ensure an adequate range of site specialisation
- Centres should serve a population of at least 1,000,000.

[XLIII] Thirty-four cancer networks were subsequently formed within England. The networks have a clear relationship to Trusts, Strategic Health Authorities and Primary Care Trusts. http://www.doh.gov.uk/cancer. http://www.doh.gov.uk/cancer/implementingcancerplan.htm.

The identification of a population minimum was a development of the earlier recommendation of the Royal College of Radiologists that cancer centres should serve a minimum of two-thirds of a million people. The Calman-Hine expert committee also recommended that a cancer centre would normally serve a population of more than one million, but that a population base of two-thirds of a million should however be considered the absolute minimum used as the reference population for new and/or re-structured radiation therapy facilities. In this regard the Calman-Hine Report broke new ground when it recommended networks of cancer care, reaching from primary care to cancer units. Typically a network services a population of around one to two million people. Cancer networks were identified as the organisational model for services to implement the Cancer Plan.[XLIV] The National Health Service (NHS) Cancer Plan was published in September 2000.[215] The goal of the Plan is to bring together health service commissioners and providers, the voluntary sector and local authorities. The Plan has indicated that a rapid development of new treatment equipment and facilities will be implemented, including 45 new linear accelerators,[XLV] in order to treat an extra 12,000 cancer patients.[215]

The report defined the theoretical optimum radiation oncology facility as having the following principal features:

- The size and location of the facility would be determined by a strategic planning process, which took into account the size of the catchment area, the population to be served, the incidence of cancer in the population and the size and location of the adjacent radiation oncology facilities.
- All clinically eligible cancer patients within the facility's catchment area would have access to radiation oncology services.
- All patients requiring radiation oncology services would be treated within waiting time targets of the Royal College of Radiologists.
- Treatment and planning machines would be used at maximum efficiency.
- Staff would have sufficient time to deliver a quality service.
- The effectiveness of the service would be monitored prospectively by measuring clinical outcomes.

The report included the additional important caveat that 'given the large number of combinations of the above variables it is not possible, or appropriate, to attempt to define a specification for an optimum radiation oncology facility in the report'. The report also contained a specific section containing guidelines on the commissioning of future radiation oncology units in the UK and the potential linkages and responsibilities of cancer centres and cancer units.

In 2001 the NHS Estates published a guidance document *Facilities for Cancer Care Centres – Design and Briefing Guidance*.[XLVI] This implementation document provided an outline of the requirements for cancer care centres against the catchment area population and the numbers of new cancer cases expected per year. Accordingly a number of categories of cancer centre are defined:

Table 5.1: NHS Categories of cancer centres

Category	Catchment population	Estimated number of new patients per annum	Special features
A	450, 000	< 1,500	Very small centre No specialised treatment facilities
B	550,000 – 750,000	1,500 – 2,500	Minimum full centre
C	800,000 – 1.5m	2,700 – 5,050	Regional centre
D	1.5m – 3.0m	5,050 – 10,000	
E	2.0m – 5.0m	10,000 – 15,000	

[XLIV] http://www.doh.gov.uk/cancer/cancerplan.htm
[XLV] http://www.doh.gov.uk/nhsplan/npch4.htm
[XLVI] www.nhsestates.gov.uk/publications_guidance/content/introduction.html

Although the Calman-Hine Report and subsequent Expert Advisory Group on Cancer (EAGC) related primarily to England and Wales,[XLVII] there was widespread support for its principles and recommendations throughout Great Britain and within Northern Ireland. It was against this background that the then Department of Health and Social Services in Northern Ireland established a Cancer Working Group to consider how the recommendations contained in the Calman-Hine Report might best be implemented in Northern Ireland (see section 5.2.2 below).

5.2.2 Northern Ireland

The work of the Cancer Working Group led to the publication of a report *Cancer Services – Investing for the Future*. This addressed the future restructuring of surgical, clinical/radiation, and medical oncology services in Northern Ireland.[XLVIII] It recommended the development of a cancer centre located in Belfast and a number of cancer units, working together as a clinical network. Since 1996 clinical cancer services have been significantly reorganised. The report acted as the major catalyst for the redevelopment of cancer services in Northern Ireland and resulted in the development of a cancer centre for Northern Ireland at Belfast City Hospital as well as the development of a network of four regional cancer unit hospitals in Altnagelvin, Antrim, Ulster, and Craigavon Hospitals. The goals of this new clinical cancer service are to co-ordinate cancer treatment, prevention, screening, education, training, and research programmes throughout Northern Ireland and to provide a patient-centred service.

Several major aspects of this programme have been implemented including the opening of cancer units at the above-mentioned hospitals, as well as the development of the cancer centre which is expected to open in 2004. Multidisciplinary specialist cancer teams for the major disease subsites exist at each of the cancer units and the cancer centre and integrated patient care pathways are being developed. Cancer clinical trials are co-ordinated through the clinical trials unit within the cancer centre funded by the Department of Health, Social Services and Public Safety. The goal of this development is a significant, continued improvement in cancer services for people in Northern Ireland, underpinned by high-quality clinical research, teaching and a quality patient-centred environment.

In regard to radiation oncology facilities, the report recommended the transfer of oncology treatment services from Belvoir Park Hospital, a 'stand alone' oncology treatment unit, to Belfast City Hospital – a multidisciplinary tertiary referral university hospital. A further and more recent analysis (2001) has considered future radiation oncology service requirements in Northern Ireland and recommended that facilities at the Belfast City Hospital should include a 10-bunker facility, initially equipped with eight linear accelerators, thereby permitting rapid future clinical service expansion. There is no proposal at present to develop a second treatment centre or a 'hub and spoke' model of service delivery in Northern Ireland.

5.2.3 The Netherlands

The Netherlands has one of the most advanced radiation oncology delivery services in Europe, with a wide range of excellent radiation oncology facilities and a high use of radiation oncology services within cancer treatment programmes.[18,216-219]

The Netherlands has a population of 16.5 million. There are currently 82 linear accelerators nationally divided between 21 hospitals, with a further 42 to be commissioned by 2010. Previously centres in the Netherlands with two linear accelerators were acceptable provided that they were directly linked to a larger department and that the physics staff cover was provided directly by the larger centre where the physicists were employed. This situation is being phased out in conjunction with the implementation of the findings of the 2000 report discussed below.

[XLVII] http://www.doh.gov.uk/cancer/calmanhine.htm
[XLVIII] www.shsscouncil.net/pdfs/Final.pdf

In 1999 the Netherlands Department of Health commissioned an expert multidisciplinary Group from the Dutch Association for Radiotherapy and Oncology (Nederlandse Vereniging voor Radiotherapie en Oncologie – NVRO),[XLIX] to describe the current developments in radiation oncology specifically with a view to aiding future planning and structuring of radiation oncology services.[206] The report recommendations followed an earlier 1993 document (Ontwikkelingen in de Radiotherapie: een behoefteraming voor 1995-2010), which addressed the overall national workforce and equipment requirements for the period 1995-2010. This earlier report did not attempt to identify the optimum or preferred scale of radiation oncology facilities. The more recent 1999 report had a particular remit to recommend the preferred configuration of radiation oncology treatment centres in the Netherlands.

The NVRO attempted to address regional variations and inequity of access in their recommendations. Strong emphasis was placed on the evolving complexity of treatment and the need to reflect this in future planning of service delivery. A revised and unique system of estimating existing and future equipment requirement based on a range of different levels of complexity has been developed. The expert committee of the NVRO recommended that the basic configuration of an 'average' or 'model' department would include four linear accelerators for the treatment of 2,000 patients.[206] In addition the principle of this scale of unit is supported as a strategic goal by both the European Society for Therapeutic Radiology and Oncology (ESTRO) and the European Board of Radiation Oncology (EBRO).

5.2.4 Scandinavia

Radiation oncology services are well developed in a number of Scandinavian countries, particularly Sweden, Norway and Denmark. In Scandinavia the predominant model is medium to large treatment facilities,[L] where geographically remote patients are facilitated with hotel or hostel type accommodation on the site of the major treatment centre.

Sweden

Sweden has a population of 9 million. Seventeen radiation oncology departments exist with a total of 56 linear accelerators. Of these only four departments have fewer than four linear accelerators. At the time of this report, Swedish healthcare authorities are at an advanced stage of producing an updated report addressing the national requirements in radiation oncology.

In 1996/1997 the Swedish Council on Technology Assessment in Healthcare (SBU) published a two-volume description of the existing and future radiation oncology services in Sweden.[41,42] The organisation of radiation oncology in Sweden adheres to a series of regulations, guidelines and recommendations developed by the National Swedish Board of Health and Welfare. A number of governing bodies (particularly County Councils) have responsibility for ensuring that cancer services are delivered. The report contained no specific guidelines on the distribution or scale of future radiation oncology facilities. However, this may reflect the advanced radiation oncology facilities that already exist in the country and the very significant international leadership role that several Swedish radiation oncology treatment hospitals/units have played in the development of radiation oncology technology.

Norway

Norway has a population of 4.5 million, with five health regions. Nationally there are 24 linear accelerators divided between six radiation oncology centres. Radiation oncology service development is restricted by legislation to university hospitals and/or affiliated hospitals. A further expansion of treatment facilities/equipment to a national complement of 36 linear accelerators is due for completion by 2010.[210]

Norway is one of the first European countries to pilot a 'hub and spoke' system for radiation oncology service development, particularly for the north western region of the country that is sparsely populated and a

[XLIX] A translation of the document 'Nederlandse Vereniging voor Radiotherapie en Oncologie (Dutch Association for Radiotherapy and Oncology) Radiotherapy: Our Care – An actualisation of the developments in radiotherapy for the period 2000-2010' was commissioned by the Expert Group.

[L] The majority of radiation oncology centres have high staff/consultant-patient ratios and an equipment configuration greater than four linear accelerators.

considerable distance from major urban centres.[88] The initial satellite centre was developed in 2001 at Kristiansand, linked to the Norwegian Radium Hospital in Oslo.[88] The distance between the two population areas is approximately 1,000 kilometres.[210] A critical element of this pilot development is the co-ordinated development of a sophisticated telemedicine linkage allied to a shared radiation oncology information management system (Oncentra TM) co-developed between the linked institutions.[88] In addition the clinical and support staff at Kristiansand are employed by the Norwegian Radium Hospital in Oslo, which provides services for the local population of 2 million.[LI]

Denmark

Denmark has a population of 5 million, with five radiation oncology treatment centres containing 27 linear accelerators.[LII] There are six radiation therapy departments, each with a minimum of four linear accelerators. In 1999/2000 the purchasing authorities within Denmark decided to increase the number of linear accelerators to 39 units within the next decade.

5.2.5 Canada

In 1997, the population of Canada was 30.2 million. At this time Canada had 28 radiation oncology centres, in nine provinces.[LIII] In eight of the nine provinces the services are provided through provincial cancer foundations, which operate under protected budgets separated from the general provincial healthcare budgets.[209] The total number of megavoltage units was 162 with 121 linear accelerators.[LIV] The total number of consultant radiation oncologists was 234 with an average 273 patients treated per consultant. Collectively the centres treated 63,783 patients. New patients represent approximately 80 per cent of the total number of patients treated except for Newfoundland (65 per cent).

In Canada the structuring of radiation treatment services is the responsibility of provincial governments. The organisation and quality assurance of radiation therapy in Canada is compounded by the complex organisation of the National Health Service which, in principle, is governed by the federal Canada Health Act. A single province has developed a pilot hub and spoke system.[LV] However, the remainder have developed networks of large co-operative treatment centres particularly in the provision of healthcare for geographically remote areas.[209,220-224] It is important to note that the scale of distance of these remote populations is generally in terms of hundreds or thousands of kilometres from a major treatment centre. In addition the scale of the majority of the 'satellite units' is generally larger than the US counterparts.

5.2.6 Australia and New Zealand

Detailed analyses of the radiation oncology service within Australia and New Zealand has been undertaken in the last 20 years with at least 47 reports addressing specific aspects of the system.[10,25,26,98,119-129,225-231] These have identified serious deficiencies in the physical infrastructure and staffing levels required to provide best practice.[25,26,129,232] Radiation oncology services are provided through both public and private sectors in Australia, and all states and territories, with the exception of the Northern Territory, have treatment facilities. In December 2000, services were available from 28 institutions with 99 linear accelerators at 37 sites.[LVI] There were 143.4 FTE radiation oncologists, 771 radiation therapists and 119 medical physicists at this time.[25]

With one exception, radiation oncology service development has been limited to the state capital cities or to other major population centres.[LVII] This decision was based upon standards which indicate that for a radiation oncology centre to be economically and logistically viable it should serve a population of at least one million

[LI] A second satellite unit linked to the Norwegian Radium Hospital has recently been opened at Gjøvik in 2002/2003.
[LII] Twenty-seven linear accelerators in 1999.
[LIII] Residents of Prince Edward Island (population 137,200), the North West Territories (pop 31,600) and the Yukon (pop 67,500) received radiation therapy in adjacent provinces.
[LIV] 5.35 (range 4.0-7.8) megavoltage units per million population.
[LV] The Ontario Ministry of Health announced approval in 2001 for the construction of a single machine treatment delivery facility for the Northeastern Ontario Regional Cancer Centre, Sudbury. The new Sault Sainte Marie unit is 300km from Sudbury and serves a population of 137,000, 80 per cent of whom live within 40km of the proposed site of the treatment facility.
[LVI] Of the 99 linear accelerators, 72 were in the public sector and 27 in the private sector.
[LVII] http://www.racr.edu.au

and should be associated with a major general hospital facility. Recently the Royal Australian and New Zealand College of Radiologists has initiated a discussion/moratorium on the appropriate policies for radiation oncology in rural Australia.[25] In addition several regions with similar dispersed and/or sparsely populated regions, for example Western Australia and rural Victoria, have considered hub and spoke systems and some are at an early stage of analysis and development.[122,212]

The Australian Health Technology Advisory Committee (AHTAC) undertook a major review of the radiation oncology service in 1996 and made a number of recommendations with respect to infrastructure and workforce requirements for a sustainable national radiation treatment programme.[130,228] The AHTAC report noted: 'Radiation therapy services in Australia must expand, not only to compensate for the current shortfall in staff and facilities but also to keep pace with the growing demand for services. The objectives of expansion include the ability to treat increasing numbers of radiation therapy patients, to reduce waiting times for radiation therapy and to improve the accessibility to radiation therapy services'.[228] Additional key recommendations within the AHTAC report included the following:

- Future service planning to be based on a referral rate of 50-55 per cent of new patients
- Minimum equipment requirements for radiation oncology facilities to be revised regularly in light of technological developments
- Progressive expansion of radiation therapy facilities to meet the continuing growth in the need for clinical services
- Increased numbers of radiation oncologist and trainee positions
- Regular review of the requirements for the radiation therapist (therapeutic radiographer) workforce
- Review of the staffing requirements for medical physicists in radiation oncology, the identification of national minimum qualifications for medical physicists, and the introduction of medical physics training posts.

The AHTAC report was endorsed by the National Health and Medical Research Council in 1996, and subsequently endorsed by the Federal Minister for Health and Aged Care.[26]

In 2001 several professional groups in Australia produced a National Strategic Plan for Radiation Oncology, as a progression of the work undertaken by AHTAC in 1996, with two objectives:[LVIII]

- To address the immediate crisis in the radiation oncology sector
- To create a sustainable sector in the future.

A major asset in undertaking their analyses was the availability of extensive databases on infrastructure and workforce.[LIX] The main findings of this very recent analysis were as follows:

- Radiation oncologist, radiation therapist and medical physics workforces were inadequate to meet benchmark levels of service provision.
- The RANZCR determined that 250 new cases per year is the acceptable workload for a radiation oncologist, equating with 8.8 radiation oncologists per million population in 2000, and 9.8 per million in 2005. This required the appointment of 99 consultants by 2010, providing a total of 229 consultant radiation oncologists.
- The ACPSEM determined that 1.7 physicists per machine are required to provide a safe quality service, with a requirement of 307 posts in 2010, an increase of 181 staff.
- The RTAP determined that 1.06 radiation therapists (therapeutic radiographers) per hour of linear accelerator operation are required to provide a safe quality service. This requires the recruitment of an additional estimated 760 staff by 2010 when the projected need is 1,531 full time equivalent (FTE) staff.

[LVIII] The Faculty of Radiation Oncology (FRO), Royal Australian and New Zealand College of Radiologists (RANZAR), Radiation Therapy Advisory Panel (RTAP), Australian Institute of Radiography (AIR) and the Australasian College of Physical Scientists and Engineers in Medicine (ACPSEM).

[LIX] The Radiation Oncology Tripartite Committee (ROTC) designed a survey instrument to measure the amount of existing equipment and the size of the specialist workforce. Additional data collection was already established with surveys of all radiation oncology units in 1986, 1988, 1990, 1992, 1994, 1995, 1997 and 1999 undertaken by the Radiation Oncology Standing Committee. The Royal Australian and New Zealand College of Radiologists conducts a survey of workforce and equipment every two years, and the RTAP conducts an annual survey of the radiation therapist workforce and equipment.

- The number of places in training programmes beyond 2000 for radiation oncologists and radiation therapists were inadequate to meet existing and future needs.
- Training programmes in radiation oncology physics needed to be more formally established and recognised.
- The linear accelerator base was old, particularly in the public sector. One hundred new linear accelerators were identified as necessary to be installed between 2000 and 2005 to meet replacement and expansion requirements, with an additional 71 units by 2010.
- Significant variations existed in the nature of available linear accelerators, particularly with regard to advanced features designed to enhance safety, efficiency, and quality of treatment.

The report highlighted that 'a substantial replacement and expansion programme was necessary to meet benchmark levels of service provision'. The report also provided additional detailed analysis on the age, capacity, operational hours, reliability, and advanced features within the national configuration of treatment units, especially linear accelerators, and recommended norms for meeting the 50-55 per cent patient treatment target. In addition, the report provided details of the age and sex distribution of consultants, radiation therapists, medical physicists, and trainees in these disciplines. A preliminary analysis of potential factors that contribute to staff retention difficulties within the various professional groups was also undertaken.

5.2.7 United States

Decentralised models of care have developed over time in North America.[101,233-237] This has led to a number of different systems of care.[238,239] The majority are relatively loose networks of radiation oncology centres where the co-operative mechanisms relate to either academic–community hospital linkage programmes, hospital groupings facilitated by health management organisations and medical insurance schemes, or large private healthcare organisations.[72] The majority of such networks are a result of recent consolidation of pre-existing hospitals rather than of forward planning of completely new services.[237] In many of these networks it would appear that financial competitiveness in addition to the goal of advancing clinical care are considerable catalysts in such developments.[207,208,240] A considerable variation in the degree of 'independence' of participating institutions exists.[208] The United States radiation oncology community has contributed significantly to the advancement of clinical radiation practice and existing standards of care are frequently excellent in the larger institutions. However, the majority of clinical and scientific advances arising from the United States radiation oncology community have come from the larger comprehensive cancer centres[LX] or co-operative research groups co-ordinated by such centres.[3,115,239]

In the United States the Patterns of Care Study (PCS) was initiated in 1972 to evaluate the quality and demographics of clinical radiation therapy. [22,54,64,114,115,117,203,233,234,241-251] Subsequent patterns of care studies have raised concerns about the quality and outcomes of treatment in small units and decentralised departments. Critically it has also demonstrated that there are significant benefits to be gained both in terms of patient survival and in reduced morbidity if modern techniques and equipment are used.[233] Additional important themes that emerge from the patterns of care studies include:

- Patterns of care are different in teaching and non-teaching hospitals. There was some evidence that university hospitals had better survival rates than general hospitals in certain common cancer types. Not all studies have shown or confirmed this benefit of specialised care but no patterns of care study has ever shown a disadvantage.
- Studies in paediatric and rare adult cancers show consistent advantages to the management of these cancers in specialist centres.
- Data suggest that the provision of cancer care/treatment within specialised centres for certain common malignancies can increase long-term survival by 5-10 per cent.

[LX] National Cancer Institute, Cancer Centers Program. http://www.cancer.gov

5.3 Previous policy on radiation oncology services in Ireland

The early and more recent hospital developments leading to the existing national radiation oncology treatment capacity and service model have been summarised in section 2.

In the late 1990s the DoHC published *Cancer Services in Ireland: A National Strategy* which outlined an initial framework for future oncology service development.[2] This has resulted in a significant investment and expansion of certain treatment areas, in particular the development of regional medical oncology services, the phase I development of BreastCheck®, the symptomatic breast disease report/recommendations, and the pilot phase of a national cervical screening programme. The Strategy did not specifically address or highlight a need for significantly expanded radiation oncology services, apart from the recognition that they preferably function within the context of supra-regional services located within three catchment areas – one each in Dublin, Cork and Galway. In addition, the definition and concept of a supra-regional centre was not fully elaborated. It was suggested that these centres would provide specialist diagnostic techniques and specialist therapies including radiation oncology. In discussing the potential additional expansion of radiation oncology services within the supra-regional framework it was noted that 'there may be merit in developing links with Northern Ireland to explore the scope for co-operation in the provision of radiation oncology services'. In particular, it was noted that 'the larger catchment area that this would offer might provide a case for additional investment'.[2]

5.4 Previous recommendations on models of delivery of radiation oncology – Ireland

In 1995 the Faculty of Radiologists of the Royal College of Surgeons in Ireland submitted a report entitled *Cancer Services in Ireland* to the Department of Health.[252] The report was re-submitted to the National Cancer Forum following its formation in 1997,[LXI] and the following is a summary of its recommendations:

- Twenty-two consultants should be appointed.
- Radiation oncology services would be best provided by the development of radiation therapy services in major comprehensive cancer centres, at the principal population centres, Dublin, Cork and Galway.
- The following distribution of treatment centres should be developed:
    - Either one or two comprehensive cancer treatment centre(s) for Dublin
    - A comprehensive cancer treatment centre for Cork
    - A comprehensive cancer treatment centre for Galway
- The availability of state of the art facilities for the provision of radiation therapy should be a central prerequisite for the development of cancer services.
- The Faculty was opposed to the proliferation of small centres with limited technical and personnel resources. The development of a larger number of cancer centres would diminish the quality and comprehensive nature of radiation therapy facilities available to patients.
- The development of peripheral cancer treatment units served by all oncological disciplines (surgical, radiation and medical) and sited at larger general hospitals within adjacent health boards would provide efficient and reasonable access for the respective health boards.

In 1999 the consultant clinical/radiation and medical oncologists attached to St Luke's Hospital submitted a separate proposal to the DoHC and subsequently to the National Cancer Forum outlining a re-configured 'hub and spoke model' of radiation oncology service for the eastern region of the country, where four additional 1-2 linear accelerator treatment centres would be developed at selected Dublin academic teaching hospitals (DATHs), with a number of aspects of service provision being co-ordinated through linkages to St Luke's Hospital. This submission was considered by the National Cancer Forum and was not deemed to provide an overall equitable solution for a national framework of radiation oncology service development.

[LXI] Proposal for the development of Radiotherapy Services in the Republic of Ireland. Presented by the Clinical Oncology Subcommittee, Faculty of Radiologists, RCSI, to the National Cancer Forum 1999.

The above submissions, along with additional information and the identified need to consider a national plan, were considered by the National Cancer Forum and contributed to the genesis of the existing Expert Group on Radiotherapy Services.

5.5 Generic models of service delivery

On an international basis no one model of radiation treatment service is universally applicable or successful. Individual countries have developed or proposed services that attempt to take account of existing services, future developments, and local issues unique to the specific area, for example:

- Population density
- Existing oncology service development
- Strategic plans for other partner oncology services
- Transport infrastructure.

In considering service development in Ireland it is evident that the future scale of new services envisaged by the Expert Group is significantly greater than the known planned expansion of existing public and private facilities, and cannot come about solely by the minor expansion of existing treatment facilities. The scale of development provides a unique opportunity to establish a national co-ordinated service plan. In addition, and by virtue of the need for very significant investment in modern treatment facilities, there is a particular opportunity to capitalise on the development of state of the art facilities that address all the needs of patients, in particular the provision of the highest quality care.

The issue of patient access is a significant factor in many published reports that consider the development of radiation oncology services.[25,26,42,71,114,221,223,253-257] This has also been a major issue of concern for the Expert Group. A key challenge for the future development of radiation oncology services is to address the various dimensions of service provision which influence patient access and to ultimately balance the potentially conflicting aspirations of bringing 'the service to the patient' or 'the patient to the service'. The Group was particularly conscious that patient access to a new national radiation oncology service was a larger issue than that of simple geographic proximity. In this regard the Group commissioned two bodies of research to aid the analysis of patient expectations in this area in Ireland:

- A study on patient access to potential treatment services undertaken by the Small Areas Health Research Unit (SAHRU) at the Department of Community Health and General Practice, Trinity College Dublin[LXII]
- A study of patient views on radiation therapy services undertaken by the Institute of Public Administration (IPA) and the Royal College of Surgeons in Ireland (RCSI).

The context of the SAHRU study is further discussed in this section and the results of both studies are documented in section 7.

5.6 Models of delivery of radiation oncology – model options

There are a number of possible healthcare 'models' that would increase the distribution and availability of radiation therapy treatment units around the country.[LXIII] At its simplest the spectrum of infrastructural solutions include the following options:

- Model A: The development of larger radiation oncology treatment centres with a consequent relative concentration of treatment resources
- Model B: The development of an increased number of smaller radiation oncology treatment centres
- Model C: A mix of large and small radiation oncology centres that may operate in a linked manner.[LXIV] This is sometimes referred to as a 'hub and spoke' model.

[LXII] Department of Community Health and General Practice, Trinity College Dublin
[LXIII] The expert group looked at 19 different configurations/models of radiotherapy treatment provision.
[LXIV] Many different forms of linkage exist.

Model A: the larger centre model

This model consists primarily of the development of large treatment centres with a high level of sub-specialisation of clinical and other staff. Such centres typically exist either as large comprehensive cancer centres or as large clinical units incorporated into larger multi-specialty hospitals.[69] Centres of this type may also function within clinical networks. Such centres exist in Europe, North America and Australia and extensive guidelines on the range of clinical facilities in this type of treatment facility have been identified in World Health Organisation (WHO), National Cancer Institute (NCI),[LXV] and other recommendations.[69,239]

Larger centres generally have the ability to treat all malignant conditions, including rare cancers, and this tends to support the development of very high levels of expertise across all areas of radiation oncology and may be linked to improved outcome. By virtue of scale and anatomic site sub-specialisation, quality systems and protocols are easier to develop and standardise, as are continued professional development (CPD) and continued medical education (CME) programmes for clinical and non-clinical staff. This model traditionally has developed at large urban population centres. The strategic development of such centres was also a major recommendation within England and Wales in the Calman-Hine Report. Guidelines for potential attending populations for such centres typically suggest a minimum catchment population of two-thirds to 1 million.

In Ireland, this model could translate to a clinical network of large treatment facilities, each with more than six treatment units developed according to their caseload requirement, located at a number of major cancer treatment hospitals. It is possible that such units would function within the responsibility of supra-regional services.

The advantages and disadvantages of this approach can be summarised as follows:

Advantages of Model A

- The development of specialist clinical teams with either tumour site-specific or technology-specific expertise (e.g. complex 3-D conformal, intensity-modulated radiation treatment, paediatric oncology, stereotactic radiosurgery, brachytherapy, radio-immunoisotope treatment)
- The development of more extensive integrated multidisciplinary teams as a consequence of greater resources in other clinical disciplines. This has a positive impact on the management of all cancers but particularly in regard to co-ordinating specialist services, for example pre-operative treatment protocols, reconstructive and other specialist surgical services, patient support services including psychological medicine and rehabilitation
- The more rapid implementation of new radiation technologies. New technology developments are frequently introduced on a limited range of treatment equipment often as a consequence of initial expense and to permit clinical training of staff[LXVI]
- A greater ability to accommodate unscheduled downtime with the minimum interruption of patient treatment
- A greater capacity for ongoing research and development. This generally arises as a consequence of greater clinical caseload within individual tumour sites, the development of clinical sub-specialistion, access to the latest treatment technology and a more frequent opportunity to synergise with basic science and translational research groups
- An increased ability to provide the necessary education programmes and infrastructure for the training of radiation oncologists, radiation therapists, medical physicists and oncology nurses that meet national and international accreditation standards
- A potential reduced initial building cost[LXVII] and lower ongoing operating costs as a consequence of reduced staff requirements per patient treated.[258]

[LXV] National Cancer Institute, Cancer Centers Program. http://www.cancer.gov
[LXVI] Recent examples of new technology in radiation oncology include intensity-modulated radiation treatment (IMRT), inverse treatment planning, and amorphous silicon electronic portal imaging devices.
[LXVII] The eventual construction and equipping costs have many significant local factors that ultimately have a significant impact on total cost.

Disadvantages of Model A

- Reduced geographic proximity to the treatment service for some patients and as a consequence the need to develop additional hostel/low-cost accommodation services for those patients/families unable to attend as day cases
- The need to develop a more comprehensive 'cancer' transport system
- Scarcity of space/sites in existing large hospitals for the building of such centres.

Model B: the small centre model

This model supports the delivery of radiation oncology services at an increased number of smaller treatment facilities, for example where each unit would have 1-3 linear accelerator treatment units. In Ireland this model could be exemplified by the development of small treatment centres adjacent to either existing or planned 'regional' oncology services.

The advantages and disadvantages of this approach can be summarised as follows:

Advantages of Model B

- In comparison to the large centre model, closer proximity and local availability of some of the radiation oncology services to the area of patient domicile for a greater percentage of patients
- Greater potential for onsite availability/presence of consultant radiation oncologists at smaller hospitals within certain health board regions
- The possibility that some components of multidisciplinary care would be available at a larger number of centres
- Improved patient access for palliative radiation oncology services for some patients by virtue of closer geographic access, especially when patients are too unwell to travel very long distances
- The more ready availability of potential building space/sites because of the reduced scale of proposed treatment centre.

Disadvantages of Model B

- The increased difficulty in developing multidisciplinary teams and radiation oncologist sub-specialisation
- A very limited capacity to absorb equipment failures, particularly through a lack of capacity to shift patient loads to other treatment or planning equipment in-house. In order to avoid the possibility of significant alterations in treatment, smaller centres can only minimise this by incorporating inbuilt redundancy of equipment and personnel so as to provide continuous cover
- The need to have less common and/or complicated cancer conditions referred on to the larger centres
- A reduction in the 'critical mass' of the radiation oncology team
- The greater difficulties in maintaining CPD and CME and the associated risks of intellectual isolation and difficulties in attracting staff
- More limited infrastructure necessary to support education programmes in medical and paramedical staff training that meet national or international accreditation standards
- A more limited capacity to introduce new radiation technologies. New technology developments have generally been introduced on a limited range of treatment equipment because of initial expense, along with the difficulty of clinical training for staff with associated low patient caseloads
- Difficulties in the retention of an adequate range of suitably skilled radiation oncology staff particularly for clinical treatment programmes associated with significant increases in the technological complexity, e.g. head and neck protocols, 3-D conformal, intensity-modulated radiation treatment
- Increased overall national expense in initial construction and equipment costs, and in continued service provision due to the replication of certain specialist support services, e.g. mould room, physics, engineering
- Risk of reduced access for patients to clinical trial participation.

Model C: hub and spoke model

This model is an amalgam of large and small centres. The final configuration of services and operational linkages is very dependent on the actual mix and integration of such units. A critical requirement of this model is the necessary development of functional linkages between institutions and networks in small and larger treatment centres, for example where clinical and support staff are centrally employed at the larger institution, with staff rotations. Linkages and clinical care pathways/protocols would be expected to exist between centres in the hub and spoke model, and the utilisation of telemedicine technologies is an important element in facilitating the functional operation of such a system. [88,257,259-261]

There is no international agreement on the 'minimum scale' for the smaller treatment unit in such a model. The Calman-Hine Report refers to the preferred location of radiation oncology facilities in the large cancer centres in terms of providing services for a minimum population of two-thirds of a million,[205,262] whereas the recent recommendations from The Netherlands indicate that a basic department should contain a minimum of four linear accelerators.[206]

The advantages and disadvantages of this approach can be summarised as follows:

Advantages of Model C

- Closer proximity of radiation oncology services to the area of patient domicile for some communities. However, this is very dependent on the specific population density of the region in question
- Greater access to certain central resources located at the larger centre, with consequent benefits. The degree of benefit is proportional to the strength of linkages between the respective institutions
- Reduced travel time for some patients
- The creation of additional linkages between the radiation oncology and other oncology services
- Improved patient access for palliative radiation oncology services for some patients by virtue of closer geographic access, especially when patients are too unwell to travel very long distances.

Disadvantages of Model C

- Inherent restrictions in the range of treatment programmes that can be provided. It is therefore critical that approaches to patient management optimise the appropriate selection of patients for treatment at either the larger or smaller centres in such a linkage
- A possible dependence on a larger centre for staff educational CPD/CME programmes, quality assurance programmes, access to specialised treatment procedures and clinics, protocol development and research and development programmes
- A sense of isolation for some staff members in terms of ongoing education and training and experience in complex treatment procedures
- Difficulty in the deployment of staff within smaller centres, particularly as sub-specialisation develops in radiation therapy and medical physics
- A sense of a lack of continuity of care on the part of some patients as components of their clinical management are transferred to different medical/surgical specialties and/or locations.

In conclusion, Models A and C appear to indicate further consideration for development of the future national treatment requirement. There appears to be no significant advantage in considering Model B and it is not discussed further. The Group examined the perceived advantages and disadvantages of Models A and C when applied to a number of different configurations of centre size, location and predicted future patient caseload within Ireland. Several parameters were assessed in comparing the model options, including the following:

- **Standard of care and effectiveness** – including the ability to provide the highest standard of care in conjunction with providing an effective model to embrace research and development opportunities and integration with other clinical disciplines, access and training
- **Equity** – acknowledging the need to provide solutions that enable the maximal access to quality services at a national level
- **Responsiveness and flexibility** – taking account of the foreseeable clinical and technological developments in the discipline

- **Safety** – recognising the recent significant increase in treatment complexity and the immediate technological advances that will further develop this, along with the need for rigorous quality assurance and risk management programmes
- **Efficiency** – in particular the maximal use of a highly specialised workforce required for modern radiation therapy
- **Integration of service development** – taking note of existing service developments in oncology
- **Acceptability** – to both patients and healthcare professionals
- **Affordability/Cost**

Analysis of travel time and distance to radiation oncology treatment centres – the SAHRU study
The issue of geographic access and proximity to a radiation oncology treatment centre has been a significant issue for patients, their families and carers, and healthcare professionals mandated with providing organisational and clinical components of radiation oncology care. The intrinsic difficulties associated with the provision of an increasingly complex clinical treatment to population areas that are remote from urban areas and/or sparsely populated regions are not unique to Ireland, but have equally taxed the organisational capacity of healthcare providers worldwide, particularly in Scandinavia, rural Australia and Canada.

In order to analyse this problem the Group commissioned the Small Areas Health Research Unit (SAHRU) at Trinity College Dublin to undertake a study examining the estimated travelling times and distances in the context of a number of potential models of service delivery. The radiation oncology service models considered in this study encompassed the following permutations of centre development:[LXVIII]

- Treatment provided by the existing centres at St Luke's Hospital, CUH, and UCHG
- Treatment provided by the existing centres at St Luke's Hospital, CUH, and UCHG plus the addition of a new treatment centre in the Eastern Region
- Treatment provided by the existing centres at St Luke's Hospital, CUH, and UCHG plus new units at either the SEHB, or the MWHB or both
- A network of one, two, three or four 'satellite units' in the Eastern Region at existing University Hospitals linked to St Luke's Hospital in conjunction with developed facilities at CUH and UCHG
- All configurations of the potential network of one, two, three or four 'satellite units' in the Eastern Region linked to St Luke's Hospital in conjunction with CUH and UCHG plus new satellite units at either the SEHB, the MWHB or both the SEHB and MWHB.

The full study methodology and results are provided in Appendix 3. The study did not attempt to analyse any additional factors that can influence patient proximity and/or individual patient choice in attending a treatment centre, for example the potential closer access of patients to a centre through family or friends, the particular circumstances requiring patient attendance at a specific treatment centre, or patients with special needs.

The major patient group that the study attempted to measure in terms of travel time and/or distance was those individuals and/or families who attend as day cases. The impact of travel is less for those patients who require admission to the hospital as part of their treatment protocol. With existing treatment protocols the range of treatment attendances vary from a single or low number of visits (generally less than five attendances for palliative patients) to 35-40 daily attendances for selected high-dose curative intent protocols (see section 1).

The key results of the SAHRU study are as follows:

- As expected, the provision of a larger number of treatment centres would enable a greater percentage of patients to live in closer proximity to a treatment centre.
- The potential development of a more restricted number of sites would require the development of innovative transport solutions and additional new inpatient and hotel/hostel accommodation for a greater percentage of patients and carers.[LXIX]
- In regard to the Eastern region and the anticipated catchment areas, there was no significant demonstrable difference in estimated travel time or distance for populations accessing any of the potential radiation oncology centre locations that have been modelled.

[LXVIII] Nineteen different combinations of centre location were identified and studied.
[LXIX] Low cost hotel/hostel accommodation is widely used within European countries and Canada to provide appropriate accommodation for the majority of patients attending for inpatient care.

5.7 Indicative capital and revenue costs associated with models of service delivery

Delivery of a high-quality radiation oncology service requires significant initial investment in a range of treatment equipment and accompanying infrastructure.[208,256,258,263,264] This investment requires multi-annual budgeting and a cyclical replacement of treatment equipment. The total cost of the initial investment in upgrading radiation therapy services is undoubtedly a factor that must be taken into account when comparing different model options for future care delivery.[134,221,240,258,265-268]

There are a number of costing configurations outlined in this section related to the following:

- The total value of both capital and revenue costs associated with differing numbers of linear accelerators in each treatment centre. Capital costs include the construction of buildings, the purchase of linear accelerators and the provision of accommodation support for patients
- Patient accommodation. This will include a variety of bed types from high support units to low support hostel type arrangements. The exact configuration of accommodation will depend on the patient casemix attending the radiation oncology services and may differ between urbanised and rural catchment populations
- The details of revenue costs associated with each category of staff.

Table 5.1 provides a range of indicative capital costs associated with the development and configuration of a range of treatment centres where the number of linear accelerators acts as a surrogate marker for radiation oncology treatment centre size. Total indicative capital costs range from €34.77 million for a 4-linear accelerator centre to €92.12 million for a 12-linear accelerator centre. Comparison shows significant cost savings associated with different model developments in favour of large centre versus small centre models. Larger centres will not only require dedicated patient accommodation facilities but also more flexible accommodation structures to allow for changing patient demands for high and low support care. International analysis and/or recommendations of required bed capacity for the provision of radiation therapy are limited in number.

In 1979 the UK Department of Health and Social Security (DHSS) proposed a minimum of 50 beds per million population.[269] A separate UK study also recommended at least 50 beds per million UK population with full nursing support.[270]

In 1987 the Super-Specialty Services Working Party of the Australian Health Ministers Advisory Council concluded that 40 dedicated inpatient beds per million population were required, provided additional hostel accommodation was available.[26,271] In 2001 Wigg reported on behalf of the Radiation Oncology Workforce Committee that in order to provide treatment for the 50 per cent target population, 43 radiation therapy inpatient beds per million population would be required.[26]

In 1996 the European Organisation for Research and Treatment of Cancer (EORTC) surveyed 50 radiation therapy centres and found that the total radiation therapy and brachytherapy beds available was between 20 and 35 per 900-1200 new cases.[112]

The recent and expanding development of combined modality treatments for a number of common cancers, previously highlighted in section 3, may also impact significantly on the requirement of inpatient beds,[LXX] because of the increased acute toxicity associated with these new protocols. It is increasingly evident that a higher percentage of patients receiving this form of treatment will require either planned or emergency admission. As a consequence there will be a need for continued monitoring of bed requirements.

[LXX] Combined modality treatment protocols are now used as the standard of care in the management of lung cancer, rectal cancer, oesophageal cancer and head and neck cancer.

A detailed analysis of actual bed requirement for the Republic of Ireland undertaken by the Group has not been possible. The number of beds attached to a specific treatment centre will require detailed review of the caseload, transport arrangements and patient access solutions that are relevant to the particular proposed location and patient catchment area. Estimates for patient accommodation for 4 to 12 linear accelerator facilities are provided below in Table 5.2 as an illustration of the potential bed requirement for centres of this size. However, it is strongly emphasised that the exact accommodation needs and costs are dependent on a range of complex issues including patient case-mix, and access and complexity of treatment. The existing data suggest that a minimum requirement of 250-300 dedicated inpatient beds with additional hostel beds should be an initial national bed capacity target.

Table 5.2: An illustrative indication of the estimated range of costs associated with the construction and equipping of different sized treatment centres (2002 costs)

Summary of costs (€M)

Radiation therapy facilities	**4 Linear accelerator**	**6 Linear accelerator**	**10 Linear accelerator**	**12 Linear accelerator**
Construction, fees	12.99	18.13	24.22	29.28
Equipping	13.47	17.42	25.86	30.77
Total	**26.46**	**35.55**	**50.08**	**60.05**
Patient accommodation	30 bed+ 30 hostel	60 bed+ 60 hostel	90 bed+ 90 hostel	120 bed+ 120 hostel
Construction, fees	8.08	15.57	23.36	31.15
Equipping	0.23	0.45	0.68	0.92
Total	**8.31**	**16.02**	**24.04**	**32.07**
Total	**34.77**	**51.57**	**74.12**	**92.12**

It should be noted that the scaling of beds from from a 4 linear accelerator to a 12 linear accelerator facility is not linear. A larger 'pro rata' number of beds has been modelled for the 10-12 accelerator facilities to cater for their probable larger geographic patient catchment area and their ability to have a larger throughput of patients. As centres reduce in size there is a more limited capacity to absorb equipment failures, particularly through a lack of capacity to shift patient loads to other treatment or planning equipment. In order to avoid the possibilty of significant alterations in treatment, smaller centres minimise this by incorporating inbuilt redundancy of equipment and personnel in order to provide continuous cover.

Facilities costing assumptions

- The facilities provided at a treatment centre are arranged in four categories dependent on their functions, treatment, diagnostic and planning, general support and patient accommodation.
- Treatment facilities include linear accelerators, high dose rate brachytherapy, and orthovoltage radiation protected bunkers, associated control areas, sub-waiting and changing cubicles.
- Diagnostic and planning facilities contain simulator, CT simulator and associated control areas, changing cubicles and sub-waiting, mould room, treatment rooms, consultant suites, treatment planning, physics and mould room workshops, quality assurance and equipment stores.
- General support accommodation includes reception and main waiting, family suite, offices for consultants, physicists, radiation therapists, nurses and administrative staff.
- Patient accommodation facilities include standard ward accommodation and self-contained hostel units.
- Costings assessment base date: 2002.

For illustrative purposes revenue costs are presented below for medical, nursing, radiation therapy, medical physics, and administrative staff typically involved in the delivery of treatment. These costs assume a number of factors such as senior and basic grade personnel and locum and out of hours cover. It should also be noted that the costings presented in Tables 5.3 and 5.4 cover only the core disciplines associated with the radiation oncology treatment process. A number of other services are provided in association or in addition to radiation oncology treatments. For example, the radiation oncology service will require access to a liaison psychiatric service, a counselling/psychology support service, dietetics and where appropriate a complementary therapy service. Pastoral care is often provided as a special service or as part of the normal general hospital services.

Table 5.3: Radiation therapy unit – indicative staff numbers and revenue costs (€M)

	4 linear accelerator	**6 linear accelerator**	**10 linear accelerator**	**12 linear accelerator**
Radiation oncologist and medical support	3-4 8	4-6 12	6-8 18	8-10 24
Radiation therapist	43	51	82	90
Physics staff	20	27	36	39
Nursing staff (Radiation oncology centre)	5	6	8	9
Administrative and support staff	11	18	26	29
Revenue €M	**7.36**	**9.60**	**14.48**	**16.37**

The exact number of staff required will depend on a variety of factors that influence the activity level of the centre (see sections 6 and 9). These include the patient caseload, case-mix complexity, the provision of special radiation treatment procedures and the training/ accreditation status of the hospital department.

Table 5.4: Patient accommodation – indicative staff numbers and revenue costs (€M)

	4 linear accelerator	6 linear accelerator	10 linear accelerator	12 linear accelerator
Nursing (30 bed wards)	23.5	46	69.5	93
Administrative and support staff	9	16	24	32
Nursing (Hostel)	8	15	23	31
Administrative and support staff	6	7	11	14
Revenue €M	**2.3**	**4.4**	**6.7**	**8.9**

It should be noted that the scaling of beds and indicative staff numbers from a 4 linear accelerator to a 12 linear accelerator facility is not linear. A larger 'pro rata' number of beds has been modelled for the 10-12 linear accelerator facilities to cater for their probable larger geographic patient catchment area and their ability to have a larger throughput of patients. The exact number of staff required will depend on a variety of factors that influence the activity level of the centre (see sections 6 and 9). These include the patient caseload, case-mix complexity, the provision of special radiation treatment procedures and the training/accreditation status of the hospital department.

5.8 Analysis of models as applied to Ireland

The proposed service development plan must be capable of addressing the major challenges that will face new treatment centres and in particular must be capable of providing sustainable solutions that will ensure the highest standards of care for a period of decades. The latter is a critical concern as the forthcoming development of new radiation oncology services, by virtue of the anticipated initial costs, construction complexity, and expected duration of working life, will determine the future clinical standard of care for a minimum period of 20 years and probably longer. The national solution must therefore not only improve existing standards of care, but perhaps more importantly be configured in a way that provides maximum opportunity to address the anticipated and unrecognised elements of future radiation therapy provision.

The immediate challenges that need to be addressed by the first phase of radiation oncology service development include the following:

- A structure and service model that will enable the rapid development of clinical and tumour sub-specialisation among consultant radiation oncologists. A critical clinical gain from this advance will be the development of teams of consultant radiation oncologists based primarily at the treatment centre, capable of providing future specialist care for the majority of common adult cancers. Each of the consultants will have developed the clinical skills and competencies required for the management of a range of cancers. The new expanded treatment service will permit the development of this more specialised role rather than the present system where consultants have functioned by virtue of suboptimal staff numbers as 'generalists'
- The development and appropriate utilisation of new radiation treatment technologies at the new centres
- The development of a sufficient scale of resources that will permit the development of extensive multidisciplinary teams including the complete range of medical and appropriate paramedical disciplines

- The integration of modern standard of care radiation therapy within a rapidly changing and evolving multidisciplinary care environment that is likely to see additional sub-specialisation in the other major treatment modalities of surgical and medical oncology.

In considering future service models there are implicit dangers in defining a preferred treatment centre size where the human resource /staffing numbers and equipment infrastructure become the rate limiting factors for advancing clinical care.

It is difficult to unequivocally verify a 'maximum' or 'optimal' size of radiation oncology treatment unit beyond which the quality of clinical care deteriorates.[30,69,205,213,239] The group has noted, however, that the majority of large centres in Europe, North America and Australia tend to have a leading role in new treatment development within radiation oncology and in addition have had major roles in defining the 'standard of care' for many cancers. There are a number of complex inter-related factors contributing to this, including access to greater resources, stronger linkages to universities and other research and educational groups, and increased competitiveness in receiving support from national and international grant awarding authorities. Larger centres frequently have the additional advantage of enhanced competitiveness in developing partnerships with advanced technology groups and the pharmaceutical and biotechnology sectors.

A parallel question in considering the future radiation oncology service model and configuration of treatment centres for the Republic of Ireland remains the uncertainty over the 'minimum' centre size that will provide the highest quality of care and that will also support the anticipated developments in radiation oncology as outlined in section 3. It is not possible to state a minimum size of facility below which the quality of clinical care falls. However, there is unequivocal evidence in other oncology disciplines that outcome measures including survival are linked to individual practitioners and institutions having a critical mass of patients so as to maintain and advance clinical care.[272-280] The US patterns of care studies have also highlighted their preliminary concerns over small radiation oncology treatment centre size and the potential relationship to poorer clinical outcomes.[22,114,115,233] A separate study has raised concerns about the 'joint venture' model of care within the USA.[208] In some countries small treatment units have been developed but in general this is a consequence of specific communities having a degree of geographic isolation that is not evident in Ireland, for example in Scandinavia.[25,26,88,127,129,210,233] In other situations where private healthcare systems dominate, small centres have been developed in a free market environment where overall planning of a comprehensive service at a national level has not been a requirement.[26,63,229,240]

The Group has concerns regarding the long-term viability of small radiation therapy treatment centres as a major component of the proposed clinical network of facilities that will form the 'backbone' of the future national service within the existing Irish healthcare environment. These concerns are based on the following factors:

- The development and appointment of consultant radiation oncologists and other medical staff with tumour site-specific skills would be extremely limited. This would restrict the quality and delivery of clinical care that has become the norm in all advanced cancer treatment programmes worldwide.
- Similar restrictions in tumour site-specific skills would also very likely be the case in the other healthcare professional groups, particularly radiation therapy and oncology nursing.
- There remains uncertainty over the ability of smaller units to appropriately implement the anticipated future changes in technology, given the evolving nature of radiation therapy delivery and complex treatment planning. Several factors contribute to this uncertainty including insufficient caseload to maintain clinical expertise in the use of complex treatment techniques, staff training, quality assurance and risk management strategies.

- Smaller centres would invariably be restricted to a more limited range of less complex radiation therapy procedures, and as a consequence might suffer in terms of the public perception of being more limited in clinical skills development. It is also likely that smaller centres would be more limited in acquiring new treatment technologies due to the intrinsic costs and the potential overlap with similar services developed and available in larger centres with an increased patient caseload. These factors would tend to promote a hierarchical service introducing a considerable risk of smaller centres ultimately being viewed as less capable.
- Considerable uncertainty exists as to whether small centres would meet the existing and anticipated National/European accreditation standards for training programmes in radiation oncology, radiation therapy, medical physics, and oncology nursing, thereby limiting the staffing potential and vibrant development of such centres. It is difficult to envisage a dynamic development of clinical radiation therapy that is bereft of undergraduate and postgraduate training programmes in the key healthcare professional groupings.
- There have been significant difficulties in recent years within the Irish healthcare workforce in maintaining appropriate technical, physics, engineering and IT support for radiation oncology services. This is a particular concern given the predicted staffing arrangements in these disciplines and the existing limited Irish base for all major radiation oncology treatment equipment vendors.

In considering these issues, and taking account of the most recent trends, analyses and recommendations in this area, the Group has formed the opinion that in order to optimally address the identified deficiencies and the future clinical needs over the next 1-2 decades, the initial phase of radiation therapy service development should be a rapid expansion of additional treatment capacity. This would be best developed in the context of a clinical network model, where new treatment centres have appropriate staff and equipment resources based around a minimum 4-6 linear accelerator treatment capacity.[LXXI] This does not mean that every centre should be of this exact size, rather it is the indicative minimum size of treatment facility that will function at an appropriate level for the majority of patients with commonly occurring cancers and where the anticipated care provision will be equivalent to that being delivered at larger facilities within the Republic of Ireland and at an international level. Dr L. Grogan and Mr G. Watson held a different opinion from other members of the Group regarding the conclusions to be drawn from the relative advantages and disadvantages of the models described in section 5.6. However, the predominant view of the Group is that the greatest opportunity for success is through the initial co-ordinated development of larger treatment centres that must provide appropriate outreach services to other hospitals in a partnership model.

In summary, the shortfall of clinical radiation oncology services in the Republic of Ireland is of such a magnitude that a major programme is required to rapidly develop treatment services to acceptable modern standards. The initial imperative in this development is to provide services of the highest standard to all patients who require such facilities.

[LXXI] As discussed before, the numbers of linear accelerators can be used as a simple demonstrator of facility size. It is important to note that the treatment equipment configuration of any centre will contain a much more extensive range of diagnostic, treatment planning, and treatment equipment than 4-6 accelerators.

5.9 Summary

- A number of different models of radiation oncology service provision exist in Europe, North America and Australia.

- In the last decade comprehensive national reviews of cancer services including radiation oncology have been performed in England and Wales (Calman-Hine Report), Northern Ireland, Sweden, The Netherlands, Canada and Australia.

- The majority of these reports acknowledge the significant increase in the technological and clinical complexity of modern radiation oncology and the critical need to ensure appropriate structures to provide the existing and future standard of care.

- Dr L. Grogan and Mr G. Watson held a different opinion from other members of the Group regarding the conclusions to be drawn from the relative advantages and disadvantages of the models described in section 5.6.

- The predominant view of the Group is that the greatest opportunity for success is through the initial co-ordinated development of larger treatment centres that must provide appropriate outreach services to other hospitals in a partnership model.

- The costs associated with this development will be significant and there are complex cost benefit and cost utility elements that are important in examining the options that will provide the highest quality service for the maximum number of patients.

- Given the magnitude of service development there is a need to consider an element of prioritisation particularly in regard to short, medium and longer-term objectives. Nevertheless there will be a clear requirement to put in place the major elements of the national service plan within the forthcoming decade.

- The estimated capital costs for constructing and equipping the treatment centres ranges from €34.77m for a 4-linear accelerator treatment centre to €92.12m for a 12-linear accelerator treatment centre.

- The indicative revenue costs for the treatment centres range from €7.36m for a 4-linear accelerator treatment centre to €16.37m for a 12-linear accelerator treatment centre. In addition, the indicative associated patient accommodation costs range from €2.3m for a 4-linear accelerator treatment centre to €8.9m for a 12-linear accelerator treatment centre.

Section 6

Analysis of staffing requirements

6.1 Introduction

In this section the Group has examined the existing staffing levels of a number of professional groups involved in the delivery of radiation therapy, particularly radiation oncologists, radiation therapists, medical physicists and oncology nurses. The Group has in addition reviewed the following:

- The international comparisons and recommendations on staffing in the above groups
- The training pathways for the above professional groups.

The Group has taken into account that the work of the National Task Force on Medical Staffing may well have a significant impact on its recommendations (see section 9).

High-quality radiation oncology requires the close co-operation and expertise of individuals drawn from various professional and other groups. The resulting multidisciplinary team requires an appropriate mix of skills and knowledge and the maintenance of expertise by each individual member of the team. The individual responsibilities of team members are interdependent and collectively enable delivery of the clinical radiation oncology service.

It is acknowledged that a more extensive team of healthcare professionals is necessary for the appropriate delivery of modern radiation therapy. However, the Group's analysis has concentrated primarily on radiation oncologists, radiation therapists, physicists and nursing staff. A more extended analysis of other healthcare professionals was outside the terms of reference of the Expert Group.

6.2 Medical staff

Radiation oncologists are the clinical group that takes primary responsibility for the prescribing of radiation therapy to cancer patients.[LXXII] The title and training pathways of this clinical specialty have recently been reviewed by Comhairle na nOspidéal.[4] 'Radiation Oncology' is the new specialty designation recognised by the Medical Council for listing of individuals on the specialist register, and the award of the certificate of completion of specialist training (CCST).

In the past, alternative professional descriptors, including radiotherapist and clinical oncologist,[LXXIII] have been used by various regulatory bodies to describe the discipline and have also been used in the description of consultant posts.

The postgraduate training programme in radiation oncology is regulated by the Faculty of Radiologists of the Royal College of Surgeons in Ireland (RCSI).[LXXIV] The training scheme is consistent with training programmes in Canada, the US and Europe.[111,235,238,281-286] The training programme has existed for over two decades and successful candidates from the programme have generally proceeded to additional higher specialist training outside Ireland.[LXXV] Previous trainees have subsequently taken up consultant level posts in Ireland, the UK, Europe, Canada and the USA. The training programme has recently been granted specialist registrar (SpR) status (June 2002), with a new proposal for a 2-year post-fellowship (FFR) higher training period.[LXXVI] The SpR

[LXXII] 'A consultant radiation oncologist is expected to possess clinical competence in oncology and technical proficiency in the therapeutic uses of radiation. The radiation oncologist has a sound background in the sciences basic to the understanding of malignant disease and its treatment by radiation therapy and other modalities. The specialist in radiation oncology possesses clinical skills in patient assessment and management and has responsibility for the care of both hospitalised and ambulatory patients. They have proficiency in planning and executing radiation treatments utilising external beams, intracavitary and interstitial radioactive sources, and radionuclides' (Comhairle na nOspidéal document on Review of Roles, October 2000).

[LXXIII] This descriptor remains in use in Northern Ireland and the UK.

[LXXIV] A more detailed synopsis of the training programme is available form the Faculty of Radiologists, RCSI.

[LXXV] Up to 1997 the training programme consisted of initial formal instruction in the core subjects of a 2 module Part I examination in parallel with a formal 3-year clinical training programme. Recently the Part 1 training syllabus has been modified to a new 5-module format. The clinical training programme has adapted to accommodate the recent developments in radiation oncology technology including 3-D conformal and intensity-modulated radiation therapy (IMRT) and specialised areas of radiation therapy including stereotactic, electron beam, brachytherapy and radio-isotope treatments (see section 3).

[LXXVI] Successful completion of the part II Fellowship of the Faculty of Radiologists (FFR) examination is an essential component towards the Faculty's nomination for CCST/CSD (Certificate of Specialist Doctor) award. However, an additional 2-year post-fellowship training period is required.

programme was activated in January 2003, with an initial six SpR posts being approved.[LXXVII] The Faculty has proposed to Comhairle na nOspidéal the following additions to the training programme, to take effect from 2003[4]:

- The development of an accreditation-dependent phased increase in the national training programme to accommodate the forthcoming upgrade in radiation oncology services at the Cork University Hospital (CUH) supra-regional centre and the new treatment facility being commissioned at University College Hospital Galway (UCHG)
- The development of a rotational training programme involving both Cork University Hospital and University College Hospital Galway, and where possible with the equivalent training scheme being undertaken in Northern Ireland at Belfast City / Belvoir Park Hospitals
- The development of rotations and/or placements of specialist registrars (SpRs) in suitable training programmes in Europe, North America, and other locations as appropriate
- The further exploration of additional training, educational and research opportunities created through the recent Memorandum of Understanding[LXXVIII] signed by the governments of Ireland, Northern Ireland and the United States and the subsequent establishment of the Ireland-Northern Ireland-National Cancer Institute Cancer Consortium.[260]

International norms that define an optimal number of training positions equivalent to SpR-grade NCHDs or their relationship to population figures do not exist. In part this stems from the enormous variation between different countries in their radiation oncology workforce plans and the timeframes for staff replacement. Both Ireland and the UK appear to share the objective of moving to a model of one trainee/SpR per consultant and this has been the basis of the recommendation of an initial six SpR positions approved by Comhairle na nOspidéal. Notwithstanding this, there is a low number of consultant appointments in Ireland and more particularly consultants working in hospitals with accredited training programmes in radiation oncology.

What is the required number of radiation oncologists in the Republic of Ireland?

A significant number of international publications exist outlining recommended radiation oncologist staffing levels.[10,26,209,238] Two methods of reporting this are commonly used:

- The number of new cases of cancer per year per radiation oncologist
- The number of radiation oncologists per million of population.

The first method is complicated by some uncertainties that relate to the understanding of specific terms including new cases, cases requiring re-treatment, and total cases. In general the number used is the number of newly diagnosed patients who are actually treated with radiation therapy for their cancer. A number of analyses of medical staffing requirements have been completed in the last two decades by governmental, professional and other groups in Europe, Canada, the USA and Australia and the recommendations therein are discussed in this section (see Table 6.1).[216] Analyses undertaken in the last decade have suggested that a consultant radiation oncologist should supervise the care of 250-300 new patients per annum (see Table 6.1). An analysis of this question was undertaken by the Pan American Health Organisation (PAHO) reporting to the World Health Organisation (WHO) in 1997.[23] The PAHO proposed the equivalent of 250 new patients requiring treatment per year as a preferred guideline.[LXXIX] This means that per annum a radiation oncologist should see 300-320 new patients, treat approximately 250 of these and with existing patients requiring re-treatment be responsible for the treatment of a total of 300-310 patients.[23]

[LXXVII] The Faculty of Radiologists suggested a requirement of 12 SpR positions in 2002, 18 in 2003 and 21 in 2005.
[LXXVIII] http://www.allirelandnci.org/new/02-06.asp
[LXXIX] The PAHO report estimated that 7 radiation oncologists per million of population were required for this patient caseload and that it would equate with 250 new patients treated per radiation oncologist per year at the 50 per cent treatment rate. In routine clinical practice, it is estimated that approximately 20 per cent of newly referred patients are not suitable and do not receive radiation therapy. Of the 80 per cent of patients treated, 25 per cent will require a second or further additional course(s) of treatment (re-treatment). On this basis if a consultant assesses 300-320 new patients per annum, 250 will be treated with radiation therapy and an additional 50-60 patients will receive re-treatment radiation therapy.

The second method of defining the actual requirement for consultant radiation oncologist posts in terms of population is simpler to derive and equally suitable in identifying future staff estimates. It is important to note that the appropriate number of radiation oncologists per million is not a static figure and it reflects the anticipated cancer incidence. To illustrate the use of this model, during the early 1980s the cancer incidence was 3,500 per million of population. Cancer incidence is increasing and the data relating to this have been summarised earlier in this report (see section 4). The majority of recent analyses suggest that, for medical staffing requirements to address the expected increase in cancer incidence in the forthcoming decade (2000-2010), nine to twelve radiation oncologists will be required per million of population. This will enable 250 new patients to be treated per radiation oncologist per year at the 50 per cent treatment rate. These guidelines have been interpreted in a number of ways by a variety of national and international review groups. The data from many of the reviews are summarised in Table 6.1.

Europe – recommendations on medical staffing in radiation oncology

The European Society of Therapeutic Radiology and Oncology (ESTRO) surveyed 22 European countries in 1990 and reported that the average number of radiation oncologists was 8.2 per million population, although there was substantial variation between countries. In a study of 50 European centres in 1990, Bernier *et al* reported that the average number of cancer patients treated per radiation oncologist per year was between 276 and 316.[LXXX] In 1997 the Dutch Health Council on Radiotherapy published guidelines and estimates on the expected infrastructure requirements for radiation therapy up to the year 2010.[216] The analysis attempted to take account of anticipated developments in technology, treatment protocols (including fractionation policies) and evolving indications for treatment. It concluded that the numbers of radiation oncologists per million population should have been 8.6 in 1995, increasing to 10.9 in 2005 and 12.7 in 2010.[216]

In 1991 the Royal College of Radiologists (RCR) documented the workloads per consultant clinical (radiation) oncologist in the UK and eight other European Countries excluding Ireland. The numbers of radiation oncologists per million varied from 14.1 (Norway) to 4.5 (UK) and 4.0 (Portugal). The Royal College noted that the current consultant numbers were too low and that patients 'were not getting the time and care expected in a modern developed country'. It is worth noting that at the equivalent time in Ireland the approximate number of consultant radiation oncologists per million population was 2.0,[LXXXI] significantly below the UK figures and the lowest in Western Europe. The RCR has subsequently updated these figures and suggested 350 new patient caseload per consultant per annum.[287]

Canada – recommendations on medical staffing in radiation oncology

In 1985, the Canadian Department of Health and Human Services estimated that 8.3 radiation oncologists per million population were needed, increasing to 10.3 by 1990. In 1992 the Canadian Association of Radiation Oncologists (CARO) recommended that appropriate standards of clinical care could only be achieved if a radiation oncologist was treating 200 new patients per year (approximately 9.7 radiation oncologists per million population). The Canadian guidelines were not achieved, leading to a significant public commentary on the consequent 'major crisis' in clinical care.[209] In the mid-1990s, all 27 Canadian centres were compared to a larger cohort of US centres. The analysis indicated that medically unacceptable delays were evident in Canada because of insufficient resources including medical personnel.[222,224] As a consequence, patients frequently waited 3-4 times longer than their US counterparts for treatment. More recently this has resulted in the direct purchasing of radiation therapy at US centres by a number of Canadian healthcare agencies.

United States of America – recommendations on medical staffing in radiation oncology

The USA has seen a steady increase in the number of radiation oncologists from the mid-1970s when initial data permitting this analysis were collected.[101,238,281] The estimates suggest the following number of positions equivalent to consultants per million of population: 6.7 (1974) to 13.5 (1998).[LXXXII] The number of radiation

[LXXX] This number included re-treatment patients.
[LXXXI] Seven consultants in Radiotherapy / Clinical Oncology were in post in the early 1990s, five posts at St Luke's Hospital and two posts at CUH.
[LXXXII] In the USA observed medical staffing per million population was 6.7 (1974), 7.0 (1975), 7.5 (1978), 7.8 (1980), 8.1 (1983), 8.6 (1986), 9.4 (1990), 9.6 (1991), 12.2 (1995) and 13.5 (1998).

oncologists in 1990 (9.4 per million population) was close to 10.1 as recommended by the Graduate Medical Education National Advisory Committee (GMENAC).

The above ratio of consultants per million has for many years permitted the average radiation oncologist to treat approximately 210 new patients, although this figure has reduced in the last decade to 202 (1994) and 192 patients (1996).

Republic of Ireland – previous and existing consultant posts

Analysis of previous and existing consultant numbers demonstrates a considerable deficit when compared to published international guidelines.

In the time between the formalisation of radiation oncology services (1950s) and the mid-1990s, there was a gradual increase to seven consultant positions. This resulted in approximately two radiation oncologists per million population. The Group estimates that each consultant would on average have been responsible for the treatment of 700-900 new patients, with a larger number of patients receiving an initial consultation. When patients requiring re-treatment are taken into account it is conservatively estimated that the overall consultation rates may have been higher than 1,000 patients per year. There has been no significant reduction in caseload per consultant since the early 1980s and recent trends suggest that the numbers of patients per consultant is continuing to increase, in part because of changes in standards of care but in addition as a consequence of investment in other oncology services and disciplines and the subsequent increased referral rate of patients for a radiation oncology opinion.

In 1993 the Faculty of Radiologists, Royal College of Surgeons in Ireland (RCSI) recommended that an interim target of 22 consultants should be achieved in the short term, permitting a projected caseload of 350 new cases per consultant. This target was in keeping with UK guidelines at that time. In 1994 one additional consultant post was approved by the DoHC,[LXXXIII] raising the total number of consultants to seven. As a consequence of planned retirement and lack of immediate replacement, the permanent Comhairle na nOspidéal approved consultant number reduced to six for the period 1996-2002.[LXXXIV] An earlier Comhairle na nOspidéal Review of Consultant Manpower in the Southern Health Board (1994) suggested an increase from two to four consultant radiotherapists. However, these appointments have not taken place to date.[LXXXV] Two new consultant posts at St Luke's Hospital have been approved by Comhairle na nOspidéal and the DoHC in 1999 and the appointment process is ongoing at the time of completion of this report (2003). The number of filled Comhairle na nOspidéal permanent appointments in radiation oncology within the Republic of Ireland at the time of completion of this report is eight consultants.

It is immediately evident from the above that there is a considerable shortfall in consultant numbers at present. In 2002, if all approved consultant positions were filled, this would provide a total of 10 consultant radiation oncologists. This equates with 2.5 consultant radiation oncologists per million population, the lowest in Western Europe.

The consultant numbers and the caseload per consultant identified in the Republic of Ireland diverge significantly from all identified national and international guidelines. Consultant numbers are approximately 25-30 per cent of the current staffing ratios accepted in most western countries.[25,101,209,213] It will be critical to address this deficiency in an immediate and planned manner. Maintenance of existing radiation oncology / medical staffing levels is not appropriate and it is very doubtful whether, even in the short term, it can continue to provide modern radiation oncology treatment services.

[LXXXIII] At St Luke's Hospital and linked to Meath and Adelaide Hospitals and the North Western Health Board.
[LXXXIV] Two locum consultant posts were approved at this time.
[LXXXV] Comhairle Review of Consultant Manpower for Southern Health Board (1994) p.35

Table 6.1: Recommended and actual number of radiation oncologists per million of population for various countries

Country	References	Year	Recommended	Actual
Ireland	Faculty of Radiologists, RCSI[252]	1993	6.5 approx	2
Europe				
Netherlands	Van Daal and Bos for Dutch Health	1995	**8.6**	
	Council[216]	2000	**10.0**	
		2005	**11.9**	
		2010	**12.7**	
UK	RCR[288]	1986	**6.5**	
UK	RCR[289]	1991		**4.5**
UK and 8 European countries	RCR[289]	1990		**4.0 – 14.1**
Europe (22 countries)	Leer et al for ESTRO[111]	1990		**8.2**
Australia	RACR[290]	1982	**6.7**	
	Trinker report for NSW[291]	1983	**6.7**	
	Lovell report	1985	**7.0**	
	(Victoria)[292]	1987	**8-10 FTE**	
	Super-Speciality Report[271]	1987	**7.0**	
	RACR			
		1999	**7.4**	
	Diagnosis PTY Ltd for MWDRC[293]	2004	**9.3**	
		2009	**10.5**	
		1999		**7.2**
	RANZCR survey[26]			
New Zealand	AMWAC[132]	1997	**7.9-8.3**	
	Morgan, Wigg and Childs[10]	2000	**8.8**	
		2007	**10.0**	
	NZ Clinical Training Agency	1999		**7.4**
	RANZCR survey[26]			
Canada	Canadian Department of Health	1975	**8.3**	
	Canadian Department of Health	1990	**10.3**	
	Canadian Association of Radiation Oncologists	1999	**9.7**	
	Thorne et al[294]	1995		**6.8**
United States	Owen et al[101]	1974		**6.7**
	Owen and Teshima[118]	1990	**10-12**	**9.4**
	Hussey et al[238]	1995		**12.2**
		1998		**13.5**

6.3 Radiation therapists[LXXXVI]

Radiation therapists are the group of professionals with direct responsibility for the administration of radiation therapy to cancer patients including the technical delivery of the radiation dose. They contribute to the multidisciplinary team that facilitates the clinical and psychosocial care of the patient throughout treatment preparation and delivery. The recent change of professional title was recommended as a more accurate reflection of the professional role and was introduced following the publication of the findings of the Report of the Expert Group on Radiography Grades (2001) and of the Report of the Radiography Service Review Group (2002).

The undergraduate education programme for radiation therapists is a four-year honours BSc degree programme conducted at the School of Therapeutic Radiography under the auspices of the University of Dublin, Trinity College. The School is an integral part of the Faculty of Health Sciences at Trinity College and the clinical training facilities are sited at all existing clinical treatment centres in the Republic of Ireland. The degree programme was established in 1993[LXXXVII] and the education programme reflects a national perspective and forms the basis for ensuring continued service provision as radiation oncology services expand in the future. The School operates to a very high standard and successful graduates have taken up posts in Ireland, Australia, New Zealand, the UK and the USA. The annual intake of students was approximately 10 students per annum until 2000 when a major expansion of student intake was prioritised following the initial meetings of the existing Expert Group, TCD, the Higher Education Authority (HEA), and the Department of Health and Children (DoHC).[LXXXVIII]

The School of Therapeutic Radiography degree programme aims to provide the following:

- The knowledge base, skills and professional competence that is central to clinical practice in radiation therapy
- A multi-professional education with significant educational exchange between the other undergraduate schools of Medicine, Clinical Speech and Language Studies, Dental Science, Physiotherapy and Occupational Therapy
- The promotion of multidisciplinary care with other healthcare professions
- An awareness of the responsibility to build on basic knowledge and skills and to pursue continuing professional development (CPD).

Some graduates have completed higher diplomas, MSc, and MBA postgraduate degrees and the School has an active programme for the development of postgraduate training and research. The School has strong links with international professional organisations and provides a European training course on radiation oncology treatment planning co-ordinated through the European Society for Therapeutic Radiology and Oncology (ESTRO).

There are a limited number of publications on recommended international norms for radiation therapist staffing. However, guidelines have been set down by a number of international and professional advisory groups.[25,26,101,295] Methods for reporting the number of radiation therapists required have historically been based on numbers of staff per linear accelerator, cobalt unit, simulator or other treatment unit. This method appears to have been consistent with past working practices. Given the increasing complexity of radiation therapy, the development of multidisciplinary teams, the increasing need for a holistic approach to patient care, the skill mix and training of radiation therapists, and the impact of degree level education on working practices, these methods are likely to change over time.

[LXXXVI] Previously the professional descriptor therapeutic radiographer was used to describe the discipline.
[LXXXVII] A diploma programme (therapeutic radiography) existed between 1982 and 1993.
[LXXXVIII] To date these discussions have supported the increased intake in 2001 of 25 students per annum on the degree programme.

Europe – recommendations on radiation therapist staffing in radiation oncology

In The Netherlands, the Advisory Committee for the Ministry for Health has recently re-confirmed its previous recommendation of four radiation therapists per linear accelerator (The National Health Council Report on the Future Needs of Radiotherapy 1995-2010), first made in the earlier 1987 and 1993 reports.[LXXXIX] In the most recent report (2000) there is a recognition that this staff number may need to be increased in the future given the evolving complexity of current and future treatment.[206] In addition the report noted the need for a more patient-centred approach to staffing levels necessitating a shift from treatment unit-based calculations to a more complex needs assessment, taking account of new professional responsibilities.

In 2000 the Board of the UK Faculty of Clinical Oncology of the Royal College of Radiologists (RCR) published a report *The Provision and Replacement of Radiotherapy Equipment*.[296] The report noted the insufficient number of radiation therapists in the United Kingdom to serve the current levels of patients and the anticipated trend that 'with changing technology and treatment techniques it is difficult to predict accurately the number of staff required nationally, but there is no doubt about the need for an increase'. In a further report from the RCR entitled *Equipment, Workload and Staffing for Radiotherapy in Scotland* (2000),[XC] the College noted that existing guidelines on therapist staffing 'almost certainly underestimate the need for staff on modern linear accelerators and will need to be revised upwards'.[XCI]

Australia – recommendations on radiation therapist staffing in radiation oncology

The 2001 National Strategic Plan for Radiation Oncology included a comprehensive review of future radiation therapist staffing requirements.[25] The report identified important trends that impact on therapist workforce planning including the inadequate current supply of therapists, high vacancy rates in existing treatment centres with evidence of increasing staff loss, and insufficient training programmes. Australia currently has a 10 per cent shortfall in therapists and the shortages have clearly contributed to an under-utilisation of treatment facilities.[XCII] Preliminary evidence from Australia has also suggested that the staff deficit may increase as a consequence of additional staff departure. Several reasons are cited for this including salary scales, job satisfaction and poor career potential. The report recommended a move to linking therapist staff requirements to a population basis rather than a direct linkage to equipment provision.

Ireland – radiation therapists

The current practice in Ireland is to provide four radiation therapists per linear accelerator, three per cobalt unit and two per simulator. In other areas of responsibility the staff required varies according to the level of activity.[XCIII] This practice is supported by recent publications from the College of Radiographers and the Royal College of Radiologists (UK): *Radiographer Staffing in Radiotherapy Departments (1999)* and *A Survey of Radiotherapy Services in England* (1999).[XCIV] Both reports recommended a minimum of four whole-time equivalent (WTE) radiation therapists to staff a linear accelerator working an 8-hour day, with additional staff required on a pro-rata basis for machines working an extended day.[295,297]

[LXXXIX] 'The National Health Council Report on the Future Needs of Radiotherapy' Ontwikkelingen in de radiotherapie: Een behoefteraming voor 1995-2010. Advies van een commissie van de Gezondheidsraad, 1993

[XC] Additional observations on therapist staffing included the following:

- Linear accelerators staffed by four or more radiation therapists generally achieved higher workload than accelerators with fewer staff.
- Extension of the working day did not allow more patients to be treated unless it was accompanied by an increase in staffing.
- High pressure of work was undesirable because of the risk of error and the effect on the quality and safety of treatment.

[XCI] 'Equipment, workload and staffing for Radiotherapy in Scotland', Royal College of Radiologists 2000

[XCII] Additional guidelines on staff requirement have been published by the Radiation Therapy Advisory Panel to the Australian Institute of Radiography. These suggest 1.06 therapists per linear accelerator working hour in order to provide a safe quality service. The model estimates a requirement for 1,268 radiation therapists to staff the existing 254 linear accelerators operational in Australia.

[XCIII] Other areas of responsibility include quality assurance, risk management, information technology management, patient information provision, clinical support groups and clinical trials.

[XCIV] This report can be downloaded at www.doh.gov.uk

Career structures for radiation therapists have recently been addressed in the Report of the Joint Working Party on Radiographers (2001) and also in the Report of the Expert Group on Radiography Grades (2001). The career structure for radiation therapists arising from the implementation process for the two reports is as follows: radiation therapist, clinical specialist radiation therapist, radiation therapy services manager I (where the manager has responsibility for a department with 25 WTE radiation therapists or less) and radiation therapy services manager II (where the manager has responsibility for a department with more than 25 WTE radiation therapists). Along with other aspects of the agreed reports on radiography, this career structure is designed to address recruitment and retention issues and also reflect the changing role of the profession, plans for services, management structure, and development and interaction with other disciplines.[xcv] The significant improvement in pay and in terms/conditions of employment arising from the Report of the Expert Group on Radiography Grades (2001) is expected to have an important effect on boosting staff retention rates.

It is also noted that the Report of the Expert Group on Radiography Grades (2001) referred to an appropriate mix of support staff and suggested that there may be a useful role for assistants. Assistants may provide practical support for radiation therapists to expand the care provided to patients rather than serve as a substitute for existing radiography grades.

6.4 Medical physicists

Radiation therapy physics support is provided by medical physicists, clinical engineers including technicians, and dosimetrists. Physics staff provide technical support for the entire radiation therapy process and take responsibility for equipment calibration, maintenance, and the data acquisition and calculation processes associated with treatment planning (see sections 1 and 2). Medical physicists in radiation oncology are trained in analytical processes and scientific principles and play a major role in the development of treatment delivery and the accurate measurement and numerical recording that underlie a proper quality control system for the equipment used in radiation oncology. In addition, the physicist possesses an understanding of the principles of radiation protection and of radiation shielding and advises on radiation protection of both staff and patients.

Clinical engineers and technicians provide operational and technical support to users of clinical equipment in addition to the equipment management service throughout the equipment lifecycle from specification and purchase to decommissioning. They are responsible for ensuring the highest levels of equipment safety, user application and financial efficiency of the critical application equipment used in radiation oncology.

The responsibility for a treatment-planning department is generally within medical physics. However, the range of staff employed in this area has changed with the development of a new staff category, the dosimetrist.[xcvi] Treatment dosimetrists are increasingly recruited from the radiation therapist professional grouping. However, there is no formal training pathway for this area of career development in Ireland, in contrast to training programmes available in many western countries. Dosimetrists are personnel trained in performing specified patient-oriented tasks under the supervision of radiation oncology physicists.[xcvii] The tasks include assembling patient data required for dose calculations, calculating dose distributions and computing treatment machine settings based on prescribed dose. Dosimetrists use complex treatment planning software to develop treatment plans for each patient. In performing these tasks, they work closely with physicists, radiation therapists and medical teams.

While the previous sections outline the major identifiable activities performed by medical physics departments, it is not exhaustive. The nature and relative importance of the different activities depend on the

[xcv] A number of specialist areas were identified within the radiation therapist's clinical role including skills associated with working at particular treatment units and/or treatment preparatory areas, for example the linear accelerator, simulator, brachytherapy, ^{60}cobalt, CXT-DXT and mould room. The Report of the Expert Group on Radiography Grades 2001, p. 21.
[xcvi] The position and title of dosimetrist is well established in many countries/jurisdictions.
[xcvii] AAPM report 38

local situation and the mix of staff in each category is therefore somewhat dependent on the local requirements in specific hospitals. The need for adequate physics support for effective and safe use of radiation therapy equipment has been emphasised in recent EU directives including a Council Directive enacted in 2003 in Irish legislation.[XCVIII]

In Ireland medical physicists are required to have a minimum BSc in physics or an equivalent subject, and more senior staff have MSc or PhD degrees. In medical physics/clinical engineering, entry level physicists in addition to graduate engineers and engineering technicians have traditionally undergone 'in-house' training and it typically takes a number of years' experience before a physicist acts in a more independent role in a clinical environment.[XCIX] This unstructured informal training is in contrast to programmes available in a number of western countries where formal training courses and certification are the norm. The Group understands that at the time of writing of this report a working group, representative of the HSEA and IMPACT, is currently undertaking a review which will encompass consideration of staffing levels for medical physicists. The following areas will be reviewed:

- Workplace planning, including recruitment and retention issues particularly in light of prospective developments in radiotherapy
- Education and training, including appropriate qualification levels, the role of basic grade posts and the requirement of continuous professional development
- Service provision, including the implications for the profession of the proposed establishment of a system of statutory registration of health and social care professionals.

The review group will be looking at the roles of other physicist grades as well as the basic grade post. The group will also be examining skill mix, out of hours cover and issues relating to the integration of medical physicist services.

What is the required number of radiation oncology medical physicists in the Republic of Ireland?

At present, there are no agreed staffing levels for radiation oncology medical physics departments in Ireland. Recommended minimum staffing levels for the provision of physics support have been published by a joint working group from the European Society of Therapeutic Radiation and Oncology (ESTRO) and the European Federation of the Organisations of Medical Physicists (EFOMP)[C] and more recently from the Institute of Physical Scientists in Medicine (IPEM).[CI] Both publications recognise the roles of physicists, engineers, technicians and dosimetrists in providing the overall physics support. The reports provide formulae for staffing levels for routine service provision and additional tools to identify the synergistic effect of larger departments that may be used to reduce the final numbers of physics staff.[103] The complement of staff is based on the following:

- The amount, range and complexity of treatment equipment
- The number of patients treated
- The complexity of patient treatment techniques.

Additional physics support for complex treatment techniques (e.g. conformal radiation therapy, intensity-modulated radiation therapy, stereotactic radiosurgery, TBI), formal education programmes for all categories of radiation therapy personnel, developmental duties, and additional radiation protection duties are not covered by the ESTRO/EFOMP document and only partially by the IPEM document.[103]

[XCVIII] Council Directive 97/43/Euratom – Health Protection of Individuals against the Dangers of Ionising Radiation in relation to Medical Exposure, European Communities

[XCIX] The training available at the moment ranges from very informal and relatively unstructured approaches, essentially mirroring the old apprenticeship system, to a relatively formal programme with academic components as currently exists in St Luke's and St James's Hospitals combined with an accredited MSc in Physical Sciences in Medicine, from Dublin University, Trinity College. The MSc covers the theoretical and research components required in the training of hospital physicists. However, it does not address the practical training that is required.

[C] *Quality assurance in radiotherapy: the importance of medical physics staffing levels. Recommendations from an ESTRO/EFOMP joint task group*, Belletti et al, Radiotherapy and Oncology 41 (1996) 89-94

[CI] *Guidelines for the provision of a Physics Service to Radiotherapy*, 2002

The ESTRO/EFOMP joint task group suggested that 12.5 physics staff (5.16 qualified physicists with engineering support) would be the minimum staff resource for a radiation oncology centre treating 2,000 patients with external beam, 400 patients treated with brachytherapy and an equipment configuration as follows: one ^{60}Cobalt unit, four linear accelerators, two afterloading brachytherapy units, one simulator, one CT unit and two treatment planning systems.[103]

Table 6.2 shows the recommended minimum staffing levels from the ESTRO/EFOMP and IPEM publications. The levels for both qualified physicists and other physics staff are provided on an equipment and patient number basis.[CII] The number of qualified medical physicists within the total staff complement is also given. In all departments the IPEM have recommended that there must be at least two qualified medical physicists, at least one of which must be appointed at principal grade or higher.

The ESTRO/EFOMP joint task group noted that with lower staffing levels 'the quality of treatment is likely to be reduced and the risk of mistreatment increased'.[103] It is critical that the latter possibility is minimised and the group strongly recommends that due account is taken of the ESTRO/EFOMP task group guidelines in this regard.

Table 6.2: Medical physics departments – published recommendations on staffing in radiation oncology[103]

Unit	Item	Total staff (WTE)		Qualified physicists within WTE	
		ESTRO	IPEM	ESTRO	IPEM
Equipment related					
1	**Accelerator**	0.88	2.2 (multimode) 1.6 (single mode)	0.37	0.7 (multimode) 0.5 (single mode)
1	**Cobalt**	0.34	0.75	0.14	0.4
1	**Orthovoltage**	0.07	0.4	0.03	0.2
1	**Afterloading Brachytherapy**	0.42	0.75 (HDR) 0.4 (MDR/LDR)	0.18	0.4 (HDR) 0.2 (MDR/LDR)
1	**Simulator or CT Simulator**	0.3	0.75	0.13	0.4
1	**TPS**	0.38 (ext. beam) 0.08 (Brachy)	0.75 0.4 (Advanced)	0.16 (ext beam) 0.04 (Brachy)	0.4 0.2 (advanced)

[CII] In order to calculate physics staffing the number of items applying to the department should be multiplied by the number of whole time equivalent (WTE) staff per item to give the number of physics staff for that component. The number of staff for each component should then be summed.

Unit	Item	Total Staff (WTE)		Qualified physicists within WTE	
		ESTRO	IPEM	ESTRO	IPEM
Patient Related					
100	Patients/year (ESTRO) or courses/year (IPEM)	0.27 (ext) 0.22 (Brachy)	0.26 (ext) 0.4 (3DCRT) 0.6 (Brachy)	0.11 (Ext) 0.09 (Brachy)	0.12 (ext) 0.2 (3DCRT) 0.2 (Brachy)
50	Special Techniques (TBI, Stereotactic, IMRT etc)	N/A	1.0	N/A	0.4
Department Factors	Radiation Protection Advisor	Included in other staff numbers	0.1		
	Quality System	Included	0.2		

Recommended WTEs for the estimation of minimum medical staff levels for routine clinical work in radiation oncology. The WTEs have to be multiplied by the numbers specific equipment and summed to calculate the total number of physics staffing. The staffing figures in the table appear from limited surveys undertaken by the ESTRO/EFOMP joint task group, to closely resemble the actual staffing in a number of European countries, e.g. Austria, Germany, UK and Scandinavia. In addition the staffing numbers at St Luke's Hospital resemble these guidelines.

6.5 Oncology nursing in radiation therapy

Recent trends in radiation oncology practice have highlighted the increasing need for qualified nursing staff to facilitate the delivery of inpatient care and the more recently developed role in day-care attendance for radiation therapy.[107-110,241,298,299] Nurses have a significant contribution to make to radiation oncology as part of an integrated service working with other disciplines, collaborating with voluntary agencies and liaising with primary care colleagues. The necessity for trained, experienced skilled oncology nurses has been cited in previous reports including *Cancer Services in Ireland: A National Strategy (1996)*.[CIII]

The role of the nurse in radiation oncology includes patient assessment, education, physical care, co-ordination and continuity of care, liaison with hospital and with community services, research and administration activities. In 1990 the American College of Radiology defined the role of the radiation oncology nurse as providing the 'appropriate nursing intervention for the actual or potential problems that the patient and family may experience related to the disease process, treatment course and follow-up period.' [CIV]

[CIII] *Cancer Services in Ireland, a National Strategy* (1996), pp 53-54
[CIV] Bruner, D.W., Report on the Radiation Oncology Nursing Sub-Committee of the American College of Radiology Task Force Standards Development Oncology. 4:80-81, 1990

To date there have been many developments in nursing, most notably the Report of the Commission on Nursing (1998) which provides a framework for future developments in nursing. A key recommendation of this report was the establishment of the National Council for the Professional Development of Nursing and Midwifery, with nurse and midwifery planning and development units established in each health board area. The purpose of this initiative is to promote and develop the professional role of nurses in order to ensure the delivery of quality nursing care to patients.

At present a range of nursing professional grades exist in Ireland and are involved in the radiation therapy process outlined in section 1. The posts have been developed to a varying degree in various health boards and hospitals:

- Clinical nurse specialist: This relatively new post has been created in line with recommendations contained in the Report of the Commission on Nursing.[CV] The role of clinical nurse specialist in radiation oncology is being developed in line with the definition, educational requirements and pathways suggested by the National Council for the Development of Nursing and Midwifery.
- Radiation oncology nurse co-ordinator: Two nurses with a specialist interest in radiation oncology were appointed between 1999-2001.[CVI] A larger number of cancer nurse co-ordinator posts have existed in the Eastern Region for nearly two years. A formal review of their role has recently been completed and the recommendations support this new role and the expansion of further positions.
- Advanced nurse practitioners (ANP) are at an early stage of assessment. However, it is envisaged that this role may be developed in the future in line with the Report of the Commission on Nursing.[CVII] New programmes tailored to the advanced nurse practitioner post have also being developed at some third level institutions.
- A Masters degree nursing programme is available at many third level institutions. A Fellowship programme in nursing is co-ordinated by the Faculty of Nursing and Midwifery (RCSI).

Recent UK recommendations suggest that the majority of nurses working in a radiation oncology unit should have completed an oncology nursing qualification.[CVIII] In Ireland most dedicated oncology nursing education training is provided following completion of existing undergraduate programmes. Higher-level oncology nursing programmes have also been developed at a number of third level education institutions:

- Trinity College, Dublin – 2-year part-time or 1-year accelerated full-time postgraduate higher diploma in association with St Luke's and St James's Hospitals
- University College Dublin – 2-year part-time or 1-year accelerated full-time postgraduate higher diploma
- National University of Ireland, Galway – 1-year full time higher diploma in nursing studies. This course commenced during 2001.

Four clinical nurse education facilitator posts have been approved and funded by the ERHA/DoHC to assist with the planning, organising, implementing and evaluating of clinical learning for nurses undertaking post-registration programmes in oncology nursing.

The Irish Cancer Society offers an introductory five-day training programme in co-operation with all health boards for registered general nurses (RGNs). St Luke's Hospital, many teaching hospitals throughout the country and professional associations including the Irish Association for Nurses in Oncology (IANO) also provide short education programmes and conferences.

[CV] The National Council for the Professional Development of Nursing and Midwifery has defined the role of Clinical Nurse Specialist and Advanced Nurse Practitioners – Report of the Commission on Nursing 1998. This details the core concepts, criteria and portfolio requirements of the post (The National Council for Professional Development of Nursing and Midwifery, Autumn 2002, Issue 7).
[CVI] A Radiotherapy Cancer Nurse Co-ordinator was appointed to St James's Hospital, Dublin and a Cancer Nurse Co-ordinator for Stereotactic Radiosurgery was appointed to the programme at Beaumont Hospital.
[CVII] The National Council has defined the role and the core concepts of the ANP and will shortly publish full details on the process of establishment and education requirements (The National Council for the Development of Nursing and Midwifery, 2001).
[CVIII] UK Department of Health, NHS Executive 2000

Radiation oncology services – What is the requirement for oncology nursing in the Republic of Ireland?

The shortage of nurses skilled in certain specialties in Ireland has a significant potential to affect the establishment of additional oncology services identified in this report. The current shortage of staff has for example necessitated additional recruitment measures within the existing radiation oncology centres at St Luke's Hospital:

- Use of agency nurses
- Nurses recruited from overseas
- Nurses working increased overtime.

Strategies to enhance retention of oncology nurses will continue to be important.[CIX] The DoHC has recently published a National Study of Turnover in Nursing and Midwifery[CX] together with the final report of the Steering Group – Towards Workforce Planning,[CXI] and Guidance for Best Practice on the Recruitment of Overseas Nurses and Midwives.[CXII] The broad focus and comprehensiveness of these reports will form an important part in the planning of the future nursing workforce. The Dublin Academic Teaching Hospitals and St Luke's Hospital have produced an action plan for the recruitment and retention of nursing staff. This information may provide guidance on some aspects of recruitment and retention of nurses in radiation oncology.

There are wide variations in nursing practice and staffing throughout Western Europe and North America, and as a consequence it is difficult to extrapolate from the workforce recommendations applicable in those jurisdictions. Nevertheless significant research has been carried out in Australia, Canada and the United States. The Australian Nursing Federation and the American Nurses Association have both developed principles for general staffing requirements and many models for measuring nursing workload exist in both countries. Considerable research had been carried out in Ireland on skill mix and workload assessment in nursing although in most cases this has not been specific to radiation oncology.[CXIII] The two main methods discussed in the literature and those being used in the public sector in the Republic of Ireland are:

- Dependency-based methods such as *Criteria for Care* (Ball and Goldstone 1986)[300,301]
- Activity-based methods such as the Grace Reynolds Application and Study of Peto (GRASP) system of automated healthcare workload management.

The Commission on Nursing has recommended the development of appropriate systems to determine nursing staff levels which take account of skill mix, patient acuity and dependency and the specific clinical category of the patient. The existing literature suggests that neither activity-based nor dependency-based models are totally reliable in predicting nursing workforce requirements and as a consequence optimal tools for measuring workload and staff requirements within oncology nursing do not exist. Currently two different systems are employed within the radiation therapy centres at St Luke's Hospital Dublin (Criteria for Care,[CXIV] and the Hospital System Study Group[CXV]) and University Hospital Cork (GRASP).[CXVI]

Criteria for Care and the Hospital System Study Group models have been used in Northern Ireland, the United Kingdom, Europe, Canada and the United States. The system encourages the planning of nursing care on an individual basis, taking account of patient special requirements associated with the type and phase of current cancer therapies. The needs of patients and family are also reflected when categorising patients. Ultimately a range of different levels of nursing care is required during different phases of hospitalisation, extending from high dependency patients undergoing intensive treatment protocols to lower dependency care.

[CIX] Nursing Recruitment and Retention Group Report (2000). The Dublin Academic Teaching Hospitals (DATHs) and St Luke's Hospital have recently produced an action plan for the recruitment and retention of nursing staff.
[CX] Nursing Recruitment and Retention Group Report 2000. DATHs and St Luke's Hospital
[CXI] Nursing and Midwifery Resource Final Report of the Steering Group – Towards Workforce Planning, July 2002
[CXII] Guidance for Best Practice on the Recruitment of Overseas Nurses and Midwives, December 2001
[CXIII] Workload assessment is an attempt to predict the nursing time and skills required to provide nursing care.
[CXIV] Ball and Goldstone, 1986
[CXV] Jackson and Mc Kaye, 1989
[CXVI] GRASP is an activity-based system and is an Automated Healthcare Workload Management System. As with Criteria for Care this system of workforce planning has also been used in other oncology centres in the UK, Canada and the United States.

The following staffing arrangements were identified within St Luke's Hospital using the Criteria for Care modelling tool and help illustrate potential future nursing requirements in proposed radiation oncology centres in Ireland: [CXVII]

Table 6.3: Nursing staff - St Luke's Hospital

St Luke's Hospital	CNM II	CNM I	Staff nurse	Care attendant	Ward clerk	WTE nurses per bed	Other staff
Inpatient wards (Four wards 25-29 beds)	1	1	15-17	3.5-4.5	1	0.96-1.04	
Radiation therapy department	1		4				
Day ward (9 beds, 11 couches)	1	1	5-6	1	1	0.34	
Outpatient department		1	4-5	1	1	N/A	
Hostel accommodation (20-25 beds)	-	-	2-3	-	-		1 house-keeper
Operating theatre	0.5		0.4	N/A	N/A		

The staffing figures do not take account of the requirement for clinical nurse specialists and other nursing grades in education, practice development and research.[CXVIII] The specific configuration for Nursing Administration which is inclusive of a Director of Nursing, Assistant Director of Nursing and Clinical Nurse Manager III are dependent on the size and nature of the Radiation Therapy Centre.

6.6 Other staffing considerations

A significant number of additional healthcare professionals are essential members of the multidisciplinary team and assist in providing the totality of care that accompanies the radiation oncology treatment process. These include members of the physiotherapy, dietetics, specialist dentistry, psychological medicine, medical social work, occupational therapy, speech and language therapy and pastoral care professions. It is outside the remit of this report to detail the existing training pathways in these professional groups. There is however a clear recognition by the Group that the proposed expanded radiation treatment service will place extra demands on the educational programmes that provide skilled healthcare professionals in these fields.

The Expert Group has noted that *Sustaining Progress*, the new Social Partnership Agreement 2003-2005 recognises that 'the increasing demand for improvements in the provision of public services requires a flexible approach to working practices by individual public servants, managements and unions. This entails the removal of unnecessary demarcations, the adoption of more modern approaches to work and the promotion of innovative ways of meeting the demand for services'.

This report does not preclude the development of skill mix solutions to staffing issues which may arise, given the pace of technological change, increased automation, and major developments in IT systems.

[CXVII] The Criteria of Care analysis of St Luke's Hospital nursing staff requirements examined the time period 2001-2002.
[CXVIII] The following range of nurse specialist has been developed at St Luke's Hospital: clinical nurse specialists (9), advanced nurse practitioner (1), cancer nurse co-coordinator (1), education facilitator (1), practice development nurse (1), nursing research (1), bed utilisation (1).

6.7 Summary

- Healthcare professionals involved in the delivery of radiation oncology require appropriate education and training programmes in order to provide the skills and experience that enable radiation oncology services of the highest quality.

Medical staff

- In Ireland the number of consultant radiation oncologists per million population is the lowest in Western Europe. Each consultant radiation oncologist supervises the clinical management of a patient caseload up to four times that suggested in a number of international guidelines published in the mid-1990s.

- Maintenance of existing radiation oncology / medical staffing norms is inappropriate. In the short term the existing medical staffing levels cannot continue to provide modern radiation oncology treatment services.

- The short-term expansion of the postgraduate SpR/fellowship training programme should be considered, to permit an immediate and future planned expansion of consultant numbers.

- Recent national and international recommendations on medical/consultant staffing indicate a need for 8-12 radiation oncologists per million population, permitting an estimated caseload of 200-350 new patients per consultant.

Radiation therapists

- The Report of the Expert Group on Radiography Grades (2001) and the Report of the Radiography Service Review Group (2002) have recently been completed. The reports identify significant issues that relate to radiation therapist staffing, including staff development, grading structure, education and training and areas of specialist skill development.

- Staffing ratios for radiation therapists have historically been based on numbers of staff per treatment unit. However, with the increasing complexity of treatment, revised models for estimating radiation therapist numbers may be developed in the future. This may necessitate a shift from calculations based on treatment units to a patient-centred approach that recognises complex care and patient needs assessment.

- In many countries there is preliminary evidence of an inadequate supply of therapists, with high vacancy rates, increasing rates of staff loss, and insufficient numbers of training programmes for staff replacement.

- Appropriate staffing ratios are essential to reduce the risk of treatment errors and to ensure the optimal quality and safety of treatment.

- Current Irish guidelines on therapist staffing are similar to those in The Netherlands, UK, Australia and other western countries. The general practice is four radiation therapists per linear accelerator with appropriate staffing ratios for other areas of specialised activity.

Physicists, engineering and dosimetry staff

- The need for adequate physicist support for effective and safe use of radiation therapy equipment has been emphasised in Council Directive 97/43/Euratom – Health Protection of Individuals against the Dangers of Ionising Radiation in relation to Medical Exposure.

- Postgraduate training for staff in radiation oncology medical physics, engineering and dosimetry is poorly structured and informal in contrast to most western countries where formal training courses and certification are the norm.

- There are no agreed staffing levels for radiation oncology physicists in Ireland.

- Recommended minimum staffing levels for the provision of physics support have been published by a joint working group from the European Society of Therapeutic Radiation and Oncology (ESTRO) and the European Federation of the Organisations of Medical Physicists (EFOMP).

Oncology nursing

- Current trends and evidence in radiation oncology indicate the increasing need for highly qualified nursing staff both for the delivery of inpatient care and the more recently developed role in day-care attendance for radiation therapy.

- A range of nursing professional grades are involved in radiation therapy including a number of new positions: oncology nurse co-ordinator, clinical nurse specialist, and advanced nurse practitioner.

- In Ireland most oncology nursing education training consists of short education programmes. Higher-level education programmes on radiation oncology exist at a number of third level education institutions including Trinity College Dublin, UCD and NUI, Galway.

- The existing literature suggests that neither activity-based nor dependency-based models are totally reliable in predicting nursing workforce requirements.

Other staff

- A significant number of additional healthcare professionals are essential members of the multidisciplinary team and assist in providing the totality of care that accompanies the radiation oncology treatment process. They include physiotherapists, dieticians, specialist dentists, psychologists, medical social workers, occupational therapists, speech and language therapists and pastoral care workers.

Section 7

Analysis of radiation oncology infrastructural requirements

7.1 Introduction

The Group undertook a systematic analysis of different configurations of hospital-based treatment centres including examples of networks of the large centre, small centre, and hub and spoke models referred to in section 5.5-5.6.[CXIX]

The Group used a large number of datasets provided by the National Cancer Registry to estimate the magnitude and geographic distribution of the present and future cancer caseload. Information examined included:

- A study of patients who had recently received radiation therapy, conducted by the Institute of Public Administration (IPA) / Royal College of Surgeons in Ireland (RCSI) group. This analysis was undertaken in order to explore patient attitudes, priorities and experiences of radiation therapy with a view to identifying patient expectations and priorities for cancer services, identifying important elements of the service including the best and worst aspects of the existing services, and potential recommendations on the basis of patient priorities on future radiation therapy services. Full results are provided in Appendix 2
- Estimates of the existing and projected population of individual health boards provided by the National Cancer Registry
- Estimates of the existing and projected cancer caseload of individual health boards provided by the National Cancer Registry
- Estimates of the existing and projected cancer caseload of selected hospital boards as determined from datasets analysed by the National Cancer Registry
- Preliminary estimates of potential radiation therapy requirements, particularly the number of linear accelerators was provided by the staff at the National Cancer Registry, using modelling algorithms utilised within the NHS and a separate system developed within The Netherlands. These estimates were applied to a number of scenarios including individual health boards and individual hospitals
- A study of estimated travelling distances and times for patient populations accessing different cancer treatment centre models. This study was commissioned from the Small Areas Health Research Unit (SAHRU) at Trinity College Dublin and the full results are provided in Appendix 3.

Finally, the Group initiated preliminary discussions with representatives of the Northern Ireland Department of Health, Social Services and Public Safety, and senior management and clinical staff from Belvoir Park and Belfast City Hospitals. The goal of this discussion was to be cognisant of proposed future radiation service plans for Northern Ireland, particularly in regard to the terms of reference of the Expert Group.

7.2 Patient expectations – a survey of recent patient experience and expectations of radiation therapy services

Previous studies that have examined patient experience and expectations of radiation oncology services in Ireland have been very limited. In the last decade a single pan-European study, the CAWAC study,[CXX] addressed some dimensions of radiation oncology services using a postal questionnaire. However, this study was limited to patients with either breast cancer or gynaecological malignancy.[302]

In view of this limitation, the Group commissioned a detailed independent study of Irish patient opinion. A more complete description of the study methodology and results is provided in Appendix 2. This research aimed to determine the set of hierarchical preferences and priorities of radiation oncology patients who had recent personal experience of receiving treatment at either St Luke's Hospital or CUH. The study methodology used an initial qualitative focus group methodology followed by a detailed postal questionnaire to enable quantitative assessment of a larger number of patients.

[CXIX] Nineteen different configurations of hospital-based treatment centres were examined.
[CXX] CAWAC: Caring about Women and Cancer

The focus group analysis aimed to explore patient attitudes, priorities and experiences of the radiation oncology services with a view to identifying:

- Patient expectations and priorities for cancer services
- The important elements of a quality radiation oncology service from a patient's perspective
- The perceived best and worst aspects of the existing public radiation oncology services
- Potential recommendations on the basis of patient priorities on future radiation oncology services.

The focus group methodology and postal questionnaire identified the 'best' aspects of the existing service as 'hospital staff', 'being treated alongside others with a similar illness', the 'hospital facility' and 'hostel/lodge' at St Luke's Hospital. Patients within the palliative treatment focus group also praised 'pain relief', 'support groups', 'homecare' and the 'hospice'.

The perceived 'worst' aspects of existing care included 'car parking', 'machines breaking down', several aspects of 'communication' including doctor-patient, hospital-GP, and hospital to hospital, 'receiving information about illness/progress', 'transport', and 'waiting in hospital for treatment'.

Patient recommendations

The most important aspects of service identified by both the patient focus groups and the patient questionnaire, as targets for future recommendations on service development, were the following in order of hierarchical importance:

1. Patients should receive the highest level of patient care.
2. Patients should be given information about their condition.
3. The waiting time from diagnosis to commencing radiation treatment should be reduced.
4. There should be an improvement in communication between medical and other healthcare staff.

The complex issue of geographic access was also addressed in the study, with patients asked to rank the importance of 'distance to travel to a radiation therapy centre' in conjunction with the other parameters being examined. Distance to travel was ranked thirteenth of the examined parameters and was considered less important than obtaining 'the highest level of patient care', 'information on their illness', 'information on their treatment schedule', 'a reduction in waiting time for treatment' and several other parameters (see Appendix 2).[CXXI] This is an important observation as during the course of the Group's meetings there was a significant public and professional debate on the perceived absolute need to have, in many geographic areas, services close to other locally available medical and oncology services. Whilst it is difficult for most patients to comment critically on the 'medical/clinical' quality of services, it is absolutely clear that patients expect and do not wish to compromise the highest quality treatment available, delivered within appropriate timeframes, and that patients will accept the travel requirements and associated inconvenience of attending a fully resourced high-quality treatment centre.

The patient study also identified transport and specialised accommodation as part of the solution for those patients who have to travel significant distances to a centre. Additional suggestions for improving access to the service included the 'maximum use of outreach clinics', and the 'development of more patient-friendly transport'. Specific transport solutions suggested by the patients included the following:

- The organisation of individual patient transport arrangements early in the process of patient clinical assessment and attendance
- The optimisation of transport routes particularly when patients are being collected and returned home after treatment so as to avoid 'circuitous routes' and 'delays'
- An increased flexibility in the use of transport options, for example the entitlement to first class return train tickets for patients using rail transport to and from the hospital. The latter was identified as a means to ensure that patients would have a comfortable seated journey.

[CXXI] Sixty-four per cent of patients had no difficulty travelling for treatment and 25 per cent expressed low satisfaction for distance to travel for treatment.

In regard to future service development it is a clear requirement that the future service plan must help address many of the areas identified by the patient studies. It will be essential to address patient concerns regarding the 'highest level of professional care', 'getting information about my illness', 'communication', 'distance to travel for radiation therapy treatment', 'waiting time from diagnosis to treatment', 'patient transportation', 'more radiation therapy machines around the country', 'improving the transport' and 'improved staffing levels'. It is clearly evident that patients who access the current services have identified several aspects of service limitation that relate to the insufficient capacity and access to both treatment equipment and medical staffing, information availability and communication at a number of levels within the hospital and community-based services, and the need for a more developed and flexible transport solution that is responsive to patients' needs.

From the patient's perspective, it is also clear that achievement of the goals of rapid access to the highest quality care with appropriate communication between the patient and all healthcare staff should be the greatest priority for healthcare professionals and planners in providing future radiation oncology care.

7.3 National linear accelerator requirement

The development of a modern radiation therapy centre is an extremely complex process which requires the installation and integration of high technology treatment equipment and the parallel appointment of an extensive range of healthcare professionals, particularly in the fields of radiation oncology, radiation therapy / therapeutic radiography,[CXXII] medical physics, engineering and information technology and oncology nursing. Although all of the above are essential, an initial method of identifying the national treatment requirement can be based on the estimated number of treatment units required to treat the projected national cancer caseload. Similar estimates of service requirements can be undertaken for the core staff involved in delivering radiation therapy, using the widely accepted staffing norms and guidelines outlined in section 6. However, this is more complex because of the range and grades of staff. Guidelines on future human resource requirements are discussed more extensively in section 9.

The majority of future treatment will be delivered using linear accelerator units and accurate estimates are available for the patient capacity of such units. Recent literature contains a number of modelling algorithms that use this approach and aid the calculation of national and regional linear accelerator requirements. Such an approach has been applied in the analysis and assessment of cancer services in The Netherlands and the UK.[205,206] The Group applied the treatment unit modelling algorithms from both The Netherlands and the United Kingdom in order to identify the future treatment unit requirements of the projected patient population provided by National Cancer Registry and Central Statistics Office data (see section 4). The use of these models and their predictions enabled independent estimates of the national requirement and the results are discussed in detail below.

Prediction of the required number of linear accelerators – use of The Netherlands and United Kingdom modelling algorithms

In establishing the estimates of current needs, the Group used models based on the recommendations of groups from the UK and the Netherlands with regard to percentages of patients treated and linear accelerator throughput.[205,206,215,296] The assumptions of the two models are given in Table 7.1. In both modelling systems the predictions of current requirements depend on:

- The overall number of patients to be treated
- The optimum number of patients per linear accelerator per year
- Recognition that a subset of patients will require more than one treatment course
- Acknowledgement of the need for planned downtime to enable routine maintenance, equipment and software upgrades, and quality assurance programmes.

[CXXII] Prior to 2002 and the Report of the Radiography Service Review Group the professional descriptor 'Therapeutic Radiographer' was used. The title is now changed to Radiation Therapist.

It is important to note that the models used different input criteria in their modelling algorithms to determine linear accelerator requirements.[206] This is not unexpected as it is not at present possible to model all possible permutations of factors that influence radiation oncology practice and its future development. The Netherlands model uses an estimate of the average number of fractions for a patient in determining need,[CXXIII] whereas the UK model uses exposures per year and courses per patient. Nevertheless the existing modelling approaches are the consequence of considerable international research effort to produce tools that enable the forward calculation of treatment requirements. The Group believes they significantly facilitate the calculation of future treatment requirements in Ireland.

Table 7.1: Assumptions of linear accelerator prediction models

The Netherlands model[206]
Excludes treatment of non melanoma skin cancer cases **15.2 fractions per patient increasing to 26.6 in 2010** **10.9 fractions per course increasing to 19.0 in 2010** **Complexity factor of 1.15**
UK model
20,000 exposures per linear accelerator per year **35 per cent uptake 28 exposures per year** **50 per cent uptake 34 exposures per year** **1.4 courses per patient** **10 per cent downtime per linear accelerator**

Using the National Cancer Registry estimates of cancer incidence between 1994 and 1998 (see section 4), the Netherlands' modelling algorithm suggests a current total national requirement of 29 linear accelerators at a 50 per cent uptake of radiation therapy (Table 7.2), while the UK model estimates a need for 25.4 linear accelerators (Table 7.3). Given the widely different assumptions within the comparative modelling algorithms, the two independent estimates are in considerable agreement. The average of these two estimates is 27.2, and this is used as an indicative initial baseline for predicting future needs in Ireland.

[CXXIII] The terms *course, fraction*, and *exposure* are commonly used in radiation oncology and refer to the way in which a course of treatment is broken down for delivery. A *course* refers to a specific period of treatment that is delivered to the patient over a specified period of time. The amount of time can vary between a single treatment on one day to daily attendance for several weeks. This course of treatment is given as individual *fractions,* and typically one fraction of treatment is given per day. During each fraction of treatment the particular region of the body can be treated from a number of different beam positions or treatment fields and each of these fields is called an *exposure.* The number of treatment fields chosen to deliver the radiation dose to the specific area determines the number of exposures on each visit, for example four-field arrangement for pelvic treatment.

Table 7.2: Estimates of current Irish radiation oncology treatment equipment requirement using the Netherlands' modelling algorithm

	Netherlands model
New cancer cases per year	14,232
Desired uptake (percentage)	50
Actual uptake (cases per year)	7,116
Courses per patient	1.4
Courses per year	9,962
Complexity factor	1.15
Courses per year	11,456
Fractions per patient	15
Fractions per course	11
Fractions per year with complexity factor	124,875
Courses per linear accelerator per year	395
Fractions per linear accelerator per year	4,306
Linear accelerators required	**29.0**
Linear accelerators per 1,000,000 population	**8.0**

Table 7.3: Estimates of current Irish radiation oncology treatment equipment requirement using the United Kingdom's modelling algorithm

	UK model
New cancer cases per year	19,399
Desired uptake (percentage)	50
Actual uptake (cases per year)	9,700
Courses per patient	1.4
Courses per year	13,579
Downtime factor	1.1
Exposures per patient	34
Exposures per year with downtime factor	507,866
Exposures per linear accelerator per year	20,000
Linear accelerators required	**25.4**
Linear accelerators per 1,000,000 population	**7.0**

7.4 Future national linear accelerator requirement

Projection of future linear accelerator requirements within the Republic of Ireland by the Group has been estimated using the future patient caseload estimates previously detailed in section 4 and the Dutch and UK modelling algorithms. In the case of both modelling systems the number of fractions per course is expected to increase in the forthcoming decade as a result of changes in clinical protocols (see section 3). In the previous section, which identified potential current need, significant changes in treatment fractionation policies have not been factored which consequently give the lowest possible estimate of future linear accelerator need. The potential future adoption of more prolonged fractionation protocols for an increased number of patients would inevitably result in a further increase in the requirement for radiation oncology treatment facilities beyond that attributable to the caseload increase alone.

Table 7.4: Estimated national linear accelerator requirements, 2005 to 2015[CXXIV]

Year	Netherlands model	UK model	Combined average
1994-1998	29.0	25.4	**27.2**
2005*	33.3 (32.8-33.9)	29.2 (28.8-29.6)	**31.3** (28.8-33.9)
2010*	36.6 (36.1-37.1)	32.0 (31.6-32.4)	**34.3** (31.6-37.1)
2015*	40.4 (39.8-41.0)	35.5 (35.0-35.9)	**37.9** (35.0-41.0)

* Utilising the Dutch and UK models, the lower figure from the UK estimates and the higher figure from The Netherlands model are provided in brackets in the combined average column. They are provided to illustrate the range of the national linear accelerator requirement estimates. The average of both is provided in bold text.

The modelling estimates indicate the national need for 38 linear accelerators in 2015. Currently there are eight linear accelerators in the public health service. An additional three linear accelerator treatment units are due to be commissioned at UCHG in 2003/4. There are three linear accelerators in the private sector (see Section 2).

An additional expectation of a forthcoming radiation oncology service expansion will be a greater ability to adhere to international and future national guidelines on 'waiting times' for radiation therapy.[CXXV] Several publications have attempted to analyse the need to balance treatment resources with the varying rate at which patients present for treatment, with the ultimate goal of ensuring that planned service provision can meet indicative clinical waiting times. The limitations on the maximum use and capacity of radiation therapy services are partly due to random fluctuations in demand, particularly with periods where patient demand exceeds the 'averaged' level of radiation therapy provision. This problem is increased when management of the patient's condition requires a series of steps, exemplified by radiation therapy planning which involves a large number of consecutive processes (see section 2). In order to avoid unacceptable waiting times, the capacity of each step in the radiation therapy process must be sufficient to cope with the variation in patient referral.[CXXVI] The aims of increasing efficiency and shortening waiting times are therefore opposite, so that the use of facilities at a near 100 per cent level and short waiting times are mutually exclusive.

Recent analyses of radiation therapy waiting times have highlighted a number of factors that are important in developing a national service plan within Ireland that ultimately should help prevent the development of waiting times. These include the following:

- A recognition and measurement of the variable rate of patient referral is necessary. Patient referral is not uniform over short periods of time so there is invariably some clustering of patients with accompanying peaks and troughs in demand for radiation oncology treatment.[CXVII]
- It is recognised that smaller treatment centres will tend to have larger variations in the numbers of patients being referred, which in turn can lead to inefficiencies in the utilisation of treatment capacity and the need for proportionally greater excess capacity.

[CXXIV] Utilising the Dutch and UK models, the lowest figure of the UK estimates and the higher figure from The Netherlands model have been used as the extreme limits of the linear accelerator estimates.
[CXXV] Appropriate 'waiting times' are dependent on the specific cancer type and treatment protocol. There is an enormous range of preferred time schedules for commencing radiation therapy, encompassing immediate access to emergency and urgent treatment to the elective provision of radiation therapy in a period of weeks to months after initial surgery and/or other neoadjuvant therapies.
[CXXVI] Analyses of patient attendances at radiation oncology centres using Queuing theory demonstrates that treatment provision becomes highly inefficient with long waiting lists when utilisation rates are high. The expansion of treatment centres (i.e. multiple servers) will enable a higher efficiency even when utilisation rates are high. A future examination of a 'single queue' – multiple server models on a regional or national basis – may enable additional efficiencies.
[CXVII] The statistics of randomness allow calculation of the necessary treatment capacity required to avoid excessive waiting lists. Analyses using Monte-Carlo and other stochastic methods can be used to identify the level of surplus capacity necessary to achieve different durations of waiting times.

- The trend to site sub-specialisation and the need to be able to prioritise certain sub-groups of patients may add to the above and generate an additional increment to the overall national treatment capacity requirement.

In order to adhere to the existing and anticipated guidelines for those patients requiring short waiting times for treatment, the proposed national service plan must have a degree of planned over-capacity that exceeds the mean demand. This level of excess capacity depends on the future level of demand and the maximum/preferred waiting times as defined by clinical protocols and guidelines (see sections 1, 3 and 4). It is evident that if the treatment resources are too few, waiting times will not be met, with the self-evident consequences for clinical care and patient outcome.

The Group considered the potential development of additional treatment capacity with the knowledge that radiation oncology treatment units would continue to exist within the larger metropolitan areas of Dublin and Cork and at the recently approved Galway development. A number of pivotal questions arose in parallel with the examination of potential care delivery models:

- Given the significant population base and projected cancer caseload in the Eastern Region and SHB, what is the preferred future service model for the specific Authority and Health Board?
- What are the preferred care options for the significant patient population that have reasonable access to the medical facilities within the EHRA but who live in a number of adjacent health boards?
- In regard to the Eastern Region and St Luke's Hospital what is the optimum future service model?
- What is the optimum service model for all other geographic areas?

The Group recognised that recommendations should support a radiation oncology service with rapid access to the highest quality care. It is inevitable, however, that some patients will choose to avail of other radiation oncology services including those provided at other supra-regional facilities, private facilities, or treatment facilities available in other countries. Significantly, the Group recognised that, apart from the latter situation being a consequence of personal choice, there would be many situations where cross-referral of a patient to other supra-regional radiation oncology services would be highly appropriate on the basis of clinical requirements or additional specialised care and treatment.

In considering the existing international experience, trends in radiation therapy, and recommendations, the Group has in addition examined and highlighted linkages with the health strategy *Quality and Fairness: A Health System for You*.[27] The Group developed the following series of guidelines to facilitate the future identification of suitable locations for the development of additional radiation therapy facilities:

- **A sufficient patient population should exist within a proposed catchment area to support the existing and future development of a radiation oncology service.**
- **A radiation oncology service should enable maximum patient access to the highest quality service.**
- **Other clinical specialties and support services that enable the appropriate function and development of a radiation oncology centre and/or supra-regional cancer centre should exist on the site.**
- **Radiation oncology must be part of organised multidisciplinary cancer care.**
- **A radiation oncology service should take account of patient groups with special needs.**
- **A radiation oncology service should develop links between those hospitals providing radiation oncology care and other hospitals involved in the provision of cancer care but without physical treatment facilities.**
- **Where radiation oncology facilities are not available on site, it will be important to provide appropriate outreach services particularly through the development of joint clinical and other appointments between hospitals and/or health boards.**

Population within a catchment area

The resident population of a catchment area, and as a consequence the extrapolated patient caseload, is an important indicator of future patient referral, access, and use of a radiation oncology centre.[CXXVIII] The Group agrees in principle with the existing international recommendations that a population of greater than 650,000 should, where possible, be the minimum preferred population necessary to support a radiation oncology unit. This population of itself is not sufficient without adherence to additional guidelines highlighted below.[2]

Patient access

A radiation oncology centre should have good geographic access for patients and families, including road and public transport, as well as ambulance transfer. New centres will need to address and highlight any particular access issues and preferably implement indicative solutions that relate to this. This should include facilitating the closest proximity and availability of public transport inclusive of road (private car and bus), ambulance, regional and suburban train/LUAS/DART, and other options. Hospitals should also address any additional or unique patient transport requirements.

Existence of other clinical specialties and their relationship to a radiation oncology centre – the potential role of a supra-regional cancer centre

A radiation oncology centre should have or co-develop the extensive range of established clinical and other support services that provide major components of oncology care.[69,239] It is recommended that the majority of radiation oncology treatment facilities be located within the context of a supra-regional cancer centre.[CXXIX ,69, 239] The exact nature of a supra-regional cancer centre as outlined in *Cancer Services in Ireland: A National Strategy* requires further clarification. However, the following clinical and related specialties highlight a range of patient services with which radiation oncology specialists interact.[2] Where possible these services should be accessible at the same hospital site as the proposed clinical radiation oncology service:

- Medical oncology
- Surgical oncology, e.g. thoracic/respiratory, breast, prostate, colorectal
- Full pathology services including histopathology, microbiology, haematology and clinical chemistry
- Diagnostic imaging (including MRI, CT, US, Nuclear medicine and other imaging facilities)
- Palliative care
- Haematological oncology
- Easy / on site access to intensive care facilities
- Easy / on site access to general medical services, e.g. cardiology, respiratory and gastro-intestinal medicine
- Easy / on site access to specialist surgical services, e.g. head and neck, gynaecological, and neurosurgical oncology services, orthopaedic surgery services, and access to plastic and reconstructive surgery
- Easy / on site access to patient rehabilitation and support services, e.g. speech and language, physiotherapy, occupational therapy, dietetics, dental services
- Access to specialist medical services, e.g. psychological medicine and physical rehabilitation, cancer genetics clinics
- Access and/or linkages to paediatric oncology care programmes
- Additional special/national/regional oncology services.[CXXX]

Existence of established multidisciplinary cancer care

A radiation oncology centre location should facilitate the operation of multidisciplinary oncology meetings. There should be a clear requirement to enable such meetings at a hospital, inter-departmental, inter-institutional, inter-health board level. Support for advanced telemedicine packages such as Telesynergy® will be important in permitting such developments.[260,261]

[CXXVIII] Where a health board does not have the suggested population base, a partnership model with adjacent proximate health boards should be considered on the basis of optimal patient access and pre-existing shared care and joint appointment arrangements between the proposed 'partner' health boards.

[CXXIX] National Cancer Strategy 1996, pp 52-55

[CXXX] It will be important to consider the existence of any current or planned special services that relate to oncology care, particularly if other regional or national oncology services exist at a particular heath board or hospital location.

Linkages with other hospitals in the provision of cancer care

A radiation oncology centre should have or develop operational linkages with other hospitals that relate specifically to oncology care provision. The nature of and requirement for linkages should be identified and illustrate functional oncology services co-ordinated among the hospitals within a catchment area and where appropriate between hospitals from adjacent health boards.

Existence of joint appointments to boards/areas for whom services will be provided by a hospital

A radiation oncology centre should develop and support joint appointments particularly at the level of consultant radiation oncologists in order to facilitate patient care shared between hospitals either within a catchment area or between individual hospitals in adjacent health boards.

Patient groups with special needs

Radiation oncology centres may in addition need to identify special patient groups or national programmes that cater for distinctive cancer patient populations with particular radiation oncology care requirements, particularly in regard to inpatient and/or complex radiation oncology treatment protocols (see section 1.6).

7.5 Analysis by health board

The Group requested written information from all health boards on their existing and future plans for the development of clinical radiation oncology facilities.[CXXXI] In addition, representatives of each health board were invited to a further meeting with the Group in order to provide an additional update on this area.[CXXXII] A wide spectrum of submissions detailing potential radiation services including new regional centres and linkages are summarised later in this section.

The Group has undertaken a detailed analysis of these submissions in conjunction with the information available on future population and caseload projections for individual health boards provided by the CSO[202] and the NCRI. At an early stage of this analysis it became evident that a future national structure for radiation oncology services could not be simply aligned to the existing regional oncology services as developed by a number of health boards, as in a number of boards the patient population and other criteria are not sufficient to support the scale of treatment facility that has been identified by the Group.

With the exception of the population served by the Southern Health Board and adjacent regions and that of the collective area health boards constituting the Eastern Region, no other recognised health board or catchment population meets the suggested 650,000-population minimum requirement for the development of a radiation therapy centre as defined in the 1996 *Cancer Services in Ireland: A National Strategy*.[2] Publicly funded radiation oncology services already exist at both the Eastern Region[CXXXIII] and the SHB,[CXXXIV] although the specific centres serve populations and resultant caseloads larger than the respective health board or authority. Further detail on the catchment populations has been provided in section 2.

In considering the future development of national services the Group took cognisance of the recent approval and forthcoming commissioning of the new radiation oncology facility at UCHG. This is an important development which impacts on the analysis of care provision, the future organisation of services on the western seaboard, and the future structure of a national service provision. The DoHC announced the approval of a radiation oncology unit at UCHG in 1999 prior to the formation of the Expert Group. The unit is at an advanced stage of development with the equipment tendering process completed and the clinical commissioning of the unit expected to begin in mid-2003/early 2004. The UCHG unit will provide care to an

[CXXXI] The Group requested on two occasions written submissions from each health board regarding the details of any existing or future plans for radiation oncology service development.
[CXXXII] An opportunity to make an oral submission and respond to any queries was extended and taken up by the Eastern Regional Health Authority, the Midland Health Board, the Mid Western Health Board, the North Western Health Board, the South Eastern Health Board and the Southern Health Board.
[CXXXIII] St Luke's Hospital
[CXXXIV] Cork University Hospital

estimated catchment population of 620,000,[cxxxv] and as a consequence it will have the capacity to deliver radiation oncology services to a considerably larger geographic catchment area than the existing Western Health Board (1996 population 365,000). The estimated population outside the WHB that will be served is approximately 250,000.

At the time of this report, potential linkages between adjacent health boards to utilise this new facility have not been fully established or agreed. The Group has reasoned that patient referral to UCHG will in all probability come from geographically proximate parts of adjacent health boards, particularly the MWHB, NWHB and possibly the western part of the MHB. Of importance, this catchment area was also identified in the 1996 *Cancer Services in Ireland: A National Strategy* and patient flows of this type were recognised as pivotal to the future development of the UCHG facility.[cxxxv] The Expert Group has endeavoured to take this service development into account when considering the aspirations of other locations and adjacent health boards which will form some part of the UCHG catchment area, and where as a consequence the population in adjacent regions would not be sufficient for an appropriate or viable radiation oncology facility.

7.6 National linear accelerator requirements – estimates arising from health board populations

Based on average cancer incidence documented for the period 1995 to 1998 within each health board area, the radiation oncology requirements of each health board can be estimated in a similar way as those for the whole country (see section 7.3-7.4). The figures in Table 7.6 are based on the estimated national requirement for 27.2 linear accelerators (see section 7.3) and on The Netherlands and UK modelling algorithms that have already been discussed.

Population projections

Detailed population projections are not available by health board area. In most cases, however, the regions used for population estimation coincide with health board areas; where they do not, estimates have been made based on the current distribution of population between counties. The results of projected future patient populations for health boards are presented in Table 7.5. There are significant uncertainties associated with population modelling at regional level, as levels of internal migration cannot be predicted with a high degree of accuracy and there will be additional inaccuracy in estimates where regional and health board area boundaries do not coincide. However, any inaccuracy in the estimates will have a relatively minor effect on calculated projections of radiation therapy requirements.

Table 7.5: Population projections by health board area, 1996-2015

	Eastern	MHB	MWHB	NEHB	NWHB	SHB	SEHB	WHB	All
1996	1,295,939	205,542	317,069	306,155	210,872	546,640	391,517	352,353	**3,626,087**
2000	1,397,128	207,516	328,172	318,169	214,941	559,595	400,274	365,339	**3,791,134**
2005	1,529,841	209,971	343,281	333,980	220,573	576,936	410,704	383,255	**4,008,541**
2010	1,659,027	210,960	357,949	349,269	225,999	592,417	418,492	401,920	**4,216,033**
2015	1,774,043	209,986	370,293	362,734	230,367	604,341	422,840	418,763	**4,393,367**

[cxxxv] *Cancer Services in Ireland: A National Strategy 1996*

Using the projected requirements from Table 7.4, and the additional CSO population projections (Table 7.5), an estimate of the need for radiation oncology facilities arising from health board populations up to 2015 is obtained (Table 7.6).[202] These projections take into account projected changes in both population numbers and age distribution. Table 7.6 provides a preliminary estimate of potential linear accelerator requirements for the identified patient populations from the 1996 CSO data and the estimated populations for 2005 and 2010. Appropriate forward planning for 2015 and beyond will require detailed ongoing review of changes in population, cancer caseload and future clinical management protocols so as to anticipate any additional treatment requirements for the longer time period. The potential estimates of need for 2015 are provided in italics to highlight the anticipated additional increase in national treatment capacity from approximately 34 to 38 linear accelerators.

Table 7.6: Estimated national linear accelerator requirements arising from health board populations to 2015

	1996	2005	2010	2015
Ireland	**27.2 (25.4-29.0)**	**31.3 (28.8-33.9)**	**34.3 (31.6-37.1)**	***37.9*** **(35.0-41.0)**
Eastern	**8.9 (8.2-9.5)**	**10.9 (9.7-12.2)**	**12.3 (11.0-13.7)**	***13.9*** **(12.5-15.5)**
MHB	**1.6 (1.5-1.7)**	**1.8 (1.5-2.1)**	**1.9 (1.6-2.2)**	***2.0*** **(1.8-2.4)**
MWHB	**2.4 (2.3-2.6)**	**2.7 (2.4-3.1)**	**3.0 (2.6-3.4)**	***3.2*** **(2.8-3.7)**
NEHB	**2.3 (2.2-2.5)**	**2.6 (2.3-3.0)**	**2.9 (2.6-3.3)**	***3.2*** **(2.8-3.6)**
NWHB	**1.7 (1.6-1.8)**	**1.9 (1.6-2.1)**	**2.0 (1.8-2.2)**	***2.1*** **(1.9-2.4)**
SHB	**4.3 (4.0-4.6)**	**4.8 (4.2-5.4)**	**5.2 (4.6-5.8)**	***5.6*** **(5.0-6.3)**
SEHB	**3.0 (2.8-3.2)**	**3.4 (3.0-3.9)**	**3.7 (3.3-4.2)**	***4.1*** **(3.6-4.6)**
WHB	**3.0 (2.8-3.2)**	**3.2 (2.9-3.7)**	**3.5 (3.1-3.9)**	***3.8*** **(3.3-4.3)**

Note: The figures in brackets give the lower and upper limits of confidence of each estimate.

7.6.1 Eastern Region and ERHA[CXXXVI]

Demographics

CSO population growth models estimate an increase in population to approximately 1.66 million by 2010 and 1.77 million by 2015 (Tables 7.5 and 7.6).[202] The population within the catchment area of the ERHA is the largest in the country and recent projections suggest that it will continue to be the fastest growing area, with an estimated 37 per cent increase in population between 1996 and 2015 compared to an estimated 21 per cent increase on a national basis. The recent National Spatial Strategy public consultation paper highlighted the population scale of the Eastern Region and noted that collectively the other gateways had a combined population in 1996 equal to 38 per cent of Dublin's population: Cork (population 180,000), Limerick (80,000), Galway (60,000) and Waterford (45,000).[CXXXVII] In addition it was noted that Irish towns above 40,000 in population are generally concentrated in the east and south-east and many are now part of or adjacent to the Greater Dublin Area.[CXXXVIII] Research carried out as part of the National Spatial Strategy (NSS) analysis has also suggested that by 2020, 80 per cent of the population growth in the state could take place in the Greater Dublin Area, with only marginal growth and possibly decline in other areas.[CXXXIX]

The estimated scale of population growth within the Eastern Region therefore constitutes a major challenge for the appropriate future structuring of radiation oncology services within the national plan and development timeframe being considered by the Group.

Existing oncology/radiation oncology services

Patients living in other health boards have traditionally availed of oncology services within the Eastern Region. In recent years this appears to have increased somewhat despite the development of certain regional oncology services, particularly medical oncology, in other health board areas. A complex mix of DoHC funded oncology services has developed over many years, including:

- A national centre for the provision of radiation oncology services – St Luke's Hospital
- Adult medical oncology departments in at least six hospitals[CXL]
- A wide range of surgical oncology services at the six university-affiliated hospitals
- National paediatric oncology services at Our Lady's Hospital for Sick Children, Crumlin
- Haematological oncology departments in five hospitals,[CXLI] with one hospital providing the National Bone Marrow Transplant Programme[CXLII]
- A limited oncology service at three maternity hospitals
- A limited oncology service at a number of specialist hospitals including the Royal Victoria Eye and Ear Hospital, Cappagh Hospital, and Hume Street Hospital
- A limited oncology service at a number of general hospitals including St Michael's, Naas, and Loughlinstown hospitals.

Three hospitals provide radiation therapy services within the Eastern Region, the largest of which is St Luke's Hospital, with two private hospitals which are not responsible to the ERHA (see section 2).[CXLIII] St Luke's Hospital is the major clinical service provider of radiation oncology. However, it also provides a component of

[CXXXVI] The term Eastern Region refers to the geographic area encompassed by the three subdivisions of the Eastern Regional Health Authority, and the term ERHA refers to the administrative entity responsible for commissioning services.
[CXXXVII] National Spatial Strategy – Public Consultation Document. A gateway is a 'centre which has a strategic location relative to a surrounding area'.
[CXXXVIII] National Spatial Strategy – Public Consultation Paper
[CXXXIX] The Greater Dublin Area (GDA) refers to the area including Dublin County Borough and all the counties of Dun Laoghaire/Rathdown, Fingal, Kildare, South Dublin and Wicklow.
[CXL] One medical oncologist at Beaumont Hospital, two medical oncologists at the Mater Misericordiae Hospital, three medical oncologists at St James's Hospital, two medical oncologists at St Vincent's Hospital and one medical oncologist at the Meath and Adelaide Hospitals incorporating the National Children's Hospital (AMNCH).
[CXLI] One haematologist at Beaumont Hospital, two haematologists at the Mater Misericordiae Hospital, seven haematologists at St James's Hospital, one haematologist at St Vincent's Hospital and one haematologist at the Meath and Adelaide Hospitals incorporating the National Children's Hospital (AMNCH).
[CXLII] St James's Hospital
[CXLIII] Mater Private Hospital, St Vincent's Private Hospital

the Eastern Region's medical oncology and palliative care services. The hospital is unique as it is the sole institution in Ireland dealing almost exclusively with clinical cancer management. Following the investment programme initiated in 1995 the hospital has achieved several milestones in advancing radiation oncology care within Ireland. These include, for example:

- The implementation of 3-D conformal treatment programmes for a number of cancer sites
- The development of a national adult and paediatric total body irradiation (TBI) programme in conjunction with St James's Hospital and Our Lady's Hospital for Sick Children
- The development of a stereotactic radiosurgery programme in conjunction with Beaumont Hospital
- The first healthcare institution in the country to commission hostel-type accommodation for oncology patients – Oakland Lodge
- The commissioning of a patient support and rehabilitation centre
- The development of dedicated patient transport proposals for patients living in health boards adjacent to the Eastern Region (MHB and NEHB).

Board submissions

The ERHA submission noted that, in 1999, patients from outside the Eastern Region spent 34 per cent of their acute hospital bed days in ERHA hospitals. The equivalent information on oncology admissions and day-care attendances was not available but is estimated to be significant. Additional information received from the ERHA highlighted the following:

- Existing radiation oncology services were insufficient to meet the needs of the resident population and of patients from other regions who receive radiation therapy at hospitals within the Eastern Region.
- Patient access to existing radiation oncology services was limited by insufficient facilities, geographic factors, and whether the option of radiation therapy is offered to the patient.
- Patients from the North East and Midland regions would probably continue to receive radiation oncology services in the Eastern Region.
- Patients from parts of the South-Eastern region, in particular those living in Carlow, North Kilkenny and North Wexford, would also probably continue to receive radiation oncology services at hospital(s) within the Eastern Region.

The ERHA supported the long-term development of at least two radiation oncology facilities, based on their assessment of the projected population growth, cancer trends, current services, evidence for best practice, and provision for regions outside the Eastern Region. They proposed the following immediate and phased expansion of radiation oncology services:

- Phase I: Radiation oncology services to be developed initially at two major acute hospitals in the Eastern Region over a 5-year period. During the development of the two units, St Luke's Hospital would be further developed to facilitate the introduction of new techniques, specialised procedures and the preparation of complex treatment plans for other units. Additional roles for St Luke's during this period were identified including staff training, education, research, monitoring and evaluation of outcomes, and the development of quality assurance and risk management strategies.
- Phase II: Following successful completion and commissioning of the two new units, the ERHA proposed a review of St Luke's Hospital. The review would take account of patient flows to the Eastern Region, the emerging pattern of demand, and the expanding role of radiation therapy in treating malignant and non-malignant conditions.
- At a national level certain rare cancers requiring radiation oncology treatment would continue to be treated at appropriate centres within the Eastern Region.
- Appropriate transport and accommodation should be provided for any patient travelling long distances to Dublin-based services, and all patients and families should have additional access to psychosocial support and information.

Analysis

Analysis of the estimated future Eastern Region population projections and resultant oncology caseload provides an unequivocal case for the development of additional radiation therapy treatment capacity and/or facilities within the Eastern Region. The Group supports the ERHA proposal to develop two sites for radiation oncology services within the Eastern Region. In addition the Group agrees that the radiation oncology requirements of the patient population residing in the MHB, NEHB and part of the SEHB would, in the first phase of service expansion, be best met by the development of additional treatment capacity at appropriately resourced treatment facilities located within the Eastern Region. Both the MHB and the NEHB have indicated that clinical radiation oncology treatment services for the majority of patients in these areas would be provided through the appropriate partnership development of services in the Eastern Region. The levels of equipment, infrastructure and staff required within the Eastern Region are therefore dependent on the future patient caseload that may attend from these adjacent health boards in conjunction with the significant additional caseload identified within the Eastern Region.

The location of the additional radiation oncology centres within the Eastern Region has not been identified by the ERHA. This complex and difficult question requires a unique and sensitive analysis of options particularly in regard to the future of existing facilities at St Luke's Hospital. As indicated in section 2, significant resources have been made available to upgrade St Luke's Hospital over recent years and significant developments and advances in clinical care have followed. At the present time, however, the radiation oncology unit at St Luke's Hospital does not meet all of the guidelines identified by the Group for a future radiation oncology centre / service development (see section 7.5). Given the proposed model of service development the Group has attempted to identify the potential implications and options for the future development of St Luke's Hospital, and the additional service expansion necessary to address the need of the expected patient caseload. At its simplest, two options for service expansion can be considered which should in addition meet the concept and future specification of supra-regional service development:

Option A

- The upgrading of St Luke's Hospital to incorporate the additional non-radiation therapy elements of the cancer service, which have been identified as essential (see section 7.4), in conjunction with the development of an additional radiation oncology treatment centre within the Eastern Region Dublin Academic Teaching Hospitals (DATHs). In regard to a potential St Luke's Hospital expansion, there are a number of 'stand alone' cancer centres that have the appropriate resources and clinical disciplines to be recognised as comprehensive cancer centres, for example, the Royal Marsden Hospital and Christie Hospitals in the UK,[213] the Institut Gustav Roussy in France, Memorial Sloan Kettering and MD Anderson Hospitals in the USA, the Peter McCallum Cancer Institute in Australia, and the Princess Margaret Hospital in Canada. It should be noted that the scale of additional oncology, medical and surgical services to be developed in parallel with the radiation oncology services in the context of a comprehensive cancer centre is significant (see section 7.4).[69]

Option B

- The development of two new centres on university hospital/DATH campuses in Dublin. In this instance all the identified expansion of clinical facilities would be available in the context of either a comprehensive cancer centre or the supra-regional cancer centre model at two new sites (see section 7.4) and would accompany the phased transfer of the St Luke's Hospital treatment capacity to the two new service locations. Given the nature of such a transfer, it would be preferable to have a role for St Luke's Hospital in facilitating such change in order to ensure maximal continuity of clinical care and staff retention. The magnitude, logistics and forward planning of such potential change is recognised by the Group as large and would benefit from additional detailed analysis. The scale and necessary detail of the latter analysis

was not realisable by the Group. A significant and unresolved question in considering option B will be the physical/site capacity and the associated costs of any potential DATH site to integrate the proposed physical scale of development outlined in section 8. This is particularly complex because of the wide range of large teaching hospitals, the particular characteristics of individual sites, in conjunction with pre-existing site development plans, uncertainties over inter-institutional co-operation and competing expectations, and the unknown future planned scale of development of oncology services at the respective hospitals.

In the submissions from the ERHA there was no specific reference or proposal to develop specific hospital locations other than the immediate investment programme in St Luke's Hospital that was identified as necessary to cater for the immediate and ongoing expected increase in demand for radiation therapy services. It was not feasible for the Group to undertake the detailed comparison and assessment of individual hospital sites that would enable an authoritive and thorough analysis of the above options.

A comprehensive review of the advantages inherent in specific hospital sites within the Eastern Region should be undertaken using the guidelines outlined in section 7.4. This will facilitate the earliest possible identification of the preferred hospital location(s) for service expansion. It is possible at this time, however, to estimate the indicative scale of equipment and human resource requirements that will be necessary for the future provision of high-quality modern radiation oncology for the Eastern Region and adjacent catchment areas services (see sections 5, 6 and 7), and the recommendations arising from this analysis are further discussed in the recommendations detailed in section 8.

There is an immediate need to address the radiation therapy needs of the population resident in the Eastern Region and adjacent catchment areas and the action plan should include the following:

- The commissioning of appropriate additional treatment facilities at the proposed new treatment centre(s) as discussed in section 8, with the early involvement and partnership of representatives of the ERHA and adjacent health board areas
- The identification and formalisation of an additional consultant radiation oncologist(s) appointment(s) based on the identified clinical caseload in the region (see section 9)
- The rapid achievement of significant elements of such consultant-provided services through the appointment of additional consultant radiation oncologists with dedicated sessions to hospitals in the adjacent health boards and range of DATHs within the Eastern Region. The additional consultant(s) should have a full support team
- The development of additional consultant-provided radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate Eastern Region and adjacent health board catchment hospitals
- The development and refinement of dedicated transport solutions as outlined in section 8. These should be developed in partnership with the adjacent health boards and will require innovative transport solutions for patients living at a distance from the treatment centre
- The development of appropriate telemedicine linkages as outlined in section 8
- Given the extensive geographic area of the identified catchment populations, the development of appropriate hostel or low-dependency accommodation for both patients and families. This development will be of major importance in enabling the success of the proposed service.

7.6.2 Midland Health Board (MHB)

Demographics

CSO population growth models anticipate an increase in population to approximately 211,000 by 2010. However, this may stabilise to 210,000 by 2015 (Tables 7.5 and 7.6).[202]

Existing oncology / radiation oncology services

In the MHB a significant population of patients live in close proximity to the south-west and northern areas of the Eastern Region. Regional medical oncology and surgical oncology services are at an early stage of development and regional palliative care services will be developed in the near future. Two full-time consultants, one in medical oncology and the other in haematology, are in post. These consultants, together with colleagues in pathology, also hold formal sessions at St James's Hospital within the Eastern Region and additional strong linkages exist particularly between the south-west area of the Eastern Region and the MHB in the disciplines of diagnostic imaging and other pathology services.

In regard to existing radiation oncology services, a single consultant with two sessions dedicated to the MHB was appointed in 1995 between St Luke's Hospital and the MHB. Through this appointment St Luke's Hospital provides monthly outreach clinics at both Portlaoise and Longford-Westmeath General Hospitals, which facilitate new patient assessment and patient follow-up. An additional monthly clinic is provided at St Joseph's Hospital, Athlone. A new multidisciplinary clinic including radiation oncology will commence at Tullamore General Hospital during 2003 in tandem with the development of regional medical oncology and regional haematology services at this location. Data from the NCRI indicate that the majority of patients (>99 per cent) from the region who require radiation therapy access this at the treatment centres in Dublin, particularly at St Luke's Hospital (see Section 2.12).

Board submissions

Information provided by the region to the Group on potential future service development has highlighted the following:

- A relationship with Dublin-based radiation oncology treatment services is ongoing.
- In 2002 St Luke's Hospital in collaboration with the MHB commenced an innovative pilot transport initiative where dedicated daily private bus transport is co-ordinated with matched patient treatment periods at St Luke's Hospital. Initially this is being provided for patients attending the hospital from Longford-Westmeath and Laois-Offaly.[CXLIV] It is anticipated that this will facilitate a significant number of patients to attend as day cases.
- There is a need to develop an additional radiation oncology consultant position and associated team with dedicated sessions at appropriate hospitals within the MHB. This position would be linked to St Luke's and St James's Hospitals and work with the existing consultant appointed to the region.

Analysis

The MHB does not anticipate a short to medium-term requirement for a separate radiation oncology treatment centre located within the MHB. This is in keeping with the analysis undertaken by the Group, the guidelines that aid the identification of radiation therapy centre development (section 7.4), and the service development timeframe being considered by the Group. It is important nevertheless that the identified elements of future enhanced clinical radiation oncology service noted above be supported and developed. There is an immediate need to address the radiation therapy needs of the population resident in the MHB. In the short to medium timeframe this requirement will be best met by the following:

- The commissioning of appropriate additional treatment facilities developed in partnership with the Eastern Region
- The rapid recruitment of an additional consultant radiation oncologist with dedicated sessions at one of the MHB specified oncology centres.[CXLV] The additional consultant should have a full support team

[CXLIV] The pilot study addressing the feasibility of dedicated private bus transport for patients commenced in 2001. Two bus 'corridors' collect patients within each of the two Midland Health Board catchment areas. The bus corridors enable rest stops for patients and the return of patients to their family homes on a daily basis. The initial feedback on the service is excellent. The national expansion and use of transport mechanisms of this type is further discussed in section 8.

[CXLV] The regional oncology unit is located at Tullamore Hospital. However, a number of outreach oncology services are located at Portlaoise and Longford-Westmeath Hospitals.

- The development of additional consultant-led radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate MHB hospitals
- The further development and refinement of dedicated transport solutions that have been piloted between St Luke's Hospital and the MHB along the additional guidelines outlined in section 8. This will require innovative transport solutions for patients living at a distance from the treatment centre
- The development of appropriate telemedicine linkages as outlined in section 8
- The development of additional hostel or low-dependency accommodation for both patients and families that will facilitate attendance for treatment.

In the longer term, the development of additional radiation oncology services for the MHB will require further analysis, taking account of evolving clinical practice/guidelines, patient demographics, the stage of development of regional oncology services, and available international guidelines on radiation therapy service planning.

7.6.3 Mid Western Health Board (MWHB)

Demographics

CSO population growth models anticipate an increase in population to approximately 358,000 by 2010 and to 370,000 by 2015 (Table 7.5).[202] Limerick/Shannon has been identified as a gateway in the National Spatial Strategy.[CXLVI]

Existing oncology / radiation oncology services

Regional medical oncology and surgical oncology services are at an early stage of development and regional palliative care services have been developed particularly at Milford Hospice and Limerick Regional Hospital. A single consultant medical oncologist and two consultant haematologists have been appointed to the board's hospitals.

In regard to existing radiation oncology services, a single temporary locum consultant appointed to St Luke's Hospital attends the MWHB.[CXLVII] The present consultant position does not hold formal sessions within the MWHB. However, this appointment has enabled the continuation of weekly outreach clinics at Limerick Regional Hospital for new patient assessment and patient follow-up. Prior to this appointment the services were initially provided by a consultant radiotherapist (also attached to St Luke's, St James's and Crumlin Hospitals) and more recently by a non-consultant staff radiotherapist also attached to St Luke's Hospital.

Board submissions

A number of concerns were raised by the MWHB with the Group in regard to the existing service arrangements with St Luke's Hospital, in particular the distance travelled by some patients from more remote parts of the region, and the existing time delays in accessing certain forms of radiation therapy. Additional information was provided by the MWHB as a measure of existing activity in regard to radiation oncology service provision within the MWHB:

- The MWHB accounted for
  - 182 admissions to St Luke's Hospital and 36 day cases
  - 371 outpatient visits to St Luke's Hospital
  - 272 new patients and 2,299 outpatient visits to the St Luke's peripheral/regional clinic held at Limerick Regional Hospital.
- Data on patient attendance at Cork University Hospital radiation therapy department were not available from the MWHB.

[CXLVI] National Spatial Strategy – Public Consultation Document. A gateway is a 'centre that has a strategic location relative to a surrounding area'.
[CXLVII] As of 2003 this appointment has not been approved by Comhairle na nOspidéal.

- There has been a low uptake of radiation therapy by MWHB patients with lung, colorectal and breast cancer as identified in the National Cancer Registry Report – *Cancer in Ireland 1994-1998: Incidence, Mortality, Treatment and Survival*
- On the basis of the average annual incidence of cancer within the MWHB between 1994-1996 (1,475 patients), the board estimated that 50 per cent of these should receive radiation therapy. The estimate of patient caseload was approximately 750 patients.
- Patients who currently avail of day care or outpatient radiation therapy services in Dublin or Cork travel more than 60 minutes for treatment.

The board proposed that a 2-linear accelerator treatment facility be developed at Limerick Regional Hospital with links to Dublin and Cork. The board indicated the availability of both private capital funding (€1.9 million) through the Mid-Western Hospital Development Trust and completed planning permission for the development of radiation oncology services in the region. The fund was indicated as a potential mechanism to resource an initial single-linear accelerator treatment facility that would function as a satellite unit, with simulation and planning undertaken at a parent centre. The board also identified additional preliminary costs that would not be met by the Trust including the need for one to two consultant radiation oncologists and additional identified staffing (€1.027million), and estimated bed-related costs (€1.108 million). The MWHB has indicated that, following the successful implementation of a single-linear accelerator facility, the ultimate objective would be an independent, fully functional, radiation therapy centre with two linear accelerators, simulation facilities and inpatient facilities. Identified staff requirements included medical physicists, two consultant radiation oncologists and support staff. During the final drafting of this report (2003), the Group became aware of a further development of this proposal, which would involve the private sector.

Analysis

Patients within the MWHB currently access both Dublin and Cork based services (see Section 2.12). Within the MWHB the great majority of patients from the areas of Clare (89 per cent), Limerick city (79 per cent), and Tipperary North Riding (85 per cent) attended Dublin, with a somewhat lower percentage attending from Limerick county (66 per cent). The referral pattern to Eastern Region services is to some degree a consequence of the provision of radiation oncology assessment and follow-up clinics within the region by St Luke's Hospital. A smaller number of patients from the MWHB at present avail of the CUH radiation oncology facilities: Limerick County (33 per cent), Limerick City (21 per cent), Tipperary North Riding (13 per cent), and Clare (11 per cent).

The recent development and forthcoming clinical commissioning of a new radiation oncology department at UCHG has a complex and important impact on the optimal short to medium term plans for the MWHB that have been addressed by the Group. Firstly there is a clear and stated requirement that a significant number of patients from the MWHB will attend the new UCHG radiation therapy unit for the latter to be viable as a supra-regional cancer centre – *Cancer Services in Ireland: A National Strategy*, 1996 (see section 7.5). It would appear that these patients would most typically attend from north Clare. However, the board submission did not appear to prioritise potential links or strategic developments with the new radiation oncology centre at UCHG as highlighted in the original 1996 *Cancer Services in Ireland: A National Strategy*.[2] In addition a patient population from the more southern parts of the MWHB will almost certainly continue to attend the new expanded supra-regional service co-ordinated by CUH, and a patient population will in all likelihood continue to avail of certain specialised radiation therapy services in Dublin.

Given these anticipated patient flows, it appears very unlikely that the residual population estimated by the Group will provide the patient caseload that has been identified by the board. Taking account of this uncertainty and the guidelines that aid the identification of radiation therapy centre development (section 7.4), it does not appear probable that, within the service development medium timeframe being considered

by the Group, the patient caseload and existing infrastructure will provide a case for a radiation therapy unit to be located within the health board. It will be important, nevertheless, during the forthcoming clinical development of both UCHG and CUH, to closely monitor the assumed patient flows between boards, and the ongoing uptake and access to multidisciplinary care and radiation oncology services for patients within the MWHB. It will also be necessary in the short to medium term to significantly increase patient access to enhanced radiation oncology consultant-based assessment and follow-up clinics. The short-term provision of services through the continuation of a locum consultant position is not the optimum, particularly given the considerable time that has elapsed since the retirement of the previous consultant providing services to the region (1992). As with other health boards, there is an immediate need to address the radiation oncology requirements of the population resident in the MWHB.

In the short to medium timeframe being considered by the Group, this requirement will be best met by the following:

- The commissioning of appropriate additional treatment facilities in partnership with the development of new services at UCHG and CUH and within the Eastern Region / Dublin for additional and specialised radiation oncology requirements
- The formalisation of an additional consultant radiation oncologist attending sessions at appropriate hospitals in the MWHB
- The rapid achievement of significant elements of such consultant-provided services through the appointment of additional consultant radiation oncologists with dedicated sessions to the oncology unit at Limerick Regional Hospital. The additional consultant(s) should have a full support team
- The development of additional consultant-led radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate MWHB hospitals
- The development and refinement of the dedicated transport solution as indicated in section 8
- The development of appropriate telemedicine linkages as outlined in section 8
- The development of additional hostel or low-dependency accommodation for both patients and families that will facilitate attendance for treatment
- The judicious use of available local funding. The preliminary costs presented by the board for the development of a centre appear to be a significant under-estimate of the capital costs for new centre development that have been identified by the Expert Group (see section 5). Nevertheless it may be possible to use the funds to facilitate the development of some of the proposals indicated above to the benefit of patient care.

In the longer term the development of additional radiation oncology services for the MWHB will require further analysis, taking account of evolving clinical practice/guidelines, patient demographics and patient flows, the stage of development of regional oncology services, and available international guidelines on radiation therapy service planning.

7.6.4 North Eastern Health Board (NEHB)

Demographics

CSO population growth models estimate an increase in population to approximately 349,000 by 2010 and to 363,000 by 2015 (Table 7.5 and 7.6).[202]

Existing oncology / radiation oncology services

In the NEHB a significant population of patients live within a short travelling distance to the northern area of the Eastern Region. A number of consultant staff primarily employed within the Eastern Region provide

outreach regional medical oncology services.[CXLVIII] Surgical oncology services are at an early stage of development, for example through the implementation of the *Report on the Development of Services for Symptomatic Breast Services*, and regional palliative care services are being developed.

In regard to existing radiation oncology services, St Luke's Hospital provides monthly outreach clinics at Navan, Cavan and Monaghan General Hospitals, which facilitate new patient assessment and patient follow-up. The clinics have been provided by St Luke's Hospital for many years. However, there is no formal agreement between the hospital and the NEHB on their operation or funding. Until 2002 there were no radiation oncology consultants with formal dedicated sessions to any of the board's hospitals. A new consultant appointment with two sessions to the NEHB was approved in 1999 and the appointment commenced in August 2002.[CXLIX] Data from the NCRI indicate that the majority of patients (>99 per cent) who require radiation therapy from this region access it at the treatment centres in Dublin and in particular at St Luke's Hospital (see section 2.12).

Board submissions

The board's policy is to develop two locations for medical oncology care provision, at Cavan and Drogheda Hospitals. Both locations will depend in the short to medium term on outreach medical oncology clinics provided by consultants who hold a majority of sessions at the Mater Hospital.

Information provided by the board to the Group on potential future services highlighted the following:

- A relationship with Dublin-based treatment services is ongoing.
- The existing level of utilisation of radiation oncology services by patients from the board area appeared low, with an estimate of less than 200 patients availing of services in 1998.
- There is an aspiration to develop a radiation oncology treatment unit in the region.

Analysis

An analysis undertaken by the Group of the estimated future NEHB population base and projected cancer caseload suggests that the 1998 estimate provided above significantly under-estimates the number of patients that should have had access to radiation therapy services at that time and those who will require treatment in the short to medium term.[CL]

Taking account of the guidelines that aid the identification of radiation therapy centre development (section 7.4), it does not appear probable that, in the service development timeframe being considered by the Group, the patient caseload and existing infrastructure will provide a convincing case for a radiation oncology treatment unit to be located within the health board. There is an immediate need, however, to address the radiation therapy requirements of the population resident in the NEHB. In the short to medium timeframe, this requirement will be best met by:

- The commissioning of appropriate additional treatment facilities developed in partnership with the Eastern Region
- The rapid recruitment of an additional consultant radiation oncologist(s) with dedicated sessions at one of the NEHB specified regional oncology centres. The additional consultant should have a full support team
- The formalisation of a dedicated consultant radiation oncologist attending sessions at appropriate hospitals in the NEHB
- The development of additional consultant-provided radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken, for example at the proposed oncology service development at Our Lady's Hospital in Drogheda
- The development of regular multidisciplinary meetings, with consultant radiation oncologist input held within appropriate NEHB hospitals
- The early examination of dedicated transport solutions for patients as indicated in section 8

[CXLVIII] Outreach medical oncology services including day chemotherapy clinics are provided in partnership with consultant medical oncologists attached to the Mater Misericordiae Hospital.

[CXLIX] The consultant appointment is between St Luke's Hospital (7 sessions), Beaumont Hospital (2 sessions), and the NEHB (2 sessions). The appointment is a modified replacement post. The previous full consultant retired in 1992 and in the interim radiation oncology services were provided by a locum appointment for 9 years.

[CL] Expert Group estimates of existing and future caseload are based on data provided by the National Cancer Registry and the Central Statistics Office.

- The development of appropriate telemedicine linkages as outlined in section 8
- The development of additional hostel or low-dependency accommodation for both patients and families that will facilitate attendance for treatment.

In the longer term, the development of additional radiation oncology services for the NEHB will require further analysis, taking account of evolving clinical practice/guidelines, patient demographics, and available international guidelines on radiation therapy service planning.

7.6.5 North Western Health Board (NWHB)

Demographics

CSO population growth models estimate an increase in population to approximately 226,000 by 2010 and to 230,000 by 2015 (Table 7.5).[202] The geographic area encompassed within the responsibility of the NWHB is quite large and is at a significant distance from major urban population areas in the Republic of Ireland. The resident population over the age of 65 years is also above the national average and has an impact on future estimated patient caseload.

Existing oncology / radiation oncology services

In the NWHB a significant population of patients live in close proximity to Northern Ireland. A consultant in medical oncology appointed to Letterkenny Hospital holds formal sessions at Belfast City Hospital and a range of discussions has taken place between the NWHB and the Northern Ireland healthcare agencies to explore potential additional linkages in cancer services, particularly for the patient population that resides in County Donegal and other border areas. Regional medical oncology and surgical oncology services are at an early stage of development at Letterkenny and Sligo General Hospitals and regional palliative care services will be developed in the near future.

In regard to existing radiation oncology services, a single consultant with two sessions dedicated to the NWHB was appointed in 1994 between St Luke's Hospital and Sligo General Hospital. Through this appointment St Luke's Hospital provides fortnightly outreach clinics at Sligo General Hospital. An additional monthly clinic is provided at Letterkenny General Hospital by a second consultant appointed to St Luke's Hospital. However, there is no formal agreement between the hospital and the NWHB / Letterkenny General Hospital on their operation or funding and the radiation oncology consultant does not have formal dedicated sessions at the hospital. Data from the NCRI indicate that the majority of patients (>99 per cent) from the region who require radiation therapy access this at the treatment centres in Dublin, particularly at St Luke's Hospital (see section 2.12).

Board submissions

The NWHB has indicated to the Group the existence of a preliminary agreement with the WHB and the new UCHG radiation oncology unit whereby the majority of cancer patients from Sligo and Leitrim requiring radiation therapy would be directed to UCHG for radiation oncology services.

The NWHB has also outlined to the Group a number of strategic options for the future provision of radiation oncology services, particularly for the resident population of Donegal. These include the following potential phased options:

- The existing arrangements with St Luke's Hospital continue to provide a short-term solution.
- The short to medium term solution would involve the provision of additional radiation oncology services for Donegal patients at Belfast City Hospital, and the referral of Sligo-Leitrim patients to University College Hospital Galway.
- In the medium to long term the board has expressed a strategic aspiration to move towards the provision of radiation therapy services either within the board's area or possibly within a larger north-west catchment area that would cater for the cancer workload and population of both the NWHB and adjacent neighbouring areas.

Analysis

In considering the opportunity to develop links with Belfast City Hospital and the aspiration for a medium to long-term solution for radiation therapy services, the feasibility of joint service development by the NWHB and Northern Ireland healthcare agencies should be examined by the appropriate agencies in both jurisdictions. Such a task is outside the terms of reference and timetable of this Group. However, meetings between Group members and Northern Ireland representatives have supported the examination of the feasibility of the initial proposed links with services at Belfast City Hospital. With the preliminary indicative populations in both areas, and the particular geographic difficulties in both jurisdictions, there may be a case for the development of appropriate radiation therapy services that would address the treatment requirements in both jurisdictions.

There is an immediate need to address the radiation therapy needs of the population resident in the NWHB. In the short to medium timeframe this requirement will be best met by the following:

- A further examination with the appropriate Northern Ireland healthcare authorities of the feasibility of commissioning appropriate additional treatment facilities in partnership with the development of additional treatment capacity at Belfast City Hospital
- The commissioning of appropriate additional new treatment services at UCHG, and also within the Eastern Region of Dublin
- The formalisation of an additional consultant radiation oncologist attending sessions at appropriate hospitals in the NWHB
- The rapid recruitment of an additional consultant radiation oncologist(s), with dedicated sessions at one of the NWHB specified regional oncology centres. The additional consultant should have a full support team.
- The development of additional consultant-provided radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate NWHB hospitals
- The development and refinement of the dedicated transport solution as indicated in section 8
- The development of appropriate telemedicine linkages as outlined in section 8
- The development of additional hostel or low-dependency accommodation for both patients and families from the NWHB that will facilitate attendance for treatment. This is a particularly significant requirement for NWHB patients, given the potential travelling distance from either Belfast, Galway or Dublin based treatment centre locations.

In the longer term, for example beyond 2010, the development of additional radiation oncology services for the NWHB will require further analysis, taking account of evolving clinical practice/guidelines, patient demographics, the stage of development of regional oncology services in both jurisdictions, and available international guidelines on radiation therapy service planning. The detailed analyses and proposals for such a service will need to be the subject of additional comprehensive discussion with the NWHB, the DoHC and their counterparts in Northern Ireland.

7.6.6 South Eastern Health Board (SEHB)

Demographics

CSO population growth models estimate an increase in population to approximately 418,000 by 2010 and to 423,000 by 2015 (Table 7.5).[202] The population in the south-east area is the third largest in the country, although a significant percentage of the population lives in close proximity to either the ERHA or the SHB.[CLI] Waterford has been identified as a gateway in the National Spatial Strategy.[CLII]

[CLI] National Spatial Strategy – Public Consultation Paper

[CLII] National Spatial Strategy – Public Consultation Paper. A gateway is a 'centre that has a strategic location relative to a surrounding area'.

Existing oncology / radiation oncology services

The development of regional oncology services has already been established with the appointment of two medical oncologists and two haematologists,[CLIII] the initial development of surgical oncology teams, the availability of regional palliative care services, and links to both the Royal College of Surgeons in Ireland (RCSI) and the Waterford Institute of Technology.

In regard to existing radiation oncology services, a single consultant appointed to St Luke's Hospital attends the SEHB. The consultant position holds two formal sessions within the SEHB and is also attached to the Mater Hospital and St Luke's Hospital. This appointment enables a weekly outreach clinic within the region. Clinics are held in Waterford (2 per month), Wexford (1 per month) and Kilkenny (1 per month), which enable new patient assessment and patient follow-up.

Board submissions

A number of concerns were raised on several occasions by the SEHB with the Group in regard to the existing service arrangements with St Luke's Hospital and CUH. In particular the distance travelled by patients was cited, along with the associated inconvenience experienced by families and patients, and the existing delays in accessing radiation therapy.

Information initially received by the Group from the SEHB in 2000 and 2001 identified the development of radiation therapy services within the region as a long-term strategic goal. The SEHB indicated an initial preference that not all radio-therapeutic options would be available in the region but that a basic infrastructure could be supplied, and as a consequence, the delivery of radiation therapy services to patients greatly improved. The proposed configuration of this centre was identified as a single consultant radiotherapist, two physicists, seven radiation therapists, two oncology nurses and appropriate secretarial staff, with a cobalt unit, a linear accelerator, simulator, microselectron brachytherapy, and a treatment-planning computer. The estimated cost of the overall package was suggested to be in the region of €6.35 million. During the final period of analysis undertaken by the Group, the SEHB submission in 2002 indicated a very significant change in policy and a defined need for a significantly larger treatment centre. The latter consisted of a self-sufficient centre containing four linear accelerators, a CT-simulation, brachytherapy services, and associated day case and inpatient facilities. Details on anticipated appropriate staffing and operational costs were not identified. The board indicated that an estimated regional caseload of 3,500 cancer patients would attend the regional oncology services with approximately 50 per cent (1,800 patients) requiring radiation therapy.

Analysis

The assessment of future service development in the SEHB is complex, given the geographic location of some of the urban areas that are in some proximity to existing centres in the Eastern Region and the Southern Health Board. A level of uncertainty therefore exists over continued patient flow to Dublin from Carlow and Kilkenny and possibly north Wexford, and to CUH from areas within Tipperary and west Waterford. It was not possible for the Group to accurately identify the magnitude of these patient flows that may also include patient preference.

The existing analysis of the estimated future SEHB population base and projected cancer caseload does not provide a compelling short-term case for a radiation oncology unit to be located within the health board in the timeframe and associated initial phase of radiation oncology service expansion being considered by the Group. There is, however, an immediate need to address the radiation therapy needs of the population resident in the SEHB. In the short to medium timeframe this requirement will be best met by the following:

[CLIII] The forthcoming appointment of a third consultant medical oncologist to the SEHB hospitals has been approved by the DoHC and Comhairle na nOspidéal.

- The commissioning of appropriate additional treatment facilities in partnership with the development of new services at CUH and within the Eastern Region / Dublin for additional and specialised radiation oncology requirements
- The formalisation of an additional consultant radiation oncologist(s) sessions at appropriate hospitals in the SEHB
- The rapid achievement of significant elements of such consultant-provided services through the appointment of additional consultant radiation oncologists with formal attachments to the regional oncology unit at Waterford Regional Hospital. The additional consultants should have a full support team.
- The development of additional consultant-provided radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate SEHB hospitals
- The development and refinement of the dedicated transport solution as indicated in section 8
- The development of appropriate telemedicine linkages as outlined in section 8
- The development of additional hostel or low-dependency accommodation for both patients and families that will facilitate attendance for treatment.

In the longer term the development of additional radiation oncology services within the SEHB will require particularly detailed review and analysis given the existing scale of population, the envisaged development resulting from the National Spatial Strategy(NSS), and the anticipated future stages of oncology service development.[CLIV] The Group has noted that if the population growth significantly exceeds the existing estimates (see Table 7.5: 418,000 by 2010 and 423,000 by 2015), and the 50 per cent target for uptake of treatment was achieved by the full cancer caseload, the potential radiation oncology requirements beyond 2010 could be greater than the existing best estimates that the Group can provide (see Table 7.6).

With the acquisition of more detailed statistics on the region, the potential requirement for the development of new services and/or treatment centre within the SEHB area should be re-assessed at a future time in parallel with the further phases of national radiation oncology service expansion discussed in section 8. Such an analysis would need to take account of evolving clinical practice guidelines, patient demographics, the NSS, patient flows to radiation oncology services in other regions, the stage of development of regional oncology services, and the available international recommendations on radiation therapy service planning.

7.6.7 Southern Health Board (SHB)

Demographics

CSO population growth models anticipate an increase in population to approximately 592,000 by 2010 and to 604,000 by 2015 (see Table 7.5).[202] The resident population in the catchment area of the Southern Health Board will remain the second largest in the country. Cork has been identified as a gateway in the National Development Plan.[CLV]

Existing oncology / radiation oncology services

CUH was identified as a supra-regional cancer centre location in the 1996 *Cancer Services in Ireland: A National Strategy*.[2] Medical oncology and palliative care services exist at the hospital together with a number of specialist surgical oncology services that include colo-rectal, breast, thoracic, and upper gastro-intestinal surgical teams.

CUH has an existing radiation therapy department, previously detailed in section 2. This unit provides over 95 per cent of treatment services for patients within the SHB and, in addition, for a smaller percentage of

[CLIV] The SEHB has recently identified the need for a third consultant medical oncologist to be appointed to the region.
[CLV] National Spatial Strategy – Public Consultation Document. A gateway is a 'centre that has a strategic location relative to a surrounding area'.

patients from both the SEHB and MWHB (see section 2.12). The staffing structure and development of the CUH radiation therapy department have also been provided in section 2. The two consultant radiotherapists appointed to CUH provide additional outreach oncology services to other hospitals in the SHB (Tralee General Hospital) and SEHB (Cashel General Hospital).[CLVI]

Board submissions

The DoHC has recently approved an initial investment programme in treatment equipment replacement and department expansion. It should be noted that the existing programme will only result in the minor net increase in treatment capacity of one linear accelerator. Prior to this investment programme, the development of the CUH unit has been very limited, as outlined earlier in section 2. Dedicated funding for radiation oncology services was made available by the DoHC to the board in 2002 and 2003. The recruitment of additional clinical and support staff was not identified to the Group. However, the board indicated that, with the future appointment of two additional consultants, an additional commitment to the MWHB and SEHB would be developed.[CLVII] The SHB also indicated that 'in the interests of best practice and health economics the establishment of stand alone units in Limerick and Waterford would not be viable'. The board indicated that additional 'formal links with the proposed new schools of radiography and pharmacology' would take place under the auspices of University College Cork in tandem with the development of enhanced services within the region.

Analysis

The Group's analysis of the estimated future SHB population base and projected cancer caseload provides an unequivocal case for the development of additional radiation therapy treatment facilities at CUH. The Group believes that the recently approved equipment configuration of the new CUH treatment centre will not meet the estimated need of the existing patient population within the SHB catchment area (see Table 7.6). The proposed equipment, infrastructure and staffing levels required for the future are, in part, dependent on the future patient caseload that may attend from adjacent health boards, particularly the SEHB and MWHB. There is an urgent need for ongoing dialogue on the future potential partnerships in providing radiation oncology care between the SHB, MWHB and SEHB.

There will be a requirement to address other needs of the population resident in the SHB and adjacent SEHB and MWHB catchment areas including the following:

- The commissioning of appropriate additional treatment facilities at CUH, with the early involvement and partnership of representatives of the SEHB and MWHB areas
- The identification and formalisation of an additional consultant radiation oncologist(s) based on the identified clinical caseload in the region
- The rapid achievement of significant elements of such consultant-provided services through the appointment of additional consultant radiation oncologists, with dedicated sessions to hospitals in the SEHB and MWHB. The additional consultant(s) should have a full support team
- The development of additional consultant-led radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate SEHB/MWHB hospitals
- The development and refinement of dedicated transport solutions as outlined in section 8. These should be developed in partnership with the adjacent health boards and will require innovative transport solutions for patients living at a distance from the treatment centre
- The development of appropriate telemedicine linkages as outlined in section 8
- Given the extensive geographic area of the identified catchment populations, the development of appropriate hostel or low-dependency accommodation for both patients and families. This development will be of major importance in enabling the success of the proposed service.

[CLVI] Prior to 2001 the title Consultant Radiotherapist or Consultant Clinical Oncologist was used by Comhairle and the Faculty of Radiologists.
[CLVII] Consultant financial clearance / application process expected 2002/2003.

7.6.8 Western Health Board (WHB)

Demographics

CSO population growth models estimate an increase in population to approximately 402,000 by 2010 and to 419,000 by 2015 (Table 7.5).[202] Galway has been identified as a gateway in the National Development Plan.[CLVIII]

Existing oncology / radiation oncology services

UCHG was identified as a supra-regional cancer centre location in the 1996 *Cancer Services in Ireland: A National Strategy* and as part of this proposal the potential development of a radiation oncology facility was highlighted.[2]

Since 1997, the development of some elements of a supra-regional oncology service have been established with the appointment of two medical oncologists and two haematologists, the initial development of surgical oncology teams, and the availability of regional palliative care services.

Board submissions

The DoHC announced the proposed radiation oncology service development at UCHG in 1999 prior to the formation of this Group. The unit is now at an advanced stage of development, with the equipment tendering process completed. The clinical commissioning of the centre, which includes three linear accelerators, CT-simulator and conventional simulator, HDR brachytherapy, superficial X-ray, treatment planning suite and mould room will commence in 2003. Further expansion capacity for additional treatment equipment has been identified within the approved development plan. A number of senior physicist positions have recently been advertised and it is also anticipated that three consultant radiation oncologists will be appointed in parallel with the physical commissioning of the centre. In April 2003 the DoHC approved a number of key medical and scientific staff to support the development and commissioning of the radiotherapy unit in Galway.

Analysis

The 620,000-catchment population for the UCHG centre was initially identified in the 1996 *Cancer Services in Ireland: A National Strategy*.[2] The Galway-based facility will therefore provide treatment services for a considerably larger geographic area and population than the existing Western Health Board.

At the time of writing this report, only some of the potential linkages between health boards highlighted in the 1996 *Cancer Services in Ireland: A National Strategy* had been agreed.[2] As indicated above, the NWHB has noted a preference for patients in the Sligo area to avail of treatment services at UCHG (see section 7.6.5). The Group acknowledges that additional patient referral to UCHG will in all probability come from geographically proximate parts of the MWHB (North Clare) and the western part of the MHB. Both of these catchment areas were identified in the 1996 *Cancer Services in Ireland: A National Strategy* and patient flows of this type were recognised as pivotal to the future development of the UCHG facility as a supra-regional cancer centre.[2] As previously discussed in section 7.5, the strategic planning of a national service structure unequivocally requires that the UCHG-based service development be taken into account. This is particularly the case when considering adjacent geographic areas, for example the MWHB and NWHB, which contain patient populations already identified as being in the catchment area of the UCHG supra-regional service. The short to medium term consequences of this are that both populations in the adjacent regions would be best served by rapid access to the highest quality radiation therapy service achieved through the continued service development at UCHG.

[CLVIII] National Spatial Strategy – Public Consultation Document. A Gateway is a 'centre that has a strategic location relative to a surrounding area'.

There will be a requirement, in addition to the above, to address other needs of the population resident in the WHB and adjacent NWHB and MWHB catchment areas, including the following:

- The commissioning of appropriate additional treatment facilities at UCHG, with the early involvement and partnership of representatives of the NWHB and MWHB areas
- The identification and formalisation of an additional consultant radiation oncologist(s) based on the identified clinical caseload in the region
- The rapid achievement of significant elements of such consultant-provided services through the appointment of additional consultant radiation oncologists with dedicated sessions to hospitals in the WHB, NWHB and MWHB. The additional consultant(s) should have a full support team
- The development of additional consultant-led radiation oncology clinics at which significant elements of new patient assessment and follow-up could be undertaken
- The development of regular multidisciplinary meetings with consultant radiation oncologist input held within appropriate WHB/MWHB/NWHB hospitals
- The development and refinement of dedicated transport solutions as outlined in section 8. These should be developed in partnership with the adjacent health boards and will require innovative transport solutions for patients living at a distance from the treatment centre
- The development of appropriate telemedicine linkages as outlined in section 8
- Given the extensive geographic area of the identified catchment populations, the development of appropriate hostel or low-dependency accommodation for both patients and families. This development will be of major importance in enabling the success of the proposed service.

7.7 Summary

- The Group commissioned an independent study of the priorities of Irish patients and their experiences of existing radiation oncology services. The most important aspects of service identified by patients were:
  - Receiving the highest level of patient care
  - Obtaining information about their condition
  - A reduction of the waiting time between diagnosis and treatment
  - Communication with medical and other healthcare staff
  - Proximate geographic access: ranked thirteenth of the examined parameters.

- Patients expect that rapid access to the highest quality care with appropriate communication between the patient and all healthcare staff should be the greatest priority for healthcare professionals and planners in providing future radiation oncology care.

- The development of a modern radiation therapy centre is an extremely complex process which requires the installation and integration of high technology treatment equipment and the parallel appointment of an extensive range of healthcare professionals, particularly in the fields of radiation oncology, radiation therapy / therapeutic radiography,[CLIX] medical physics, engineering and information technology, and oncology nursing.

- Radiation oncology services cannot be simply aligned to the existing regional oncology services as developed by a number of health boards, as the population size and other criteria are not sufficient to support the appropriate scale of treatment facility that has been identified by the Group as a critical component of the proposed initial phase of expansion of services in Ireland. The Group developed a series of guidelines to facilitate the future identification of suitable locations for the development of additional radiation therapy facilities.

- There is a significant mismatch between existing national treatment capacity and the estimated need. The Group has estimated a current total national requirement of 25-29 linear accelerators at 50 per cent uptake of radiation therapy. There will be a need for a further phased increase to 38 linear accelerators by 2015.

- In order to adhere to the existing and anticipated guidelines for those patients requiring short waiting times for treatment, the proposed national service plan must have a degree of capacity that exceeds the mean demand.

- In the service development timeframe being considered by the Group there are significant elements of future service development that will require the active partnership of health boards. These tasks include the identification and commissioning of appropriate additional treatment support facilities, the development of additional consultant-provided radiation oncology clinics, and the early examination of dedicated transport solutions for patients.

- The NWHB has outlined a number of strategic options for the future provision of radiation oncology services to the north-western area of the country. The development of such services will need to be the subject of additional comprehensive analysis and discussion between the NWHB, the DoHC and their counterparts in Northern Ireland.

[CLIX] Prior to 2002 and the Report of the Radiography Service Review Group the professional descriptor 'Therapeutic Radiographer' was used. The title is now changed to Radiation Therapist.

- Galway was proposed as a supra-regional cancer centre location in the 1996 document *Cancer Services in Ireland: A National Strategy*. Construction of the new radiation oncology services at UCHG will be completed in 2003/4. The indicative catchment population for a Galway-based centre was proposed in the 1996 National Cancer Strategy.

- Cork was identified as a supra-regional cancer centre location in the 1996 document *Cancer Services in Ireland: A National Strategy*. The recent investment programme at CUH will not meet the existing or future treatment requirements of the existing patient population within the SHB and adjacent catchment area.

- The population within the Eastern Region is the largest in the country and recent projections suggest that it will continue to be the fastest growing area with an estimated 37 per cent increase in population between 1996 and 2015. An analysis of the projected cancer patient caseload provides an unequivocal case for the development of additional radiation oncology treatment services within the Eastern Region. The patient population residing in the MHB, NEHB and part of the SEHB will be best served, in the initial phase of radiation oncology expansion, by the development of additional treatment capacity within the Eastern Region.

Section 8

Recommendations – proposed configuration of radiation oncology services

8.1 Introduction

Equity of healthcare is a core value enshrined within *Quality and Fairness: A Health System for You*,[27] and identified as a major theme during the preliminary consultative process recorded in *Your Views about Health*.[CLX,CLXI] Equity of access to quality radiation oncology facilities is therefore a right of all cancer patients and such is acknowledged and endorsed within this report.

The Group has considered the optimal national radiation oncology service that will be appropriate for the short to medium term, taking account of the following:

- The changing demographics of the country and the expected increase in the percentage of the population aged over 60 years[CLXII]
- The need to enhance integration within the expanded service for both primary care and other hospital-based clinical specialties[CLXIII]
- Existing and future trends in radiation oncology practice[CLXIV]
- The expected increase in cancer incidence[CLXV]
- The projected increase in specific cancers that require radiation therapy as part of their management[CLXVI]
- The anticipated total number of treatment units that would be required to provide all patients with rapid access to uniformly high standards of clinical radiation therapy treatment services[CLXVII]
- The need for all patients to have access to the highest quality of care independent of the area of domicile[CLXVIII]
- The need, where possible, to facilitate rapid access for appropriate patient groups, for example patients scheduled for pre-operative treatment protocols and patients requiring palliative treatment for symptom control[CLXIX]
- The need to consider novel accommodation and transport solutions, which result in the minimum inconvenience to the patient and family, for those patients who live at a distance which prevents daily outpatient attendance[CLXX]
- The need to ensure that when services are purchased for public patients from the private sector, the agency purchasing such services must assure that their quality meets the same standards of provision, set out in this report, that will govern the provision of radiation oncology services in the public system.

Based on the outcome of these considerations the Group has identified three main areas which will underpin the development of these enhanced services:

1. A significant increase in patient treatment capacity achieved by the commissioning of new treatment equipment and the development of an increased number of radiation oncology units established as part of a national co-ordinated clinical network of centres. The Group recommends that in the short to medium term this will be best achieved through the development of radiation oncology services in the context of supra-regional cancer centres as originally proposed in *Cancer Services in Ireland: A National Strategy* (1996). Detailed recommendations are provided later in this section.

2. The development and continued support of appropriate training and education programmes that permit continuing medical education (CME) and continuing professional development (CPD) at both an undergraduate and postgraduate level in the key professional disciplines of radiation oncology, radiation therapy, oncology nursing, and medical physics. The existence of such programmes is viewed as an

CLX *Your Views about Health*. Report on Consultation, 3
CLXI *Quality and Fairness: A Health System for You* – National Goal 2, 74
CLXII Ibid, Section 2
CLXIII Ibid, Sections 1 and 2
CLXIV Ibid, Section 3
CLXV Ibid, Section 4
CLXVI Ibid, Secions 3 and 4
CLXVII Ibid, Section 5
CLXVIII Ibid, Section 6
CLXIX Ibid, Section 3 and 6
CLXX Ibid, Section 7

essential foundation stone in the future organisation of a national radiation oncology strategy. Recommendations on this are detailed in section 9.

3. The development of a national co-ordinating function that will advise additional national authorities on the co-ordinated development of this service.[CLXXI] This mechanism should facilitate specific aspects of the proposed clinical radiation oncology service that clearly benefit from forward planning and co-ordinated integration between centres including new technology assessment and national protocol development. Recommendations on this are detailed in section 10.

An important finding already documented within this report is the existing significant deficit in current radiation oncology treatment infrastructure and human resources and the resultant shortfall of treatment capacity (see sections 6 and 7). It must be stressed that future treatment requirements cannot be simply addressed by improved access to the current existing levels of treatment equipment and staff.

In order to meet the national goals set down in *Quality and Fairness: A Health System for You*,[27] a systematic programme of multi-annual investment has been identified to ensure that the system has the capacity to deliver timely and appropriate services.[CLXXII] The work of the National Cancer Forum, the proposed National Hospitals Office and the wider structural reforms in the health system will also have a significant future role and responsibility in the implementation programme of such change.[CLXXIII]

8.2 Treatment centre guidelines

Radiation oncology treatment services should, where possible, be developed in the context of supra-regional cancer centres in order to meet the requirements stated above. Whilst the scale of a centre can be indicated in terms of required linear accelerators, in all cases there will be an unequivocal requirement for the additional provision of:

- Appropriate staffing in radiation oncology, radiation therapy, oncology nursing, medical physics (including appropriate engineering and IT support) and specific dedicated access to the full range of paramedical disciplines including physiotherapy, dietetics, dental, social work, clinical psychology and psychological medicine, speech and language therapy, occupational therapy, and rehabilitation and support
- Location at or linkage to a university teaching hospital. This will be necessary to meet the significant commitment to teaching and research activities.

The group considers that a 4-6 linear accelerator treatment unit with appropriate staffing, and matched support for CT and non-CT simulation, treatment planning, therapy-based imaging, brachytherapy, and specialist radiation oncology / peri-operative procedures, is the appropriate and preferred minimal configuration for a future radiation oncology treatment centre. Such a centre would permit the treatment of a minimum 1,800 patients per annum depending on the level of clinical complexity as defined in the models discussed in section 5, and in addition work in the context of the guidelines for facility development previously highlighted in section 7.4. This scale of centre will enable the following:

- The development of a wide range of clinical treatment protocols that will provide the majority of treatment requirements for patients attending the centre
- The provision of clinical services to a sufficient caseload of patients to support the development of specialised support services, for example rehabilitation, dental, nutritional, and psychological medicine, for patients and families
- The development of specific specialised forms of radiation therapy where this is clinically appropriate

[CLXXI] Health Information Quality Authority.
[CLXXII] *Quality and Fairness: A Health System for You*, pg 92
[CLXXIII] *Quality and Fairness: A Health System for You*, pg 103

- A critical mass of healthcare professionals that will permit tumour and technology dependent sub-specialisation. This has become the international norm in advanced systems of clinical care provision
- The provision of appropriate training and education programmes including CME and CPD for oncology staff, other medical/clinical staff, patients and families
- The development of appropriate information technology services that will facilitate the immediate and future networking of centres as described in section 8.6
- Sufficient additional resources to manage the proposed transport options for patients and the proposed additional development of hostel accommodation for patients and families
- The provision of a suitable range of patient accommodation.

8.3 Proposed treatment centre location and configuration

The Group recommends that the first priority in developing a national radiation therapy service should be the development of a clinical network of large centres that collectively have the staff and treatment infrastructure to permit a rapid increase in patient access to appropriate modern radiation therapy and form the 'backbone' of the anticipated additional future service expansion. The Group believes that the development of these centres as a clinical network is of paramount importance and will in the shortest possible timeframe begin to address the profound deficit in radiation therapy services that has been identified. In addition the development of these centres should be expected to provide a benchmark for quality that can be used in considering any additional radiation therapy developments.

The following treatment centre configuration and expansion is recommended:

- Two treatment centres located in the Eastern Region
    - A single Eastern Region treatment centre serving the southern part of the region and adjacent catchment areas, ultimately providing a 13-14 linear accelerator capacity with appropriate clinical and non-clinical staff
    - A single Eastern Region treatment centre serving the northern part of the region and adjacent catchment areas, ultimately providing an 8-9 linear accelerator capacity with appropriate clinical and non-clinical staff
- A treatment centre located at Cork University Hospital ultimately providing an 8-9 linear accelerator capacity with appropriate clinical and non-clinical staff
- A treatment centre located at University College Hospital Galway ultimately providing a 6 linear accelerator capacity with appropriate clinical and non-clinical staff.

It has not been possible to identify the precise locations for the proposed service development in the Eastern Region (see section 7.6.1). The Group believe that this will require a particularly detailed and sensitive analysis of existing public treatment facilities and the potential resources of specific hospital sites, the existing stage of development of oncology services at individual hospitals, site development plans and issues of patient access. This comprehensive review of the advantages inherent in specific hospital sites should be undertaken using the guidelines outlined in section 7.4. It is important that this additional analysis of potential service development sites in the Eastern region be undertaken rapidly. The analysis and review will require expert radiation oncology input and would benefit from the additional strength and contribution of international peer review. This will facilitate the earliest possible identification of the preferred hospital location(s) for service expansion.

There are compelling reasons to develop a new centre on the north-side of Dublin and to link this with care requirements of patients from the northern area of the Eastern Region, the NEHB and possibly a subset of patients from the NWHB as discussed in section 7. The potential advantages of a specific or candidate Dublin Academic Teaching Hospital (DATH) site on the north-side of Dublin have not been identified, and in addition the existing travel assessment study undertaken by the SAHRU did not identify a site with an overwhelming transport/access benefit.

The identification of the preferred future service development site on Dublin south-side is more complex (see section 7.6.1) given the existing and long-standing major service contribution provided by St Luke's Hospital. As indicated in Sections 2 and 7.6.1 significant resources have been made available to upgrade St Luke's Hospital, however the radiation oncology unit at the hospital does not at the present meet all of the guidelines identified by the Expert Group for a future radiation oncology centre development as discussed in section 7.4. It was not feasible for the Group to undertake the detailed comparison and assessment of individual hospital sites that would enable an authoritive and detailed analysis of optimal hospital location. A similar analysis of access of travel times to St Luke's Hospital and the Dublin DATHs on the south-side undertaken by the SAHRU equally has not identified an individual hospital site with an overwhelming transport/access benefit (see Appendix 3).[CLXXIV] There are, however, similar reasons to develop additional treatment capacity and to link this with care requirements of patients from the eastern and south-western parts of the Eastern Region, the MHB and a subset of patients from the MWHB and SEHB as discussed in section 7. A detailed analysis of the advantages inherent in specific hospital sites within the Eastern Region should be undertaken using the guidelines outlined in section 7.4. The estimated scale of equipment for the future provision of high-quality modern radiation oncology services in the Eastern Region and adjacent catchment areas is provided for the indicative treatment centres serving the northern and southern parts of the region and adjacent catchment areas (Table 8.1). Guidelines on the human resource requirements for this service expansion are provided in section 9.

Catchment populations

The potential populations within the catchment areas of each of the above treatment units have been estimated as follows:

- Galway: WHB+NWHB (50 per cent)+MWHB (33 per cent)
- Cork: SHB+SEHB (50 per cent)+MWHB (33 per cent)
- Dublin north: ERHA (30 per cent)+NEHB+NWHB (33 per cent)
- Dublin south: ERHA (70 per cent)+MHB+SEHB (50 per cent)+MWHB (33 per cent)

On the basis of these catchment populations, Table 8.1 gives the projected need for radiation therapy units in each centre up to 2015.

Table 8.1: Projected treatment unit needs for each centre

	Galway	Cork	Dublin north	Dublin south
1996	**4.7 (4.4, 5.0)**	**6.6 (6.2, 7.0)**	**5.8 (5.4, 6.2)**	**10.1 (9.4, 10.8)**
~2005	**5.1 (4.5, 5.8)**	**7.4 (6.6, 8.3)**	**6.8 (6.0, 7.7)**	**12.0 (10.6, 13.6)**
~2010	**5.4 (4.8, 6.2)**	**8.0 (7.1, 9.0)**	**7.6 (6.7, 8.5)**	**13.4 (11.9, 15.0)**
~2015	**5.9 (5.2, 6.7)**	**8.7 (7.8, 9.8)**	**8.5 (7.6, 9.5)**	**14.9 (13.3, 16.7)**

*Note: Figures in brackets denote the upper and lower limits of each estimate

The proposed development, configuration and timetable to reach the target of the estimated linear accelerator national treatment capacity are detailed in Tables 8.1 and 8.2.[CLXXV] Achievement of this national target capacity will provide the estimated future treatment requirement as determined from population and cancer caseload projections provided by the NCRI and CSO. Accelerated planning and construction procedures should be considered and developed to achieve the indicated targets by 2008-2013. It is possible that some of this capacity may be developed in conjunction with the private sector. The radiation oncology

[CLXXIV] The SAHRU study did not estimate potential travel times on public transport.
[CLXXV] Population figures are taken from NCRI/CSO extrapolations.

development plan proposed by the Group also takes account of the potential need for additional linear accelerators during the latter part of the 10-year period being considered, to 2013-2015. This should be enabled by the initial provision of additional bunkers developed as part of the proposed implementation plan, which would subsequently be available for rapid clinical commissioning (Table 8.2).

In order to meet the proposed timetable of completion it is essential that the following be achieved at an early stage:

- Financial approval for the process should be assured and the required multi-annual budgeting commitment be given to the project.
- Project commencement and completion dates should be agreed.
- Full bunker capacity should be identified and developed from the commencement of the project.

Table 8.2: Illustrative timetable for the development of radiation oncology facilities

Hospital location	Present / 2003	2008	2013
Cork	3 (3 LA, ^{60}Co)* (4 bunkers)	6 LA (7th and 8th bunker free)	8-9 LA (9th bunker free)
Galway	Centre construction commenced 2002**	5 LA (6th bunker free)	6 LA
Dublin North		5 LA (6th and 7th bunker free)	8-9 LA (8th +9th bunker free)
Dublin South	6[CLXXVI] Existing 6 LAs at St Luke's	10 LA (11th and 12th bunker free)	13-14 LA (14th bunker free)
Total	**10 (including ^{60}Co)**	**26 linear accelerators 33 bunkers**	**35 linear accelerators 35-38 bunkers**
% Increase relative to 2002		**+16 units i.e. 160 per cent increase in capacity**	**+ 25 units i.e. 250 per cent increase in capacity**

* Of the four treatment bunkers at CUH, two new linear accelerators have completed clinical commissioning in 2003. The oldest linear accelerator at CUH has recently been taken out of clinical use (October 2002). The cobalt unit is working at a reduced capacity and it is the intention of the SHB to replace the pre-existing older linear accelerator and cobalt unit.
** Work commenced on the construction of three linear accelerator bunkers in 2002. The anticipated physical construction completion date is 2003/4.

For information purposes the future expansion plans in Northern Ireland are also illustrated:

Northern Ireland 1.7 million		**8**	**8 with possible expansion (9th/10th bunker free)**

[CLXXVI] Prior to 2002 St Luke's had 4 linear accelerators. However, two units work double shift and thereby provide effective 6 unit capacity. In 2002 St Luke's commissioned two new linear accelerators, increasing the equipment configuration to 7 megavoltage units (6 linear accelerators and 1 cobalt unit).

8.4 Further service development

There will be a need for continued review of service development given the additional treatment capacity requirements that have been identified to 2015 and beyond (see Table 8.1). In particular, there will be a future need to review whether additional treatment services should be configured at additional geographic locations. This should include an analysis of the success and role of outreach programmes that are currently being examined in other countries, and the potential feasibility of smaller community treatment facilities. In future phases of development in Ireland, such analysis may help improve ease of access to healthcare while not compromising quality or significantly impacting on efficiency.

The published analyses of radiation therapy care and therapeutic outcome in the context of outreach or satellite facilities is quite limited. In most European countries, such developments are very recent and are being established against a background of significant pre-existing radiation oncology treatment resources. As such they frequently constitute a 'fine tuning' of advanced radiation oncology care structures. This is not the current situation in Ireland. However, the development of state-of-the-art care is a clear objective outlined in this report, achieved through an initial phased increase in service capacity during the forthcoming decade. In the last 2-5 years there has been a limited development of 'satellite' facilities in the UK, Norway, Canada and Australia. The analysis of clinical and operational success and the difficulties encountered by these smaller centres is not yet available. There is no directly equivalent model of service delivery in Ireland, although some elements of the relationship between the independent private centres in Dublin and St Luke's Hospital have similarities. It will be important to ensure that any future outreach service or collaboration with independent private centres would provide the technical and clinical quality that is believed to be achievable with the initial phase of large centre development advocated in this report.

8.5 Radiation therapy service delivery – possible future models of care for dispersed patient populations in the Republic of Ireland

Access to radiation therapy in the Republic of Ireland has many facets that have been identified in this report. These include: the awareness of referring clinicians of the potential benefit of the service, the availability of resources to provide the appropriate level of care, and the financial, emotional and practical consequences for the patient of accessing the system. The latter group of factors is recognised as significant for many radiation therapy patients, who may face several weeks of treatment, with the difficulties associated with travel from sparsely populated remote areas.

Recently, some authorities have attempted to use sophisticated costing and modelling algorithms to enable quantitative economic assessments, including societal costs, of different structures of radiation therapy delivery including, for example, outreach satellite facilities. These modelling approaches require a range of input data that are not at present collated for similar patient groups in the Republic of Ireland.[CLXXVII] The utility of these models, however, is that they permit a more accurate costing of a course of radiation therapy, particularly when some of the activities that form the radiation therapy process take place at a number of locations. In addition, the modelling algorithms can provide important estimates of the additional societal costs of radiation oncology. The Group believes that additional future analysis and development of radiation therapy facilities in Ireland would undoubtedly benefit from similar detailed study. However, this will require the establishment of similar sophisticated databases, and it should not impede the recommendations within this report; instead it should be a required component of future service review and analysis.

[CLXXVII] Typical data fields that are captured include (a) financial: capital with discounting, salary and material expenditures incurred within the radiation treatment programme; (b) workload: estimates of the percentage of time devoted to each process by the various professional groups; (c) staffing: the numbers of staff in the various professional groups within the programme; (d) utilisation: annual numbers of patients and processes, equipment complement and hours of operation of the facility.

Such analyses will facilitate additional study of access to radiation therapy services from the patient's perspective, and efficiency in terms of cost from a societal perspective. In turn this will enable a more comprehensive study of further service expansion and the feasibility of additional radiation therapy services including 'satellite' facilities. This will need to be combined with an ongoing review of the expected technological advances in radiation therapy, in particular those in tele-medicine/tele-radiology, virtual simulation, centralised treatment planning and remote monitoring. The maintenance of professional competence, and possibly morale, in any future outreach / small treatment facility with few staff, where sub-specialisation is not possible, will however continue to be a significant challenge in such assessments and service plan recommendations.

8.6 Recommendations – equity of care and patient access

Improved patient access is an integral and critical aspect of the proposed national radiation oncology service. In order to provide access to the highest quality of care advocated within this report a number of additional factors that potentially influence patient access have been considered and are significant additional dimensions to the proposed service development beyond increased levels of equipment provision. These include the following:

- Geographic location of treatment centres
- Access to consultants during the radiation therapy process
- Patient co-ordination and administration
- Information provision to patients and their families
- Organisation of treatment attendances for patients
- Transport solutions for outpatient and day-case patients
- Accommodation requirements for inpatients.

Geographic location of treatment centres

A major challenge to the future national radiation oncology service development is the reconciliation of potentially competing demands, where there is a need to balance the obligation to deliver the highest quality care against the expectation that this level of care can be provided at a greater number of locations. The Report of the National Task Force on Medical Staffing should be taken into account in this regard. Other reports have noted these conflicting expectations and the fact that decentralisation of services is not always the means by which greater equity of access can be achieved. The Medical Council has noted, for example, 'while the concept of local and accessible services to patients is an admirable one, it must not be provided at the expense of a poor standard of care'. The Adelaide Hospital Society has also commented, 'the needs of rural populations have to be addressed within a context that complex high technology care cannot be provided outside urban centres'.[CLXXVIII] Issues of access to the highest quality of care are therefore greater than simple geographic location and these must all be considered in facilitating greater access for an increased percentage of the cancer patient population.

Access to consultants during the radiation therapy process

Quality and Fairness: A Health System for You has identified the need for consultant-provided care and continuity of consultant cover.[CLXXIX] The issue of consultant access and communication was also identified as an important area by the IPA/RCSI patient study commissioned by the Group. This is not solely related to the issue of geographical location. There is currently a very serious shortage of consultant radiation oncologists as outlined in section 6, and as a consequence, access to appropriate consultant opinion is a significant deficit.

[CLXXVIII] *Your Views about Health*, Report on Consultation, 57
[CLXXIX] Ibid, 26

In the proposed radiation oncology services, an expanded number of consultants will deliver significant elements of outreach care whilst preserving the skill base and clinical expertise associated with the development of sufficient healthcare professionals working from an appropriately resourced treatment centre. Further detail on this is provided in section 9. In this regard there is already a long experience in Ireland and other countries with regional clinics co-ordinated from the radiation oncology centres. Such a system enables the evaluation of patients at tumour boards and clinico-pathological meetings and the early identification of patient needs. Additional liaison staff should also attend the regional clinics and provide information to patients and their families on a variety of procedures that follow referral and constitute the treatment process as outlined in section 1.

An additional strategic health services target, identified in *Quality and Fairness: A Health System for You*, to be met by the end of 2004, is that no public patient will wait for more than three months to commence treatment following referral from an outpatient department.[CLXXX] In relation to radiation oncology services, a delay of this magnitude will be unacceptable in the majority of clinical situations. A number of international guidelines exist which detail a range of preferred waiting times for patients receiving radiation therapy.[25,213,220,222,224,226,296,303,304] These waiting times vary from immediate access for emergency treatments to the elective commencement of some treatments within weeks or occasionally months (see section 3). There is an urgent need for the development and publication of similar guidelines applicable to Ireland.[36,170,305-314]

Patient co-ordination and administration

Patient needs should be assessed early and on this basis appointment times, transportation methods and accommodation requirements should be arranged. The IPA/RCSI patient study has highlighted the difficulties that patients experience when information on the timing and scheduling of individual treatment programmes are unavailable or delayed. This difficulty is also acknowledged in the recent DoHC publication *Quality and Fairness: A Health System for You*.[27] In order to provide appropriate information including the proposed scheduling of treatment, the proposed treatment centres should examine the feasibility of trained liaison staff from the radiation oncology centre attending outreach clinics to take responsibility with the patient for the co-ordination of some aspects of the treatment process.

In addition there will be a need to provide both regional and institutional mechanisms that ensure patient referral to the closest treatment centre where the required type and quality of treatment can be provided. The proposed National Hospitals Office in consultation with appropriate professional groups will need to develop referral and prioritisation guidelines that adhere to best clinical practice to facilitate this process.[CLXXXI]

Information provision to patients, families and carers

Radiation oncology clinics and the consultation process should provide adequate and comprehensible information on the different aspects of care encountered by patients and their families. This includes information on the role, timing and benefit of radiation therapy for their particular cancer. The information should also be made available to primary care physicians and appropriate clinical personnel.

Information on radiation oncology and the clinical services should be available to the general public and to all cancer patient support groups through the proposed health strategy *e*-dictionary. The working group on the National Anti-Poverty Strategy (NAPS) has identified factors that influence access to health services for the poor and disadvantaged sectors. These included educational disadvantage, low levels of literacy, low expectation, and fear of health professionals and their use of inaccessible language. There will be a need to involve these groups in developing appropriate information sources.[CLXXXII] Given the recent increased level of migration of non-nationals into the country it will be important to ensure information is available in minority languages.

[CLXXX] Ibid, Action Point 81, 104
[CLXXXI] Ibid, 105
[CLXXXII] Ibid, 146

Organisation of treatment attendances for patients

It is critical that the proposed treatment services be as seamless as possible, particularly given the sense of vulnerability experienced by patients at the time of their first contact with the service. The feasibility of the following should be examined:

- Dedicated radiation oncology treatment unit time allocated to each health board to increase equity of access and ensure that patients are not disadvantaged by distance from the treatment centres
- Structuring of appointment times to facilitate the proposed group travel arrangements for patients from each health board.

Transport options for outpatient and day-case patients

The issue of patient transport is very significant given the road infrastructure and traffic congestion of many urban areas. Some of the following suggestions are not aimed at reducing the travelling time but at making it a less stressful experience:

- Treatment appointments given which will avoid the peak traffic times
- Grouped appointments per health board
- Dedicated transport for radiation oncology patients[CLXXXIII]
- Comfortable ambulance transport
- Helicopter transfer in selected or critical emergency cases
- Co-ordinated rail and road transport, for example the use of dedicated local transport to collect small groups of patients linked to additional dedicated transport at the destination point for transfer to the radiation oncology department
- In some situations the reservation of train seats to ensure that patients do not have to stand for significant parts of their journey
- The provision of free travel on public transport for cancer patients for the duration of their treatment
- The use of travel/petrol vouchers for patients/carers who travel by private transport
- The provision of rest centres at the radiation oncology centres for patients who have significant journeys
- Specific arrangements with local taxi/hackney services for patients travelling from a health board area
- Centralised collection points at the periphery of the city where dedicated transport could collect patients travelling from the country by road. This would avoid the need to negotiate the city centres for patients and relatives who are not familiar with the road system. It would reduce travelling time and relieve the time pressure and tension of both the driver and the passengers who may already be under significant emotional stress.

Accommodation requirements for inpatients

The Health Strategy as outlined in *Quality and Fairness: A Health System for You* has indicated that patient waiting areas will be upgraded to ensure that individuals waiting for treatment have easy access to basic facilities.[CLXXXIV] The following recommendations are highlighted, given the additional factors involved in attending for a course of radiation therapy:

- The increased availability of short-stay accommodation, for example through the use of:
  - Hostel accommodation for patients and/or relatives
  - Local bed-and-breakfast accommodation
- Dedicated radiation oncology ward beds for patients who require significant medical and/or nursing intervention (see section 5). The need for this form of patient care is not distance-dependent but rather treatment and/or disease-related.

[CLXXXIII] A pilot dedicated transport initiative between the Midland Health Board and St Luke's Hospital for radiation oncology and chemotherapy patients and relatives has commenced and future analysis of this will be beneficial in developing additional specialised transport solutions.
[CLXXXIV] Ibid, Action Point 47, pg 78

8.7 Potential short-term and interim measures to increase treatment capacity

Pending the increase in staff and treatment units/centres that have been identified in this report, there will be an urgent and difficult task of providing satisfactory short-term solutions that address the following requirements:

- Adherence to clinical guidelines that highlight the preferred intervals between assessment and treatment commencement. In many cases these intervals will be short, and will range from immediate same-day access to treatment being commenced within a number of weeks.[CLXXXV]
- The anticipated increase in clinical caseload that will require radiation therapy as a consequence of more recent changes in guidelines on management, as detailed in section 3, and ultimately the estimated use of radiation therapy in 50-60 per cent of patients.

Several options exist as potential short-term measures to increase treatment availability:

- The rapid commissioning of replacement equipment and/or unused treatment capacity to enable the maximum use of potential full capacity[CLXXXVI]
- The option of using an extended working day at existing treatment centres
- The interim short-term use of potential unused treatment capacity at private facilities
- In exceptional circumstances the purchase of radiation oncology services outside the country[CLXXXVII]

In considering all of the above, it is clear that existing radiation oncology services are significantly under-resourced at the present. In considering any range of short-term measures, the Group has concerns that further demands on the existing level of services may increase the potential for clinical error despite quality assurance and risk management strategies. All measures that help to limit this potential risk must be adopted.

Extension of treatment unit time

Extension of the treatment day has both advantages and disadvantages and this option has been examined by both the UK and Dutch reports.[CLXXXVIII, CLXXXIX] In addition to increasing patient throughput and access, an extended treatment day can facilitate continued patient care during periods of treatment machine replacement and work schedules associated with department upgrades. These latter measures have been undertaken successfully during periods of renovation at St Luke's and Cork University Hospitals in recent years.

An extended treatment day may facilitate the introduction of more complex techniques but not necessarily increase the numbers of patients receiving treatment. Extended days coupled with weekend working, for instance, may facilitate the following:

- The introduction of novel fractionation schedules which have been shown to benefit certain categories of patient (see section 3)
- A reduction in the overall treatment time and therefore, theoretically, a reduction in the waiting time for new patients to commence treatment
- The facilitation of protocols that require multiple daily treatments (see section 3).

[CLXXXV] The Health Strategy has identified the need to introduce a comprehensive set of actions to reduce waiting times for public patients, including the establishment of a National Treatment Purchase Fund (NTPF). The NTPF is initially concentrating on adults who have been waiting on inpatient lists over 12 months and children waiting over 6 months for surgical procedures. However, in the context of radiation oncology, extended delays in treatment would be clinically unacceptable for the majority of patients.
[CLXXXVI] Of the existing 4 treatment bunkers at CUH, 2 new linear accelerators completed clinical commissioning in 2003. The oldest linear accelerator at CUH has recently been taken out of clinical use (October 2002). The cobalt unit is working at a reduced capacity. The Group understands that it is the intention of the SHB to replace the pre-existing older linear accelerator and cobalt unit.
[CLXXXVII] In certain rare cancers, very specialised forms of radiotherapy (e.g. particle/proton-beam, unusual radio-isotope treatment). The provision of such services has been made available by the referral of the patient to services in other jurisdictions within Europe and North America. In addition, initial discussions on the cross-referral of patients from within the island of Ireland to designated centres for specialised radiation therapy procedures associated with 'low volume' patient caseloads have been discussed. Examples of the latter radiation protocols include total body skin electron treatment for cutaneous lymphoma and fractionated paediatric total body irradiation as part of the allogeneic bone marrow transplant programme.
[CLXXXVIII] The Netherlands Report
[CLXXXIX] Extending the Working Day for Delivery of Radiotherapy

Extending the treatment day by the same factor on all units in the country will increase access and facilitate more patients to receive radiation therapy. There are a number of potential difficulties in attempting to increase capacity by adopting an extended treatment day that need to be anticipated, including the following:

- The extended treatment day may not result in decreased waiting times if the rate of increase or the degree of absolute increase in patient referrals exceed the identified short-term increase in treatment capacity.
- Current models of extended day operation do not include out of hours cover by radiation oncologists, physicists, nursing staff or other professionals. The inclusion of these grades of staff has significant resource and potential industrial relations implications that would have to be carefully considered and addressed.
- Health and safety issues and their impact on the quality of treatment need to be carefully considered.
- Recruitment of additional personnel to provide an extended treatment day may be difficult.

The potential move to an extended treatment day also requires the consideration of a number of factors relating to staff and treatment equipment, for example:

- The potential introduction of shift systems and staff acceptance of flexible working arrangements
- The effect of increased working time on scheduled machine service and maintenance, including the potential reduction of the working life of a linear accelerator
- The altering of potential options for transfer of patients in the event of unscheduled machine downtime. Options for transfer are important in enabling the avoidance of gaps and the associated detrimental impact on patient outcome.

Various models exist by which the available time on treatment units can be extended. The preferred options to increase capacity will depend on the local situation and available resources but may involve considering a combination of the following:

- Extending the treatment day in the morning and evening
- The development of novel shift systems
- Increasing the number of days worked each week
- Increasing available treatment time by moving service/maintenance programmes to 'out of hours' times.

In considering the potential short-term need to purchase radiation oncology services outside the country, it would be implicit that patients were referred to centres meeting the quality criteria identified in this report. The Group believe that this approach should only be pursued in exceptional circumstances where the clinical care requirements of the patient indicate a need for specialised treatment techniques/protocols that have not been clinically commissioned, or where the clinical expertise to provide very specialised forms of treatment has not been developed within the country. The Group is cognisant of the precedent for international referral of patients in the context of specialised forms of radiation therapy for patients with rare cancers,[CXC] or where radiation protocols are unavailable in the country.[CXCI] The clinical nature of many patients' illness, the accompanying need for family support, and the complex requirement for multidisciplinary hospital and community-based care also means that provision of lengthy treatment programmes outside Ireland is unsuitable for the majority of patients.

The Group is aware that recent radiotherapy reports from other western countries have highlighted the fact that radiation oncology services are under-resourced in many jurisdictions, and that treatment service levels are currently being expanded (see section 5). The intrinsic capacity of such services to provide additional services for significant numbers of patients is therefore likely to be very limited.

[CXC] Particle beam radiotherapy (e.g. proton-beam), specialised radioisotope (e.g. ^{131}I-MIBG)
[CXCI] Up to 2001 fractionated total body irradiation as part of the paediatric allogeneic bone marrow transplant programme was provided by radiation oncology treatment centres in Great Britain.

The highest level of professional care was identified as the major priority by patients interviewed as part of the focus group study commissioned by the Group. This standard of care must therefore be ensured whether treatment is delivered within or outside Ireland. In addressing the treatment requirements of the majority of patients, it is imperative that this short-term strategic requirement be achieved through the rapid expansion of treatment infrastructure and human resources. This remains the crucial national service development goal. The latter will provide a sustainable national treatment service that is more responsive to the needs of patients, their families and healthcare professionals.

8.8 Education and training

The details of future recommendations on staff and other human resource requirements are detailed in section 9. There will be a specific need for the development of an integrated system of workforce planning aimed at anticipating the number and type of staff required to maintain and improve the national radiation oncology service. This will necessitate greater integration with the existing professional and education and training bodies, particularly for the key disciplines of radiation oncology,[CXCII] radiation therapy,[CXCIII] medical physics, and oncology nursing, in order to ensure that the number of training places matches the demand for skills and expertise in this area. There is a requirement to train increased numbers of staff in the disciplines of radiation oncology, radiation therapy, medical physics and oncology nursing and expand the existing educational and training facilities.[CXCIV]

It is appropriate to point out some additional general education and training requirements that relate to future radiation oncology service provision:

- Undergraduate programmes for medical students and other healthcare professionals should clearly develop the appropriate curriculum content that outlines current radiation oncology practice.[CXCV,CXCVI]
- The national specialist registrar (SpR) training programme in radiation oncology should be developed further in order to ensure the provision of an optimally trained clinical workforce. The training programme will require an initial significant increase in numbers in order to achieve the appropriate future balance between individuals entering the training programme, a pool of NCHDs who have completed clinical training and specialist registration, and the development of new and replacement consultant radiation oncologist posts.
- Additional postgraduate training programmes will be required for the education of staff with new responsibilities. Treatment dosimetrists, for example, have been employed at existing radiation oncology centres. However, there is no formalised training pathway for this group in Ireland.
- The postgraduate training programme in medical physics and engineering as applied to radiation oncology is not formalised and will benefit from further development in the near future.
- The radiation therapist postgraduate training programme and its relationship to specialist areas of activity within radiation oncology is also at an early stage of development. The promotion of postgraduate training opportunities should be encouraged.
- There is a need for the development of additional specific postgraduate training programmes to take account of the more recently developed roles associated with nursing in radiation oncology. Postgraduate diploma and higher diploma programmes should be more accessible to nurses in Ireland. The development of an MSc programme in this area should be explored.
- The role of distance learning approaches should be examined.

[CXCII] A national plan for a specialist registrar (SpR) training programme was approved in 2002 by the DoHC, Faculty of Radiologists RCSI, and Comhairle na nOspidéal and commenced in January 2003.
[CXCIII] In 2001 the Report of the Expert Review of Radiography Grades suggested a change in title from 'Therapeutic Radiographer' to 'Radiation Therapist'.
[CXCIV] *Quality and Fairness: A Health System for You* – Action point 101
[CXCV] Proposed undergraduate 'Bonn' curriculum
[CXCVI] *Quality and Fairness: A Health System for You* – Action point 101

The most recent publication from the International Commission on Radiological Protection – Prevention of Accidental Exposures to Patients Undergoing Radiation Therapy, ICRP 86 – provides recommendations for education standards for the specialised personnel involved in radiation oncology delivery. The recommendations include the following:

- An advanced university degree in a physical science or engineering, at least one year of academic and clinical training in radiation oncology physics, and additional training of at least one month in brachytherapy physics for radiation therapy physicists
- A degree granted by a university or medical school in academic studies and clinical training for a period of three or four years for radiation therapists[CXCVII]
- Postgraduate training and experience in oncological practice for radiation oncologists.

Future education and CPD programmes need to address the complex area of staff retention. This is a significant problem and may limit service expansion in Ireland. In particular recruitment of trained personnel will be difficult given the present worldwide shortage of radiation therapists, medical physicists, dosimetrists and nurses. A recent survey of the undergraduate pool of radiation therapists has identified that 91 per cent of this graduate population aspire to travel to other centres and jurisdictions during the early phases of career development. As a consequence, there will be a need for the proposed radiation oncology centres to adopt innovative approaches to job design and inter-disciplinary working,[CXCVIII] and strategies that support continuing medical education (CME) and continuing professional development (CPD).

8.9 Health information and radiation oncology

In order to meet key objectives outlined in the recent government publication *Quality and Fairness: A Health System for You*, and to deliver the quality of radiation oncology services that people require as advocated within this report, a comprehensive information management system, which is appropriate, high quality, available and accessible will be necessary.[27] Information availability and communication were ranked as high priorities for patients in the RCSI/IPA study. This information system should also be developed in the context of the proposed Health Information and Quality Authority (HIQA),[CXCIX] Reach,[CC] and the proposed national health Internet site.[27]

Two major areas of information provision need to be developed:

- Firstly, there is an urgent need to address the lack of awareness and understanding of the existing and future role of radiation therapy that exists among the general public, the medical and paramedical disciplines, healthcare administrators, and other agencies involved in healthcare planning. This requirement could take the form of a radiation oncology information system (ROIS) that would avail of web-based and other technologies to distribute and make available appropriate information.
- Secondly, there is an urgent need for the development of a separate specialist clinical radiation oncology information management system (CROIMS) that would facilitate appropriate national database development in the areas of quality assurance, risk management, protocol development, research, and the monitoring of patient outcome data.

Radiation oncology information system (ROIS)

The radiation oncology information system (ROIS) should support specific areas defined in the recent health strategy policy document *Quality and Fairness: A Health System for You*.[CCI] It is envisaged that it will integrate with appropriate components of the forthcoming National Health Information Strategy (NHIS) and provide the following:[27]

- Ready access to high-quality information covering all aspects of the national radiation oncology service, for the public, patients, health professionals, administrators, managers and policy makers

[CXCVII] International Commission of Radiological Protection Publication 86
[CXCVIII] *Quality and Fairness: A Health System for You* – Action point 103, 104
[CXCIX] *Quality and Fairness: A Health System for You* – Action point 116
[CC] REACH is an independent agency established by the Government to develop a strategy for the integration of public services and to develop and implement a framework for electronic government.
[CCI] *Quality and Fairness: A Health System for You* – Action point 115

- The use of evidence-based decision pathways in both clinical practice and future radiation oncology healthcare and infrastructural planning[CCII]
- Information and data supply and exchange with the National Cancer Registry (NCR).

Clinical radiation oncology information management system (CROIMS)

The use of complex information and communication technologies is already a critical component of modern radiation oncology centres.[21] Major components of the radiation oncology process are heavily dependent on complex computer and software/networking systems which are essential to treatment planning, delivery of clinical care, long-term archiving of treatment records and a wide variety of quality assurance programmes and risk management processes (see sections 2, 3 and 4). The majority of the commercial providers of radiation oncology equipment have implemented or are at advanced stages of developing additional electronic services including the electronic patient record (EPR) and in some cases complete 'paperless departments'. These developments need to be actively supported and funded as part of the forthcoming equipping and resourcing of new and expanded radiation oncology services and in addition will facilitate the national health strategy requirement to move towards the EPR being part of an electronic health record (EHR).[CCIII, CCIV]

Within radiation oncology practice, information and communication technology should provide rapid access to clinical and administrative records and assist many aspects of decision-making. For example:

- Telecare and telemedicine platforms should be further used to bring specialised diagnostic and clinical expertise closer to patients especially those in remote locations and/or peripheral/regional clinics so that the radiation oncology service is more accessible and responsive.[88,89,257,259,315-318]
- The best use of information and communication technology is required in order to improve operational radiation oncology service delivery and the responsiveness of new services, for example DICOM/DICOM-RT compliant data transfer and archive technologies, along with enabling communications technologies such as Telesynergy.®[260,261]

The development and funding of all aspects of information and communication technology is therefore a critical and essential component of the proposed network of radiation oncology centres and the national service plan.

8.10 Quality systems, research and radiation oncology

The national radiation oncology development plan proposed in this report must support and enable the major goal of developing standardised quality systems that support best patient care and safety as outlined in *Quality and Fairness: A Health System for You*.[CCV] The proposed radiation oncology centres will also need to meet the proposed written standards that will accompany the expanded Hospital Accreditation Programme, including the proposed assessment of treatment facilities and review of standards of both clinical and management practice.[CCVI]

Quality assurance

Quality assurance (QA) mechanisms should be introduced as a means of improving and monitoring performance and preventing both systematic and non-systematic problems, using a structured set of planned and methodical activities such as documentation, training and review, consistent with the fourth goal of *Quality and Fairness: A Health System for You*.[27] The expected benefits from this process include improved quality of care, informed planning and decision-making, heightened efficiency and effectiveness of the system, and the provision of service indicators that aid the commitment to continuous improvement and full accountability. These should be achieved through the use of the following:

[CCII] Ibid, Action point 120
[CCIII] Ibid, Action point 117
[CCIV] Ibid, Action point 118
[CCV] Ibid, National Goal No. 4
[CCVI] Ibid, Action point 63

- Standardised quality systems in the proposed radiation oncology centres that support best patient care and safety
- Evidence-based and strategic planning to underpin all objectives and decision-making.[CCVII]

A number of published reports on the principles and benefit of radiation oncology quality assurance exist, including those from the European Society for Therapeutic Radiology and Oncology (ESTRO).[20,86,98,103,219,234,246,319-323] The latter, for example, emphasises the impact of QA protocols on treatment outcomes and the importance of QA in the avoidance of errors.[86] Independent audit of these processes is an essential part of the QA programme and should be further developed with appropriate assistance from existing external expert groups and schemes, for example:

- The EU Network of Europe against Cancer Programme
- The UK National Dosimetry Group.

The Group strongly recommends that optimal national QA programmes be developed through the mutual co-operation of all the proposed radiation oncology centres within a national clinical network, and that this be developed in addition to the existing QA proposal that has been forwarded to the respective Departments of Health in the Republic of Ireland and Northern Ireland. There would appear to be considerable benefit in developing an 'all-island' dimension to this aspect of service provision. Such a system could also be a significant component of the evolving all-island clinical trials mechanism under the aegis of the Ireland - Northern Ireland - NCI Cancer Consortium.

Risk management

Risk management is a key area for development within existing and future national health strategic requirements.[CCIX] For a number of reasons, including the nature and complexity of radiation oncology treatment and the frequent requirement to treat patients to high dose, the area of risk management is of profound importance in radiation oncology service provision (see section 1), and is a critical area of activity within the radiation oncology treatment process.[CCX] The existing hospitals that provide radiation oncology treatment services have already implemented a number of risk management protocols and procedures that comply with intramural programmes and published guidelines (where they exist). It should be noted, however, that this area of activity is at an early stage of development at a national and international level.[87]

At present in Ireland there are limited mechanisms to enable the development of comprehensive co-ordinated inter-institutional risk management strategies. There are some early examples of the potential benefit of providing additional resources in this area. The TCD School of Radiation Therapy and TCD Academic Unit of Clinical and Molecular Oncology (AUCMO) in conjuction with St Luke's Hospital, for example, is participating in a major European research project on the development of new risk management strategies.[CCXI] There will be considerable benefit for the proposed radiation oncology centres to exchange and develop similar high-quality risk management procedures/protocols and ensure that these adhere to the highest international standards. The availability of appropriate information and networking systems between the radiation oncology centres, for example Telesynergy®, will be necessary to facilitate this area of development.

Clinical protocols and evidence-based programmes

Clinical protocols for the management of the majority of common malignancies should be developed and updated in accordance with evidence-based practice. There are a number of international resources for protocol updates and guidelines for the management of malignancy with radiation therapy.

[CCVII] *Quality and Fairness: A Health System for You* – National Goal No. 4
[CCVIII] This was established under the Memorandum of Understanding signed by the governments of Ireland, Northern Ireland and the United States. http://www.allirelandnci.org/new/02-06.asp
[CCIX] *Quality and Fairness: A Health System for You* – Action point 63
[CCX] Future generations of treatment planning systems are likely to employ tools that provide estimates of the risks of treatment side-effect (normal tissue complication probability – NTCP), in addition to the estimate of patient response (tumour control probability – TCP) and the relationship or therapeutic ratio between the two objectives – P^{+}.
[CCXI] ROISIS Project funded by the European Society for Therapeutic Radiology and Oncology (ESTRO)

The further development of evidence-based approaches must also include support for activities that ultimately enable the development of clinical protocols including cancer clinical trials and health services research. This should include an increased availability of specific resources to support health professionals who wish to carry out research on identified needs and the subsequent rapid application of research findings, where appropriate, to improve service delivery.[CCXII]

Research

The recently published Health Research Strategy (2001) identifies a number of opportunities where research funding may become available. In addition the Health Research Strategy report *Making Knowledge Work for Health* appears to create an opportunity to appoint a research and development officer to the area of radiation oncology services, and to additionally ensure that equivalent personnel appointed to health boards and other specialist agencies are aware of research issues relevant to radiation oncology.[CCXIII]

The Memorandum of Understanding signed by the governments of Ireland, Northern Ireland and the United States to establish the Ireland-Northern Ireland-National Cancer Institute Cancer Consortium, as well as the work of the Consortium, has also identified the potential for joint research interests between the United States and oncologists within Northern Ireland and the Republic of Ireland.[CCXIV] An early consequence of this process has been the HRB/DoHC funding of several clinical trial units during 2001-2002, including facilities at St Luke's Hospital and Cork University Hospital. Both hospitals are active participants in the Irish Clinical Oncology Research Group (ICORG) and St Luke's has recently become an affiliated member of the European Organisation for the Research and Treatment of Cancer (EORTC). St Luke's Hospital is also the pilot site for the investigation of an advanced telemedicine link (Telesynergy®) with the NCI (USA), Belfast City Hospital and the TCD School of Radiation Therapy/TCD Academic Unit of Clinical and Molecular Oncology (AUCMO) which aims to facilitate advanced research projects between all participating jurisdictions.[CCXV]

Resources of this type will enhance the prospect of radiation oncology treatment centres and appropriate staff obtaining additional research funding from other national, European and international research and grant-funding agencies. Ultimately, further research that addresses clinical, basic science and health-services questions will enhance the quality of service and clinical care delivered to patients, the ongoing assessment of new radiation oncology technologies, and the introduction of new protocol-based treatment approaches.

[CCXII] *Quality and Fairness: A Health System for You* – Action point 73
[CCXIII] *Quality and Fairness: A Health System for You* – Action point 73
[CCXIV] http://www.allirelandnci.org/new/02-06.asp
[CCXV] http://www.allirelandnci.org/new/02-06.asp

8.11 Summary

- Equity of access to the highest quality radiation oncology facilities is a right of all cancer patients. In order to provide this, a significant increase in patient treatment capacity achieved by the commissioning of new treatment equipment is urgently required.

- An increased number of radiation oncology treatment units should be established as part of a national clinical network of centres. In the short to medium term this will be best achieved through the development of radiation oncology services in the context of supra-regional cancer centres as originally set out in the 1996 National Cancer Strategy.

- Improved patient access is an integral and critical aspect of the proposed national radiation oncology service and the proposed development plan aspires to address the many factors that influence patient access.

- The group considers that a 4-6 linear accelerator treatment unit with appropriate staffing, and matched support for CT and non-CT simulation, treatment planning, therapy-based imaging, brachytherapy, and specialist radiation oncology/peri-operative procedures, is the minimum treatment centre configuration for a future radiation oncology treatment centre.

- The following treatment centre configuration and expansion of facilities is recommended:
  - Two treatment centres in the Eastern Region located at supra-regional cancer centres:
    - A single Eastern Region treatment centre serving the southern part of the region and adjacent catchment areas, ultimately providing a 13-14 linear accelerator capacity with appropriate clinical and non-clinical staff
    - A single Eastern Region treatment centre serving the northern part of the region and adjacent catchment areas, ultimately providing an 8-9 linear accelerator capacity with appropriate clinical and non-clinical staff
  - A treatment centre located at a supra-regional cancer centre within Cork University Hospital, ultimately containing 8-9 linear accelerators with appropriate clinical and non-clinical staff
  - A treatment centre located at a supra-regional cancer centre within University College Hospital Galway, ultimately containing 6 linear accelerators with appropriate clinical and non-clinical staff.

- The precise locations for the proposed service development in the Eastern Region have not been identified. The Group believes that this will require a detailed and sensitive analysis of existing public treatment facilities and the potential resources of specific hospital sites, the existing stage of development of oncology services at individual hospitals, site development plans and issues of patient access. This comprehensive review of the advantages inherent in specific hospital sites should be undertaken rapidly with the assistance of international experts and/or peer review using the guidelines outlined in section 7.4. This will facilitate the earliest possible identification of the preferred hospital location(s) for service expansion.

- The proposed service development plan, treatment centre configuration and equipment commissioning timetable should reach the target 35-38 linear accelerator national treatment requirement by 2010-2014. This resource will provide the expected future treatment requirement as determined from available population and cancer caseload statistics.

- The proposed radiation oncology centres must meet the proposed written standards of the Hospital Accreditation Programme including the proposed assessment of treatment facilities and review of standards of both clinical and management practice.

- Optimal QA programmes should be developed through the mutual co-operation of the clinical network of radiation oncology centres. The centres should develop risk management procedures/protocols and ensure that these adhere to the highest international standards.

- Telemedicine platforms should be further used to bring specialised radiation oncology expertise closer to patients. The use of new DICOM/DICOM-RT compliant data-transfer technologies should be developed in addition to new enabling communications technologies such as Telesynergy®.

- The development of a national co-ordinating function to facilitate forward planning, co-ordinated integration, new technology assessment and national protocol development is strongly advocated.

- Clinical protocols for the management of the majority of common malignancies should be developed and updated in accordance with evidence-based practice. Further research that addresses clinical, basic science and health-services questions in radiation oncology must be fully supported.

- The future analysis and development of radiation therapy facilities in Ireland will benefit from the development of costing/modelling algorithms that enable more sophisticated quantitative economic assessments of patient care, including societal costs.

- There is an immediate need to develop additional training and education programmes that permit both CME and CPD in the key professional disciplines. The development of a national treatment service will in addition require appropriate staffing ratios in the full range of paramedical disciplines including physiotherapy, dietetics, dental sciences, social work, clinical psychology, speech and language therapy, occupational therapy and pastoral care.

- Undergraduate programmes for healthcare professionals should clearly develop the appropriate radiation oncology curriculum content.

- The development of an integrated system of workforce planning within the national radiation oncology service is required.

- A comprehensive information management system should be developed in the context of the proposed Health Information and Quality Authority (HIQA), the proposed national health Internet site, and REACH.

- Intramural radiation oncology information systems (ROIS), available within individual hospitals, are needed to provide information to the general public, medical and paramedical disciplines, healthcare administrators, and other agencies including policy makers involved in healthcare planning.

- A separate specialist clinical radiation oncology information management system (CROIMS) with appropriate links to the National Cancer Registry Ireland (NCRI) will be required at each treatment centre to enable national database development in the areas of quality assurance, risk management, protocol development, clinical research, and the monitoring of patient outcome data.

Section 9

Recommendations – human resources

9.1 Introduction

The Group has considered the personnel and human resource requirements that need to accompany the national radiation oncology service development proposed in section 8. Existing international guidelines on staff numbers within radiation oncology departments have previously been detailed in section 6. The focus of this section is to outline staff proposals for the envisaged future national service model, where this is possible and appropriate. It is not within the Group's remit to provide detailed recommendations for all other medical, paramedical, support and administrative staff that are involved in the radiation therapy process as outlined in sections 1 and 2. However, the need for multidisciplinary clinical team development has been strongly advocated by the Group and is highly recommended in this report. Written representations on the need to involve other healthcare professionals in the development of the multidisciplinary cancer care team were received by the Group during its analysis and the need for clinical team development is fully acknowledged.

The report has confined its proposals on human resources requirements to the major clinical and support groups discussed in section 6 that are involved in the radiation therapy process as outlined in section 1:

- Radiation oncologists
- Radiation therapists
- Medical physicists (including clinical engineers, dosimetrists, and technicians)
- Oncology nurses.

The recommendations on human resources are consistent with all referenced documents and comparable recent reports from other western countries.

In providing recommendations it is important to note that it is not possible for the Group to be prescriptive about the exact staff complement of any individual radiation oncology treatment centre within the proposed clinical network described in section 8. The Group believes that it is preferable to establish clear guidelines that permit the accurate estimation of staff requirements by using a series of parameters that relate to the clinical activity associated with patients attending a centre. As a consequence the various staff groups are related to measures of caseload, case complexity, the inpatient and outpatient mix, and for certain professional groups the level, range and complexity of both treatment equipment and treatment planning systems.

A number of objectives identified in the recently published *Quality and Fairness: A Health System for You* human resources framework will impact on the staff employed within a future radiation oncology service.[CCXVI] The Group supports the following principles as part of human resource development within the proposed radiation oncology development plan:

- The development and explicit valuation of staff at all levels within the proposed service to the benefit of service users[CCXVII]
- The development of a qualified competent workforce to meet the changing demands of the people, and an integrated system of workforce planning aimed at anticipating the number and type of staff required to provide a quality health service[CCXVIII]
- The development of interdisciplinary co-operation,[CCXIX] including the examination of more flexible approaches to training, for example through the use of a common medical sciences degree before specialised training[CCXX]
- The proposed increase in the number of undergraduate and postgraduate places in medical colleges to strengthen clinician-training opportunities
- The development of closer links between the Department of Health and Children and the Department of Education and Science[CCXXI]
- The proposed statutory registration of health professionals for all professionals practising in the Irish health service in order to ensure the levels of qualification and competency necessary for public safety.[CCXXII]

[CCXVI] *Quality and Fairness: A Health System for You*
[CCXVII] *Quality and Fairness: A Health System for You*, 115
[CCXVIII] Ibid, 116
[CCXIX] Ibid, 116
[CCXX] Ibid, 119
[CCXXI] Ibid, 118
[CCXXII] Ibid, 119

The Group is aware of difficulties that exist at an international level in the sector of radiation oncology human resource planning including staff recruitment, retention, career potential, complex industrial relations issues, and the recent trend for new graduates in all disciplines to work abroad, thereby reducing the workforce at least in the short term (see section 6). The development of recruitment initiatives and exchange programmes is therefore vital for the future proposed radiation oncology treatment service.

The Group acknowledges the recently published Action Plan for People Management in the Health Service (2002).[CCXXIII] The action plan sets out a detailed road map for the management of people in the health service over the lifetime of the Health Strategy. The action plan comprises a key number of actions and deliverables intended to provide the impetus for a transformation of traditional personnel administration roles in the health service to a modern and dynamic model of people management. A competency framework for health and social care professionals is currently being finalised by the Office for Health Management. This should play an important role in helping to harness the skills, knowledge and expertise of personnel in the management and delivery of key health services.

9.2 Medical staff

In relation to the appointment of additional medical consultants, the Minister for Health and Children established a National Task Force on Medical Staffing in early 2002. Among other issues, the Task Force is considering the proposed development of a consultant-provided public hospital service and quantifying the resource and cost implications involved.

The Task Force is also addressing the reduction in working hours for non-consultant hospital doctors (NCHDs) arising from the EU Directive on Working Time and the medical education and training requirements of the hospital medical workforce. The Task Force will address the associated medical staffing needs of the Irish hospital system and consider the medical education and training requirements arising from any changes to the current model of delivering services. The Group recognises that the report may well have additional implications for the Group's recommendations.

Subject to any recommendations forthcoming from the National Task Force, arrangements for the appointment of additional consultant staff in radiation oncology is a matter for Comhairle na nOspidéal and the Department of Health and Children / agencies prioritising service developments through the service planning process. The proposed national training programme may also need to take on board recommendations forthcoming from the National Task Force in relation to postgraduate medical education and training issues.[CCXXIV]

The Group has identified a clear requirement for a significant increase in consultant radiation oncologist posts in the forthcoming decade in order to provide the clinical care that is possible with the expansion of treatment facilities proposed in section 8. The Group strongly endorses an immediate expansion of consultant numbers, thereby achieving a planned reduction in individual caseloads per consultant initially to that recommended by the Faculty of Radiologists (350 new cases per radiation oncologist), and subsequently to achieve staffing ratios that more closely approximate the international norm of one consultant radiation oncologist per 200-250 new patients. This would permit the proposed service to approach the radiation oncologist staff ratios implemented in other western countries. The case for the planned reduction in caseload per consultant, detailed in section 6, appears compelling and should be examined in conjunction with the forthcoming report of the National Task Force on Medical Staffing, the appropriate training authorities and other agencies in the Republic of Ireland.

[CCXXIII] *Quality and Fairness: A Health System for You*, 122

[CCXXIV] The proposed numbers of NCHDs (SHOs and SpRs) required to support the proposed medical consultant posts may need to be reviewed in the context of the future recommendations of the National Task Force on Medical Staffing.

Utilising the most recent estimates of cancer caseload from the NCRI (1998) and the 50 per cent treatment target, it is possible to estimate the number of radiation oncologists required at the end of the last decade. The documented cancer caseload for the period 1994-1998 and the estimated cancer caseload to 2015 are indicated in Table 9.1.

Table 9.1: Projected future cancer cases calculated up to 2015 for all cancers

The initial two rows (All invasive and pre-invasive cancers, All invasive cancers) represent classification categories of cancer used by the National Cancer Registry to identify different stages of cancer presentation and progression. The final row (All invasive cancers excluding NMSC) excludes non-melanoma skin cancer, a cancer that is common in Ireland but which in many situations has a better prognosis and a requirement for less complex treatments when compared to most adult cancers.

	New cases 1994-1998					New case projection		
	1994	**1995**	**1996**	**1997**	**1998**	**2005**	**2010**	**2015**
All invasive and pre-invasive cancers	19,068	18,683	19,527	19,871	19,846	21,997–22,582	24,175–24,788	26,772–27,417
All invasive cancers	16,964	16,654	17,132	17,342	17,383	19,348–19,898	21,315–21,891	23,713–24,320
All invasive cancers excluding NMSC	11,834	11,534	11,850	12,096	12,324	13,468–13,927	14,833–15,314	16,491–16,998

If 50 per cent of the 1998 invasive cancer is applied and if, in addition, it is assumed that a minority of non-melanoma skin cancer patients, for example 10 per cent, will also require radiation therapy, the following caseload and consultant radiation oncologist posts can be calculated.[CCXXV]

1994-1998 Target population of patients		
50% New cancer patients excluding NMSC patients	**+**	**10% of NMSC patients**[CCXXVI]
50% of 12,324 patients	+	10% of 5,059 patients
6,160	+	506
	Total = 6,660 patients (approx)	
If 350 new cases per consultant:[CCXXVII]	**19 radiation oncologists**	
If 250 new cases per consultant:[CCXXVIII]	**27 radiation oncologists**	
Actual numbers of consultant radiation oncologists employed in Ireland (1998)	**8 (10)**[CCXXIX]	

[CCXXV] In this exercise certain pre-invasive cancers that add to the total national cancer caseload, for example ductal carcinoma *in situ* (DCIS) of the breast, are not taken into account.
[CCXXVI] Complex NMSC patients requiring electron therapy and other specialised forms of radiation therapy such as treatment moulds, total skin electron therapy, megavoltage treatment
[CCXXVII] 1993 Faculty of Radiologists (RCSI) recommendations
[CCXXVIII] 1991 Pan-American Health Organisation (PAHO)/WHO Guidelines 23. Organisation, P.A.H.O.W.H. *Organisatio* (ed. C, B.) (Pan American Health Organization / World Health Organisation, Washington DC, 1997)
[CCXXIX] Eight permanent Comhairle-appointed positions (six at St Luke's Hospital and two at CUH), one locum consultant posts (at St Luke's Hospital) and one FTE in private practice.

The estimated national cancer caseload excluding non-melanoma skin cancer (NMSC) in 2010 is expected to increase to 15,000 patients (see section 4). A major consequence of this increase, together with the 50 per cent treatment target for radiation therapy, will be a further increase in patients requiring radiation therapy to approximately 7,500. The required number of consultants at that time will depend on the reference caseload per clinician. In order to adhere to the proposed 350 new cases per radiation oncologist, the clinical network of radiation oncology centres will require 22 consultants, whereas a guideline of 250 new cases per clinician will require 30 consultants, and by 2015 the anticipated number of radiation oncologists will need to rise to approximately 34 consultants.

The Group acknowledges that the magnitude of the proposed consultant expansion is very significant. However, the appointment of sufficient medical staff will be a critical cornerstone of the future enhanced service. In addition, the expanded consultant staff cohort will help address many of the deficiencies of the existing service that were identified by patients participating in the IPA/RCSI study discussed in section 5. The training programmes necessary to enable future consultant appointments will require major investment. The following points should be noted:

- The existing number of Comhairle na nOspidéal-approved consultant radiation oncology posts in mid-2003 is 10 including two new positions that were unfilled at the completion of this report.
- The above estimates assume that a small caseload of NMSC patients will require radiation therapy.
- The above estimates do not take full account of the additional patients diagnosed with pre-invasive cancers that may require radiation therapy, for example ductal carcinoma of the breast (DCIS). There will be an ongoing requirement for the assessment of needs in this area to enable the appropriate modification of future radiation oncologist numbers to match the caseload that may arise from the further development of the BreastCheck® national screening programme.
- The existing level of clinician intake in the postgraduate radiation oncology training programmes will not provide the essential resource of trained accredited oncologists that will be necessary to meet the short and medium term demands of the proposed clinical network of radiation oncology centres.

Recommendations – Consultant radiation oncologist and NCHD staffing

With regard to the anticipated numbers of training clinicians and consultant radiation oncologists the following is recommended as a matter of urgency:

- The DoHC and Comhairle na nOspidéal should develop consultant staffing procedures that take account of existing and future international guidelines on numbers of radiation oncologists required for delivery of modern radiation therapy.[25,26,101,111,209,216,287,303] Although there is some variation in individual guidelines there is a considerable degree of consensus that permits the establishment of guidelines for future consultant numbers.
- In the first phase of service expansion, there should be an immediate expansion of consultant numbers to enable individual caseloads per consultant initially in the region of 350 new cases per radiation oncologist.
- A further planned reduction in caseload per consultant should be examined in conjunction with the appropriate training authorities and statutory agencies in the Republic of Ireland.
- The national training programme should be developed further in order to ensure the provision of an optimally trained clinical workforce. The training programme will require an initial significant increase in numbers to achieve a future balance between individuals entering the training programme and subsequent radiation oncology posts. A direct matching of trainee/specialist registrar (SpR) numbers to future consultant posts is not advocated. However, there are undoubted benefits for the continuity of clinical service in developing a high-quality competitive training programme which maintains an appropriate supply of consultant candidates of the highest calibre.
- In addition to the principle of matching cancer patient caseload with international staffing guidelines, the

numbers of consultants required per treatment centre must take account of the additional needs that arise from super-specialist clinical and technology-dependent service developments, for example the consultant staffing requirements for paediatric radiation oncology, stereotactic, TBI, and radio-immunoisotope treatments.

9.3 Radiation therapists

A significant increase in the number of radiation therapists will be required in the forthcoming decade in order to continue to provide the level of technical and clinical care expected as part of a quality service and the proposed expansion of treatment facilities outlined in section 8.

This Group welcomes the recently approved expansion of student intake into the School of Radiation Therapy,[CCXXX] and endorses proposals for the development of additional postgraduate education and other CPD programmes that will ensure the workforce continues to meet the service requirements in this evolving discipline.

Using the current staffing guidelines outlined in section 6, the radiation therapist staffing requirement for the proposed clinical network of radiation oncology centres has been estimated. The indicative calculation is also based on anticipated areas of clinical specialisation, the recommendations in the recent Report of the Expert Group on Radiography Grades and the following level of staff per treatment unit:[CCXXXI]

- Linear accelerator: Four staff per unit
- ^{60}Cobalt unit: Three staff per unit
- Orthovoltage unit: Two staff per unit
- CT Simulator: Three staff per unit
- Simulator: Two staff per unit
- Mould Room: Two staff per unit
- Brachytherapy unit: Two staff per unit

There will also be a requirement for additional managerial and administrative/support staff.[CCXXXII]

Recommendations – Radiation therapist staffing

A total national requirement of approximately 270-280 whole time equivalents,[CCXXXIII] which includes the 90 radiation therapists who are already established in the existing centres, will be required.[CCXXXIV] Areas of clinical specialisation associated with the existing staff grading structure could include the following:

- Treatment planning. This is generally under the responsibility of a physics department. However, it relies significantly on the recruitment of graduate level radiation therapists who are subsequently trained as dosimetrists. The development of postgraduate education in this area is a potential area of CPD.
- Quality assurance,[CCXXXV] protocol development, information provision and support,[CCXXXVI] and clinical education should also be considered as responsibilities associated with the profession generally.

[CCXXX] The School of Therapeutic Radiography increased the intake of student in 2001 following representation form the Expert Working Group on Radiotherapy Services.

[CCXXXI] Report of the Expert Group on Radiography Grades published in July 2001

[CCXXXII] The career structure for radiation therapists arising from the implementation process for the two reports (the Report of the Joint Working Party on Radiographers (2001) and the Report of the Expert Group on Radiography Grades (2001)) is as follows: radiation therapist, clinical specialist radiation therapist, radiation therapy services manager I (where the manager has responsibility for a department with 25 WTE radiation therapists or less) and radiation therapy services manager II (where the manager has responsibility for a department with more than 25 WTE radiation therapists).

[CCXXXIII] An additional 20 per cent of the total staff complement has been integrated into the final figures to cover annual leave and sick leave in order to ensure continuity of service.

[CCXXXIV] Eastern Regional Health Authority staffing figures are based on the development of two centres. Cork region staffing figures are based on an eight-linear accelerator centre. Galway region staffing figures are based on a six-linear accelerator centre. It is anticipated that each centre will have in addition to the linear accelerator configuration, one orthovoltage/superficial unit, one CT simulator, two simulators, mould room, brachytherapy and planning facilities.

[CCXXXV] Report of the Expert Group on Radiography Grades, page 11.

[CCXXXVI] The Expert Group on Radiography Grades recommended that consideration should be given to involving radiation therapists in the provision of support services to patients and their families, particularly in the provision of radiotherapy services, page 12.

- The concept of anatomic and technology site-specialisation for radiation therapists within the existing grading structure should be considered as a potential way to improve treatment delivery.
- Participation in clinical, health services and selected translational research programmes should be encouraged and facilitated through appropriate staff linkages to the TCD School of Radiation Therapy, other appropriate university departments, hospitals and national/international agencies. Research was identified by the Report of the Expert Group on Radiography Grades (2001) as a desirable element of the personal and professional development of radiation therapists.[CCXXXVII]
- The appointment of clinical tutor posts to take responsibility for local, organisational and supervisory functions in relation to undergraduate students should be examined.[CCXXXVIII]
- The Expert Group on Radiographer Grades (2001) has dealt with the role of managerial grade posts. The numbers will depend on the size of department and the specific requirements of each department.
- In the future, further developments in the complexity of treatment equipment and techniques, the development of physician tumour-site sub-specialisation, and the increased expectations of patients, may require further revision of staff roles and staffing requirements.[CCXXXIX]

9.4 Medical physicists

At present there are no guidelines or agreed staffing recommendations for physicists working in radiation therapy in Ireland. The recommended minimum staff requirements identified by the joint working group from the European Society of Therapeutic Radiation and Oncology (ESTRO) and the European Federation of Medical Physicists (EFOMP),[CCXL] and more recently in 2002 from the Institute of Physics and Engineering in Medicine (IPEM),[26] have been discussed in section 6.[CCXLI] Both publications provide formulae for the estimation of appropriate staff levels for routine service provision. However, additional staffing requirements for complex procedures, treatment techniques, education programmes and other activities are only partly addressed.

The ESTRO/EFOMP guidelines have been used to estimate the future staff numbers within radiation oncology medical physics departments. As with the other professional disciplines, the Group does not consider it appropriate to state an absolute number of staff for each of the proposed clinical networks of treatment centres outlined in section 8. Instead it is considered essential to provide guidelines that illustrate the need to link staff requirements to appropriate measures of activity. In the case of medical physicists the best guide to staff requirements is through a linkage to equipment with additional factors taking account of the additional requirements of patient casemix and complexity, radiation protection duties and other specified responsibilities.

Recommendations – Medical physicist staffing

With regard to the anticipated numbers of medical physicists the following is recommended:

- The DoHC and the HSEA should take account of the ESTRO/EFOMP recommendations for minimum staffing levels for core medical physics support as outlined in section 6.[103]
- Staffing of individual treatment centres will in addition need to take account of additional areas of physicist activity not addressed in the ESTRO/EFOMP documents, in particular, the evolving increased complexity of treatment, the delivery of postgraduate training programmes and the statutory requirement for appropriate radiation protection programmes.[103]
- There is a need to develop more formal training programmes in radiation oncology physics, engineering and dosimetry in conjunction with appropriate accreditation mechanisms for hospitals and other agencies involved in the area.

[CCXXXVII] Ibid, page 23
[CCXXXVIII] Report of the Expert Group on Radiography Grades, page 31
[CCXXXIX] The Netherlands National Cancer Institute has for example recently piloted a system where radiation therapists have specific patients assigned to them rather than patients being assigned to treatment units. Twelve radiation therapists are assigned to two linear accelerators and are responsible for the treatment process for their designated patient population.
[CCXL] Quality assurance in radiotherapy: the importance of medical physics staffing levels. Recommendations from an ESTRO/EFOMP joint task group (1996)
[CCXLI] Guidelines for the provision of a physics service in radiotherapy, 2002

9.5 Oncology nurses

A significant increase in the number of oncology nurses will be required in the forthcoming decade to enable the provision of a quality clinical service that will be central to the proposed expansion of treatment facilities outlined in section 8.

The Group welcomes the development of dedicated nursing departments within the radiation oncology departments of both St Luke's Hospital and CUH and endorses existing proposals for the development of postgraduate education and other CPD programmes that will ensure the workforce continues to meet the service requirements.

Recommendations – Oncology nurse staffing

- The configuration of nursing staffing levels in any radiation therapy centre must be based on scientific workload measurement and professional judgement. Examples of tools that provide such estimates have been highlighted in Section 6. The required nursing complement will be dependent on the size and structure of the centre, the pre-existing nursing skill mix, documented staff turnover, patient dependency, patient length of stay, and changes in category of the patient condition.
- The specific configuration for Nursing Administration (inclusive of Director of Nursing and other supervisory posts for example Assistant Director of Nursing and Clinical Nurse Manager III) will also depend on the size and nature of the Radiation Therapy Centre.

9.6 Guidelines on the staffing requirements for future radiation oncology units

The Group has provided a guideline in Appendix 1 to illustrate the potential staffing complement of consultant and non-consultant radiation oncologists, radiation therapists, medical physicists inclusive of engineering and dosimetry staff, and oncology nurses over a range of radiation centre sizes. It is important to note that, as a guideline for healthcare planners and others involved in the future organisation of the proposed national service development, it is not intended to be prescriptive in nature. The exact staffing configuration will need to take account of a local detailed analysis of the patient caseload and case complexity of individual treatment centres.

9.7 Summary

- The report has confined its proposals on staff requirements within the proposed clinical network of radiation oncology centres to the following professional groups: radiation oncologists, radiation therapists, medical physicists (including clinical engineers, dosimetrists, and technicians), and radiation oncology nurses. A significant increase in consultant radiation oncologists, radiation therapists, medical physicists and oncology nurses is required in the forthcoming decade.

- The Group believes that the optimal estimation of staff numbers should relate to measures of clinical activity associated with patient care, for example attending patient caseload, case complexity, the inpatient and outpatient mix, and for certain professional groups the level, range and complexity of treatment equipment and treatment planning systems.

- The Group supports the objectives identified in the recently published Health Strategy *Quality and Fairness: A Health System for You* and the Action Plan for People Management in the Health Service.

- The staffing of the future radiation oncology treatment service will need to take account of the existing difficulties in staff recruitment, retention, career potential, complex industrial relations issues, and the recent trend for new graduates in all disciplines to travel. Implementation of the proposed action plan in *Quality and Fairness: A Health System for You* may help radiation oncology service planning and staff retention.

- The greatest shortfall of staff is the available number of consultant radiation oncologists and the numbers of non-consultant hospital doctors training in this discipline.

- The DoHC and Comhairle na nOspidéal should take account of the existing international guidelines on the radiation oncologist staffing ratios required for delivery of modern radiation therapy. In the first phase of service expansion there should be an immediate expansion of consultant numbers to enable caseloads of 350 new cases per radiation oncologist.

- Implementation of the Action Plan for People Management in the Health Service may help radiation oncology service planning, staff retention, and the provision of an optimally trained accredited clinical workforce.

- The Report of the Expert Group on Radiography Grades (2001) has suggested appropriate levels of radiation therapist staff per treatment unit. However, there may be need to develop additional roles to take account of the evolving complexity of radiation treatment.

- The DoHC, National Hospitals Office and the HSEA should take account of the ESTRO/EFOMP and IPEM guidelines in the context of future medical physicist staffing.[CCXLII] The staffing of individual treatment centres will need to take account of additional areas of physicist activity not addressed in the ESTRO/EFOMP documents.

- Formal training programmes in radiation oncology physics, engineering and dosimetry together with appropriate accreditation mechanisms need to be developed to provide the expanded workforce.

- The configuration of nursing levels should be based on workload measurement taking account of the size and structure of the centre, nursing skill mix and staff turnover, patient dependency, patient length of stay, and changes in category of patient condition. The specific configuration of the staff involved in nursing administration will be dependent on the size and nature of the radiation oncology centre.

[CCXLII] European Society of Therapeutic Radiation and Oncology (ESTRO), the European Federation of Medical Physicists (EFOMP), and the Institute of Physics and Engineering in Medicine (IPEM)

Section 10

Recommendations – national co-ordinating mechanisms

10.1 National radiation oncology co-ordinating mechanisms

The proposed national programme outlined in sections 8 and 9 has identified the need for the immediate development and expansion of radiation oncology services. This will inevitably be a complex process. Of note, the development of these services has in the past not been co-ordinated at a national level. Moreover, recent experience in both the upgrading of existing treatment centres and the development of a new centre has unequivocally demonstrated the following:

- The complexity of the process, particularly the physical and clinical commissioning programmes that are essential for modern departments
- The lengthy timetables that appear to accompany existing tendering mechanisms, new equipment purchase and the development of additional treatment capacity within treatment centres
- Significant clinical and technological developments in radiation oncology, anticipated in the forthcoming decade, which will add to the complexity of the range of treatment services.

The Group believes that, by virtue of the technology base and specialisation central to radiation oncology, there will be a particular need to capitalise on the existing specialist expertise in radiation oncology available within the country and to channel this to some of the proposed new executive arms of the National Health Strategy as outlined in *Quality and Fairness: A Health System for You*.[27]

The Group strongly believes that a national radiation oncology co-ordinating mechanism should be put in place to help all treatment centres in the analysis, acquisition and implementation of existing and new technologies and to ensure maximal forward planning in regard to their integration with existing facilities. This mechanism should report to the recently proposed HIQA and National Hospitals Office.

A co-ordinating mechanism would facilitate the examination of national aspects of future radiation oncology development. It is clear, for example, that no radiation oncology facility should exist in isolation without access to some aspects of the expertise developed at other centres within the proposed clinical network outlined in section 8. In addition, developments in radiation oncology lend themselves to electronic exchange of information between the treatment centres (see sections 3 and 8).

A national radiation oncology co-ordinating mechanism could initially be established through a National Radiation Oncology Co-ordinating Group (NROCG). This would facilitate inter-institutional communication and the planned development of specific clinical services. The following range of functions could be undertaken by the NROCG in conjunction with the HIQA and the National Hospitals Office:

- The development of national radiation oncology quality assurance programmes, equipment inventory and audit, equipment dosimetry protocols, and national risk management guidelines
- The co-ordination and tracking of tumour-specific and process-specific treatment protocols used in the majority of cancer patients. The latter would benefit from the partnership development with professional, clinical and research groups
- The designation of centres for certain specialised treatment procedures, for example TBI, stereotactic radiosurgery, and paediatric protocols
- Facilitating the development of multidisciplinary conferencing systems that utilise telemedicine technology. This requirement would facilitate the proposed clinical network of centres and the additional links between treatment centres and other oncology units[CCXLIII]
- The examination of innovative technologies such as the Telesynergy® programme. Enabling technologies of this type may permit cross-consultation at an international level and would have particular benefit in complex or rare cancer management
- Establishment of a national inventory of treatment-related equipment used in radiation oncology centres, and the design of common specifications for the acquisition of new technologies.

[CCXLIII] The recent moves by linear accelerator manufacturers to ensure that all existing and future equipment is DICOM-3 and DICOM-RT compatible will enable future exchange of complex patient diagnostic and treatment parameters between different treatment centres.

Through the development of these national requirements the proposed co-ordinating mechanism will facilitate major objectives of the programme by ensuring that all patients will have equal access to appropriate state-of-the-art patient-oriented services.

10.2 Composition of a national radiation oncology co-ordinating group

A National Radiation Oncology Co-ordinating Group(NROCG) should have representation from the National Cancer Forum and professional bodies directly involved in the provision of radiation therapy, with additional input from management. Professional representation is necessary to facilitate many aspects of technical and clinical commissioning and the development of the potential objectives highlighted above. Senior management input will be required as the proposed national radiation oncology service will require novel partnerships between areas in which treatment services are provided and adjacent areas where other aspects of oncology care are provided, for example new patient assessment and subsequent post-treatment follow-up and the development of proposals for patient transport and accommodation.

The DoHC should therefore examine the feasibility of this co-ordinating group interacting with additional new advisory bodies such as the HIQA and the National Hospitals Office. Given the early stage of development of the HIQA it is strongly suggested that a National Radiation Oncology Co-ordinating Group be developed rapidly.

10.3 Summary

- The Group strongly proposes that a National Radiation Oncology Co-ordinating Group (NROCG) be formed to facilitate future treatment centres in the analysis, acquisition and implementation of new technologies and to ensure maximal integration with existing facilities. This group should report to the HIQA.

- The suggested range of functions and responsibilities to be undertaken by the NROCG in conjunction with the HIQA should include the following:
  - The development of national radiation oncology quality assurance programmes, equipment inventory and audit, equipment dosimetry protocols, and national risk management guidelines
  - The co-ordination and tracking of tumour-specific and process-specific treatment protocols and the designation of centres for specialised treatment procedures
  - Facilitating the development of multidisciplinary conferencing systems that utilise telemedicine technology
  - The design of common specifications for the acquisition of new technologies.

- The Expert Group strongly recommends that the proposed National Radiation Oncology Co-ordinating Group be developed rapidly.

Appendices

Appendix 1
Potential staffing complement of radiation oncology centres

Appendix 2
IPA/RCSI Study: Consumer perception of radiation therapy services

Appendix 3
SAHRU Report: Determination of catchment populations within specified travel times and distances of particular hospitals

Appendix 1

Potential staffing complement of radiation oncology centres

Equipment	Staff				
Other	Medical staff	Radiation therapists	Physicists	Nurses	Admin & Support
4 Linear accelerators 2 Simulators CT Simulator Planning dept Brachytherapy Orthovoltage Mould Room Workshop	3-4 Consultants 8 NCHDs	43 Radiation therapists	11 Physicists 9 technical & engineering support	37.5 Nursing staff	26 staff
6 Linear accelerators 2 Simulators CT Simulator Planning dept Brachytherapy Orthovoltage Mould Room Workshop	5-6 Consultants 12 NCHDs	51 Radiation therapists	12 Physicists 15 technical & engineering support	70 Nursing staff	31 staff
10 Linear accelerators 3 Simulators CT Simulator Planning dept Brachytherapy Orthovoltage Mould Room Workshop	6-8 Consultants 18 NCHDs	82 Radiation therapists	15 Physicists 21 technical & engineering support	104.5 Nursing staff	61 staff
12 Linear accelerators 3 Simulators CT Simulator Planning dept Brachytherapy Orthovoltage Mould Room Workshop	8-10 Consultants 20 NCHDs	90 Radiation therapists	16 Physicists 23 technical & engineering support	133 Nursing staff	75 staff

The above staffing numbers illustrate the estimated human resource requirement for a new department within a hospital that has no pre-existing radiation oncology/oncology staff. The estimated staff numbers are provided for a range of radiation centre sizes. The exact number of staff required will depend on a variety of factors that influence the activity level of the centre. These include the patient caseload, case-mix complexity, the provision of special radiation treatment procedures and the training/accreditation status of the hospital department.

Appendix 2

IPA/RCSI Study: Consumer perception of radiation therapy services

Dr Catherine Gavin, Ms Marie Brady
Institute of Public Administration (IPA)
Royal College of Surgeons in Ireland (RCSI) 2002

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Overall Summary

Focus group & questionnaire results

Background
As part of the Irish National Cancer Strategy[1], the Department of Health and Children and cancer service providers are formulating a strategy for the provision of future radiotherapy services. This project was commissioned in order that future service developments would be based on best practice and sensitive to patient needs, preferences and priorities.

Objective
The research aimed to measure satisfaction with current service among radiotherapy service users in Ireland, to determine their priorities and preferences for care, and to inform service providers / policy makers regarding future strategic planning and radiotherapy service developments.

Methods
The study consisted of a series of focus groups followed by the distribution of a postal questionnaire. A random sample of male and female patients over 18 years, representing all major cancer groups who had completed their first course of radiotherapy within three months of the project was eligible to participate in the study. Following ethics committee clearance, each attending consultant sent out a personalised letter inviting eligible patients to participate in the study. Initially, seven focus groups (including one for palliative care patients) were held at various locations around the country and were made up of five to ten participants in each case, with a total of 48 participants in all. In the focus groups, patients were prompted to discuss the best and worst aspects of their experience of the radiotherapy service, to arrange service dimensions in a hierarchy of importance and to make recommendations on future radiotherapy services. Responses were recorded by two facilitators using a tape-recorder and written notes.

Following the focus groups, a detailed questionnaire was distributed to a larger sample of radiotherapy service users (n=149) to explore issues raised at the focus groups, to detail the relative importance of aspects of the service, to quantify satisfaction with service elements and to obtain recommendations for future service developments. The content of the questionnaires was further informed from the literature and through feedback from key stakeholders including the Expert Working Group on the Development of Radiation Oncology Services.

Results
Focus group results were analysed for consensus and minority opinions, emerging themes and patterns.

Priorities for care identified included; "Highest level of professional care", "Getting information about my illness", "Communication", "Waiting time from diagnosis to radiotherapy treatment", "Distance to travel for radiotherapy treatment", and "Support services for me and my family".

Best aspects of the service identified included: "Hospital staff" who were singled out for commendation by a significant majority at all focus groups. "Hospice and home care" were singled out for praise by the palliative group. Others were pleased to be "Treated in a dedicated facility with people with a similar illness". "Hostel facilities" for patients and family were praised at St Luke's Hospital.

The worst aspects of service identified included: "Radiotherapy machines breaking down frequently", "Inadequate communication (a) between doctor and patient", (b) "Between members of the treatment team" and (c) "Between hospitals providing treatment". In addition, the focus groups recorded dissatisfaction with the "Lack of information about illness/progress", "Unavailability of convenient, comfortable transport for those travelling long distances", "Lack of convenient car parking at the hospitals" and "Waiting (one's turn) in hospital for treatment".

One hundred and twelve (112) ***questionnaires*** were returned (response rate 75 per cent) and analysed using the Statistical Package for the Social Sciences (SPSS). Overall satisfaction with the service and with professional care was high with 97 per cent expressing satisfaction with each respectively. Satisfaction with facilities was lower at 72 per cent. The **most important aspects of service** for radiotherapy service users nationally were: "Receiving the highest level of professional care", "Staff inspires confidence", "Sympathetic approach of staff" and "Friendliness of staff". Other aspects of importance were "Being given information about my condition", "Waiting time from diagnosis to radiotherapy treatment" and various aspects of "Communication". The most satisfactory aspects of service were "Friendliness of staff", "Staff inspires confidence", "Receiving the highest level of professional care" and "Sympathetic approach of staff to patients".

Aspects of service which received **high importance yet low satisfaction** ratings in the questionnaires were "Waiting time from diagnosis to radiotherapy treatment", "Being given information about my condition", "Communication with my radiotherapy doctor" and "Enough consultation time with my radiotherapy doctor". Some of these findings are similar to focus group findings, in which "Inadequate communication between doctor and patient", "Between team members about patients" and "Between hospitals providing treatment" were cited as some of the worst aspects of the service. Some of these communication difficulties may relate to organisation/system shortcomings, for example staff shortages and/or appointment scheduling. Others may highlight the need for improved communication skills per se. In the questionnaire, a significant number of patients (55 per cent) reported "Uncertainty about when the treatment would begin", and experienced "Delays in getting a date for treatment" (29 per cent). Of respondents, 21 per cent reported "Waiting for longer than eight weeks" from diagnosis to treatment.

The most important aspects of service common to *both focus groups and questionnaires* were "Receiving the highest level of professional care", "Being given information about my condition", "Waiting time from diagnosis to radiotherapy treatment" and "Communication".

The questionnaire and focus group findings suggest that in a number of cases, low satisfaction ratings for "Waiting time from diagnosis to radiotherapy treatment" may be attributed to uncertainty regarding commencement of treatment rather than excessive delays, suggesting that further exploration of this matter is required.

Transport was a priority for patients in a number of focus groups who remarked on the "Lack of convenient, comfortable transport for those travelling long distances for radiotherapy treatment". Distance to travel for treatment was not identified as one of the top ten priorities in the questionnaire (actual ranking thirteenth). A majority of respondents (64 per cent) typically reported no difficulties travelling for treatment, although 25 per cent reported low satisfaction for "Distance to travel for radiotherapy treatment" and 26 per cent reported "Travelling" to be one of the worst aspects of service in an open-ended question.

In keeping with the findings from the focus groups, a significant majority of respondents to the questionnaire (65 per cent) commended "Staff" on both a personal and professional level.

Although a significant number of patients at the focus groups reported dissatisfaction with "Radiotherapy machines breaking down", this was not supported by the questionnaire findings. Only 14 per cent of respondents to the questionnaire rated "Poor facilities and machines breaking" (pooled data) as some of the worst aspects of service.

Questionnaire data was analysed regionally (in the regions for which data comparison was possible) to determine if patients' priorities and preferences for care were related to area of residence. Data for the Western Seaboard Group (WSG) (i.e. Mid-Western, Western and North Western Health Boards), Eastern Regional Health Authority (ERHA) and Southern/South Eastern Health Boards (SHB/SEHB) was analysed. It was not possible to analyse the results from the North Eastern Health Board (NEHB) and the Midland Health Board (MHB) separately as numbers were insufficient. Essentially the same aspects of service were identified as important by patients in the three regions analysed. Of the service elements rated of high importance, "Waiting time from diagnosis to radiotherapy treatment" alone received a low satisfaction rating compared with importance in the three regions analysed. "Being given information about my condition" scored high importance but low satisfaction ratings with the SHB/SEHB group alone. Similarly, "Communication between hospital cancer services and the GP", scored high importance and low satisfaction scores with SHB/SEHB patients only. "Continuing contact with the hospital after treatment" and "Availability of support services for me and my family" received significantly lower satisfaction versus importance ratings in the SHB/SEHB and the WSG groups compared with the ERHA.

In keeping with the national data, "Distance to travel for radiotherapy treatment" did not achieve a top ten importance ranking in any of the three regional groups. However, this aspect of service scored lower satisfaction ratings in the WSG compared with the SHB/SEHB and ERHA groups. Satisfaction with "Waiting time for radiotherapy treatment in hospital" was significantly higher for the SHB/SEHB group than for the ERHA and WSG groups respectively ($p=0.039$). Satisfaction ratings for "Continued contact/support with the hospital after treatment" were significantly higher for the ERHA group, and were lowest for the WSG group ($p=0.036$).

Suggestions for service improvement from the focus groups included improving "Communication between doctors and patients", "Between other hospitals", "Between hospitals and general practitioners" and in "Providing information to patients about their illness and treatment". Patients welcomed "anything" to alleviate the transport issue for patients travelling long distances. The main recommendations for service improvement recorded in the questionnaire were (providing) "More units/units nearer home" (51 per cent of respondents), "Better facilities/equipment"(14 per cent) as well as "Shorter lists/waiting time" (14 per cent).

Conclusions:

Patients had no difficulty identifying priorities and preferences for radiotherapy care. "Receiving the highest level of professional care" was identified as a significant priority in both focus group and questionnaire responses. In general, satisfaction with the overall radiotherapy service and the level of professional care received was high. Further analysis revealed areas for improvement.

Patients expressed dissatisfaction with "Waiting time from diagnosis to radiotherapy treatment", which may be due to a number of factors. As GPs are often the first point of contact that patients have with the health service, they have an important role in speedy diagnosis and referral. Nevertheless, this finding warrants further analysis, to determine if the perceived delays can be confirmed by patient records, or are influenced by other factors, e.g. uncertainty about when treatment might begin.

Several aspects of "Communication" scored high importance and low satisfaction ratings. Specifically, "Being given information about my condition", "Communication with the radiotherapy doctor" and "Having enough consultation time with my radiotherapy doctor" all scored high importance and significantly lower satisfaction ratings. This dissatisfaction with communication is not confined to the hospital setting alone, but extends into the community setting. "Communication between hospital cancer services and (the) GP" scored significantly lower satisfaction compared with importance ratings in the national findings. Regional analysis shows that this dissatisfaction is largely attributable to SHB/SEHB respondents. "Continuing contact/support with the hospital after treatment" scored significantly lower satisfaction compared with importance ratings in the WSG and SHB/SEHB groups but not, interestingly, in the ERHA group. The importance of strong links and effective communication channels between hospital cancer services and patients' GPs may be of particular relevance for patients living outside the ERHA. The interpersonal aspects of effective communication also warrant attention, as may organisational and system factors.

Although 64 per cent of respondents reported no difficulties travelling for treatment, 25 per cent rated "Distance to travel for radiotherapy treatment" as unsatisfactory. In this context, 50 per cent (40 out of 80) of suggestions made in an open-ended question recommended providing "More radiotherapy units/units nearer home". This suggestion was also put forward in some focus groups.

The lack of convenient, comfortable transport and reports that "Travelling" was one of the worst aspects of service for patients in both focus groups and questionnaires highlights the need for review of current transport arrangements for radiotherapy treatment.

Recommendations:

Undertake further analysis of waiting times between diagnosis and radiotherapy treatment, and implement any changes where appropriate.

Highlight the importance of effective communication in radiotherapy service delivery and develop guidelines to address identified shortcomings.

Review current transport arrangements and implement a more patient-centred, user-friendly approach.

Maximise the use of outreach clinics and follow-up to limit unnecessary travel for patients.

1. Introduction

This is the report of the findings of the Evaluation of Consumer Perceptions of Radiotherapy Services in Ireland. The project was commissioned by the Expert Working Group on the Development of Radiation Oncology Services in Ireland in the context of the National Cancer Strategy[1]. The Working Group was established to review current levels of service provision and make recommendations on future developments. The research project was designed to identify patient needs and preferences for care to inform the deliberations of the Working Group. In addition, it also aimed to identify relative priorities and satisfaction with general and specific aspects of service.

A report on the findings from the focus group aspect of the project is set out in Appendix A. This report concentrates primarily on the quantitative (questionnaire) results. Where appropriate, reference is also made to the focus group findings [i].

It is recognised that using a combination of research methods to evaluate patient satisfaction yields a more unbiased and comprehensive result[2]. Questionnaires allow views of a larger, more comprehensive sample of patients to be ascertained. They capture meaningful data and encourage candid responses[3]. They can be subjected to more rigorous analysis than focus groups, for example adding statistical validity to the results obtained. In addition, questionnaires permit the relative importance of service elements to be defined more comprehensively, a specific requirement for this project. First hand experience has confirmed that questionnaires allow also for a more sophisticated analysis of patients' priorities and satisfaction levels based on variables such as region, age, gender, public/private status etc[4,5,6]. Patients are not required to travel in order to complete a questionnaire, a factor which might dissuade some from participating in a focus group session for example.

The qualitative results from the focus groups served to identify areas of importance from a patient's perspective and to an extent attributed importance ratings to a number of service dimensions. In addition, patient satisfaction with current service provision was explored by asking patients to select the "best and worst" aspects of the service they received. Suggestions for service improvements were also sought at the focus groups. Questionnaire content was informed by the focus group sessions. A copy of the questionnaire is included in Appendix B.

[i] Although a small focus group was held with palliative patients (n=5), the number of palliative patients identified for participation in the questionnaire aspect was small (n=6) and consequently the number of respondents in this group was too small to provide reliable results for this group (n=4). It is advisable to refer to the focus group findings for this particular group to determine needs, priorities and recommendations for future service developments.

2. Methodology

The researchers chose 19 aspects of radiotherapy service/care to determine consumers' relative priorities for care and satisfaction with these identified priorities. The aspects of service were guided by the literature in the field, on patient satisfaction with healthcare services in general[4,5,6,7] and cancer and radiotherapy services in particular, where available[8,9,10,11]. The specific requirements of the Expert Working Group and previous practical experience of the research partnership was also taken into account[4,5,6]. In addition, prior to distribution, the researchers circulated the questionnaire to stakeholders and researchers in the Department of Health and Children and on the steering committee for the project and modified content and layout accordingly.

It was noted that information on patient needs, priorities and satisfaction with cancer and radiotherapy services was limited and in this regard the research undertaken in the Irish context was a first.

Criteria for inclusion in either phase of the project were:

- age over 18 years
- all major cancer groups to be represented
- first course of radiotherapy completed approximately three months prior to the commencement of the study.

A random sample of male and female patients fulfilling the above criteria was eligible to participate in the study.

Following chart selection, each attending consultant sent out a personalised, standard letter inviting eligible patients to participate in the study. Patients were given the option to participate in a focus group, complete a questionnaire, both or neither. The questionnaire was distributed by post to 149 male and female patients nationally who had given written consent. Of these, 87 were patients from Cork University Hospital (CUH) and 62 were from St Luke's Hospital. The questionnaire was accompanied by a letter of instruction, specifying a due date for completion and a stamped addressed envelope for ease of return to a neutral location. Questionnaires were coded to allow follow up letters to be sent to those who had not returned questionnaires by the due date.

Patients were asked a number of questions to measure their perceptions and experience of the radiotherapy service in general and to determine satisfaction ratings with a number of specific aspects of service. In addition, patients were asked to make recommendations regarding future service developments.

In some questions, a ten-point Likert scale was employed to measure importance and satisfaction with aspects of service. Respondents were asked to rate the importance of each of 19 different aspects of the radiotherapy service on a scale of 1 to 10 where a rating of 1 was considered "Not Important At All", and 10 "Very Important". For the report, these ratings were pooled further into rankings of 1-4, which were considered not important, 5-6 of moderate importance, 7-10 important and 9-10 as very important. A similar approach was adopted in relation to satisfaction ratings, with a score of 1-4 reflecting a low level of satisfaction, 5-6 moderate satisfaction, 7-10 satisfaction and 9-10 high satisfaction. A separate question asked for patients to select the top three aspects of service from a number of listed alternatives or from their personal perspectives/experiences.

3. Results

112 questionnaires were returned (overall response rate 75 per cent) and analysed using the SPSS programme[12]. Response rates from CUH and St Luke's Hospital patients were 77 per cent and 73 per cent respectively.

The results from the questionnaire are provided in the following pages. They are also compared and contrasted with the findings from the focus groups. General findings e.g. demographic profile, are provided first followed by results on significant aspects of radiotherapy treatment and care. All tables not included in the text are provided in Appendix C.

3.1 Demographic information

In general the sample of respondents was representative of radiotherapy service users nationally. However, only 19 of the 26 counties are represented in the sample (Table C1). The biggest representation came from Cork (36 per cent), followed by Dublin (15 per cent) and Kerry (9 per cent). Postal areas 8, 10 and 12 accounted for almost half (49 per cent) the Dublin respondents (Table C2). There was poor representation, i.e. one respondent, from seven other counties, though hospital records suggest a significantly higher number of patients eligible to participate. The seven counties not represented are Carlow, Westmeath, Longford, Galway, Roscommon, Cavan and Monaghan. These fall within the general catchment area of St Luke's Hospital. Some consultants at this hospital decided not to invite participation in the study because of (a) pressure of work or (b) they did not agree with the study format.

One eighth of respondents (13 per cent) were aged between 18 and 45, more than one-third (36 per cent) between 45 and 59, and 45 per cent between 60 and 75. Less than one twelfth (7 per cent) were aged 75 or over (Table C3).

Almost 60 per cent of respondents were female and 40 per cent male (Table C4). Just over half (52 per cent) were public patients, and 45 per cent were private (Table C5).

Thirteen per cent of respondents described themselves as "Retired" (Table C6); by far the most common occupation was that of "Homemaker" (21 per cent). Less than half (46 per cent) answered about partner's occupation (Table C7); again, "Homemaker" was most common at 13 per cent, while 3 per cent were "Retired".

Thirty-seven of the 48 people (77 per cent) who took part in the focus groups also answered the questionnaire (Table C8). This suggests a considerable interest and desire to contribute to the future development of radiotherapy services, and also a consistency of views across both forms of enquiry.

Over two thirds of patients (68 per cent) were outpatients, one sixth (17 per cent) were inpatients while one eighth (13 per cent) were both inpatients and outpatients (Table C9).

3.2 Experiences of radiotherapy service and treatment

3.2.1 General responses to aspects of service

In the analysis, overall satisfaction was measured by combining "excellent" and "very good" scores. Almost all respondents (97 per cent) were satisfied with the overall radiotherapy service they received, with 82 per cent rating the service as "Excellent" and a further 15 per cent rating the service as "Very Good" (Table C10). Of respondents from CUH and St Luke's 100 per cent and 93 per cent respectively were satisfied with the service overall. Less than 1 per cent ranked the service as "Moderately Good"; none described it as "Poor" or "Very Poor". Similarly, 97 per cent were satisfied with the professional care they received, with 87 per cent rating it as "Excellent" and a further 10 per cent as "Very Good" (Table C11). Facilities got somewhat lower satisfaction scores (73 per cent satisfaction rating overall; 45 per cent rating facilities as "Excellent" and 28 per cent as "Very Good"). In addition, 21 per cent rated facilities as "Moderately Good" and 5 per cent as "Poor" (Table C12). Of respondents attending CUH, 63 per cent were satisfied with facilities compared with 87 per cent from St Luke's Hospital.

3.2.2 Waiting time from diagnosis to radiotherapy treatment

One twentieth of respondents[ii] (5 per cent) reported being seen by the radiotherapy service within one week of referral for radiotherapy treatment. Over one third (36 per cent) reported they were seen from one to four weeks later, a further 36 per cent reported waiting for four to eight weeks, while one fifth (21 per cent) reported waiting for more than eight weeks to be seen by the radiotherapy service (Table C13).

While waiting to begin radiotherapy treatment, 55 per cent of respondents (n=94) experienced uncertainty as to when treatment would begin. Others reported delays in getting a date for treatment (29 per cent), having a treatment date cancelled (5 per cent), being unable to get information from the hospital (4 per cent) and 6 per cent experienced difficulty arranging transport for their treatment (Table C14).

3.2.3 Travel

Almost four fifths of respondents (79 per cent) travelled daily for their treatment, a further 10 per cent travelled twice weekly and 5 per cent once weekly (Table C15). The most common range of distance travelled by outpatients for their treatment (one-way) was 0-10 miles (44 per cent of respondents), next was 31-60 miles (20 per cent), followed by 11-30 miles (16 per cent), and 61-100 miles (14 per cent). Less than 3 per cent travelled more than 100 miles (Table C16). Reflecting this, the most common range of travelling times for the one-way journey was less than 30 minutes (35 per cent of respondents), followed by about one hour (29 per cent), then one to two hours (22 per cent). About 13 per cent spent two hours or more on the journey (Table C17).

Typically, less than one twelfth (7 per cent) of respondents – inpatients and outpatients – used health board or hospital transport to get to radiotherapy treatment (Table C18a-18d). Travel by car was most popular (70 per cent), followed by bus or train (16 per cent) or taxis (7 per cent).

Sixty-one respondents (55 per cent of total) were accompanied by a relative or friend. Of those, 28 had to take time off work for the journey (Table C18h-18i).

As far as accommodation was concerned, 25 respondents (22 per cent of total) had to stay over because of the distance travelled (Table C18e-18g). Of these, seventeen stayed in the hospital or hospital hostel, while seven stayed with relatives or friends or in a Bed and Breakfast.

[ii] Unless specified "respondents" refers to the total sample of 112 patients. In this case 94 patients replied to the question.
[iii] The referral source was unspecified in the questionnaire and includes GP, surgeon or physician.

While respondents made some suggestions about assistance with transport, most said they typically had no difficulties travelling for radiotherapy treatment (Table C19). A minority (n=12) suggested that the availability of hostel facilities might help make the experience or radiotherapy treatment easier for them (Table C19), a few others (n=4) identified accommodation as the best aspect of the whole radiotherapy service experience (Table C20). This finding is supported by findings at a number of focus groups where existing hostel facilities were commended.

3.2.4 Most important aspects of the radiotherapy service

Patients ranked **"Receiving the highest level of professional care"** as the most important aspect of the service for them (see Table 1). **"Staff inspires confidence"**, **"Sympathetic approach of staff towards patients"** and **"Friendliness of staff"** ranked second and joint third respectively. **"Being given information about my condition"** ranked joint fifth with **"Waiting time from diagnosis to radiotherapy treatment"**, while various aspects of communication with health care professionals ranked from seventh to tenth in importance. Other aspects of the service received a lower importance ranking, including **"Distance to travel"** ranked thirteenth, and **"Availability of clinical support services in hospital and in the community"**.

These responses are confirmed by the findings in Table C25, where patients were asked to select the three most important aspects of service. The most frequently selected first and second choices for this question were **"Receiving the highest level of professional care"**, followed by **"Being given information about my condition"**.

3.2.5 Most satisfactory aspects of the radiotherapy service

Respondents were asked to rate their satisfaction with the same 19 aspects of service using the Likert scale approach. The results are presented in Tables C26-28. Respondents ranked "Friendliness of staff" and "Staff inspires confidence" as the most satisfactory aspects of service. These findings concur with focus group results, where staff were unanimously singled out for praise. These aspects were followed closely by "Receiving the highest level of professional care" and "Sympathetic approach of staff to patients". "Being looked after by a team who know me" ranked fifth. "Waiting time for radiotherapy treatment in hospital" ranked sixth. Various aspects of Communication with healthcare professionals also ranked seventh to tenth in importance.

3.2.6 Satisfaction with important aspects of service

The satisfaction ratings with the most important aspects of service are detailed in Table 1 below

Table 1: Respondents' ranking of importance and satisfaction with aspects of radiotherapy service (National results)

Aspect of service	Importance Ranking (1-10)	Percentage rating as Very Important	Satisfaction Ranking (1-10)	Percentage Rating as Very Satisfactory
Receiving the highest level of professional care	1	95	3	89
Staff inspire confidence	2	90	2	90
Sympathetic approach of staff to patients	3	86	4	87
Friendliness of staff	3	86	1	94
Being given information about my condition	5	81	11	54
Waiting time from diagnosis to radiotherapy treatment	6	80	17	41
Communication with my radiotherapy doctor	7	78	9	57
Enough consultation time with my radiotherapy doctor	8	74	8	61
Communication between hospital cancer services and your GP	9	68	13	43
Communication between hospital staff about patients	10	66	10	56

Importance and satisfaction percentages were obtained in each case by combining responses 9 and 10 on the Likert scale.

In addition, the mean importance and satisfaction ratings were used to further compare patient opinions. These are shown in Table 2. Although satisfaction ratings concurred with importance ratings for some aspects of service, for others there were significant differences.

Table 2: Mean importance and satisfaction ratings for aspects of service

Aspect of service	Mean importance	Mean satisfactory rating
Receiving the highest level of professional care	9.8	9.6
Staff inspire confidence	9.6	9.6
Sympathetic approach of staff etc	9.5	9.5
Friendliness of staff	9.5	9.8
Being given information about my condition*($p<0.001$)	9.2	8.1
Waiting time from diagnosis to radiotherapy treatment* ($p<0.001$)	9.2	7.1
Communication with my radiotherapy doctor*($p=0.001$)	9.1	8.3
Enough consultation time with my radiotherapy doctor* ($p=0.005$)	9.0	8.3
Communication between hospital staff about patients	8.7	8.2
Communication between hospital cancer services and the GP * $p < 0.001$	8.6	7.0

**Denotes statistical significance between importance and satisfaction ratings*

In general, satisfaction ratings were lower than importance ratings, i.e. the importance respondents attribute to certain aspects of service are not matched by their satisfaction with those aspects. **"Waiting time from diagnosis to radiotherapy treatment"** received significantly lower satisfaction versus importance ratings amongst survey respondents. In focus groups, this aspect of care was also given high priority. A number of aspects of communication also scored lower satisfaction compared with importance ratings as indicated in Table 2 above. Communication ranked of high importance in focus group findings, where inadequate communications at a number of levels as well as lack of information about one's condition were listed as some of the worst aspects of service.

Of respondents, 64 per cent reported that typically they had no difficulties travelling for radiotherapy treatment. However, distance to travel for radiotherapy treatment was of some importance to respondents (ranked thirteenth of 19 aspects of service, rating 8.2) and scored significantly lower satisfaction ratings (rating 6.8). Of the sample of respondents, 25 per cent rated this dimension as not satisfactory (1-4 rating on the Likert scale).

3.3 Differences between regions

For the purpose of identifying any significant variations in importance and satisfaction with aspects of service between different areas of the country, the questionnaires were divided into five broad regions, the South/South East region, comprising patients (n = 56) from the Southern Health Board (SHB) and South Eastern Health Board (SEHB) counties; the Western Seaboard Group (WSG), with respondents from the Mid-Western (MWHB), Western (WHB) and North Western (NWHB) Health Boards (n = 22); the Eastern Regional Health Authority (ERHA) region (n = 20), the Midland Health Board (MHB) region (n = 4), and the North Eastern Health Board (NEHB) (n=3)[iv].

Table 3 shows the distribution of respondents by county.

Table 3: County of residence of respondents

County	Number	Percent
Clare	6	5.4
Limerick	7	6.3
Mayo	1	0.9
Donegal	4	3.6
Leitrim	1	0.9
Sligo	3	2.7
Cork	40	35.7
Kerry	10	8.9
Kilkenny	1	0.9
Waterford	4	3.6
Wexford	1	0.9
Dublin	17	15.2
Kildare	2	1.8
Wicklow	1	0.9
Laois	1	0.9
Offaly	3	2.7
Louth	2	1.8
Meath	1	0.9
Tipperary	4	3.6
Not recorded accurately	2	1.8
Deceased	1	0.9
Total	***112***	***100.0***

[iv] These figures do not include 4 patients from Tipperary who could belong to either the MWHB or the SEHB, one recorded as deceased, and two who recorded their county of origin in error, as "Ireland". The sample size for the MHB and NEHB was insufficient for meaningful analysis.

The report has concentrated for the most part on those aspects of service ranked 1-10 in importance by respondents – see Table 4 below. Statistically significant differences between importance and satisfaction at the 0.01 level are highlighted in bold in all cases. In Appendix D importance and satisfaction ratings for all 19 aspects of service for each of the three regions are compared.

Table 4: Comparing mean importance and satisfaction ratings between regions. Figures in brackets refer to rankings

Aspects of Sevice	WSG		SHB/SEHB		ERHA	
	Imp.	Sat.	Imp.	Sat.	Imp.	Sat.
Staff inspire confidence	9.7 (1)	9.8 (2)	9.8 (2)	9.7 (3)	9.5 (5)	9.3 (4)
Highest level of professional care	9.6 (2)	9.5 (3)	9.8 (1)	9.7 (1)	10.0 (1)	9.4 (2)
Being given information about my condition	9.5 (3)	8.2 (9)	9.0 (6) (p=0.003)	7.9* (10)	9.5 (5)	8.1 (9)
Friendliness of staff	9.5 (4)	9.8 (1)	9.4 (4)	9.7 (1)	9.8 (3)	9.6 (1)
Waiting time from diagnosis to radiotherapy treatment* p≤ 0.001	9.4 (5)	6.7 (12)	9.2 (5)	7.6 (13)	9.6 (4)	6.9 (17)
Sympathetic approach of staff	9.4 (6)	9.4 (4)	9.4 (3)	9.6 (4)	10.0 (2)	9.4 (2)
Communication between hospital staff about patients	9.4 (7)	8.5 (8)	8.5 (11)	7.9 (12)	8.5 (13)	8.3 (8)
Enough consultation time with my radiotherapy doctor	9.3 (8)	8.6 (6)	8.8 (8)	8.1 (7)	9.2 (8)	8.6 (7)
Communication with my radiotherapy doctor	9.2 (9)	8.7 (5)	8.9 (7)	8.0 (8)	9.3 (7)	8.7 (6)
Being looked after by a team that knows me	9.2 (9)	8.6 (6)	7.8 (14)	9.0 (6)	8.6 (11)	9.0 (5)
Communication between hospital cancer services and GP	8.6 (12)	6.7 (14)	8.7 (9) (p < 0.001)	7.0 * (15)	8.1 (16)	7.4 (16)
Waiting time for radiotherapy treatment in hospital	7.7 (17)	8.0 (10)	8.6 (10)	9.1 (5)	9.0 (9)	7.9 (13)
Continuing contact/support with the hospital after treatment*	8.1 (16) (p=0.004)*	5.4* (16)	7.6 (15) (p=0.004)*	6.2*(17)	8.7 (10)	8.1 (11)

*Denotes statistical significance between importance and satisfaction ratings

As Table 4 above shows, the most important aspects of service are very similar across all three regions.

Only one aspect of care, **"Waiting time from diagnosis to treatment"** scored significantly lower satisfaction rankings compared with importance ratings across all three regions. Region-specific differences were also recorded, for example, **"Continuing contact/support with the hospital after treatment"** scored lower satisfaction compared with importance ratings across two regions, the WSG and the SHB/SEHB. **"Being given information about my condition"** and **"Communication between hospital cancer services and the GP"** scored significantly lower satisfaction compared with importance ratings amongst respondents from the SHB/SEHB region alone.

All 19 aspects of service were analysed using One Way Analysis of Variance (ANOVA). The issue of **"Distance to travel for radiotherapy treatment"** is of particular interest in this report. In the ANOVA analysis, satisfaction with **"Distance to travel for radiotherapy treatment"** emerged as significantly lower for the WSG compared with ERHA and SHB/SEHB groups respectively. Satisfaction ratings with four particular aspects of service that might be linked to distance to travel were examined in detail (see Table 5). The aspects of service were:

- Communication between hospital cancer services and your GP
- Waiting time from diagnosis to radiotherapy treatment
- Waiting time for radiotherapy treatment in the hospital
- Continuing contact/support with the hospital after treatment.

Satisfaction ratings for "Waiting time for radiotherapy treatment in the hospital", were significantly higher for the SHB/SEHB group than for the ERHA and WSG groups (p=0.039). It is noteworthy that the ERHA was the only region where satisfaction ranked lower than importance for this aspect of service; in the other two regions, satisfaction ratings exceeded importance ratings. Satisfaction ratings for **"Continuing contact/support with the hospital after treatment**" were significantly higher for the ERHA group (p=0.036), while satisfaction for this aspect of service was lowest with the WSG. No regional differences in satisfaction ratings were recorded for the remaining aspects of service rated in the questionnaire. This suggests that the observed regional differences mentioned above were the result of geographical factors and not chance recordings.

Table 5: One Way Analysis of Variance (ANOVA) of four aspects of service that might be linked to distance to travel

Aspect of service	Average rating by region (Number of responeses in brackets)			Regional difference?	P value
	ERHA	SHB/SEHB	WSG		P
Communication between hospital cancer services and your general practitioner	7.44 (18)	7.04 (48)	6.70 (20)	No	0.765
Waiting time from diagnosis to radiotherapy treatment	6.89 (18)	7.56 (48)	6.71 (21)	No	0.449
Waiting time for radiotherapy treatment in the hospital	7.89 (19)	9.13 (48)	7.95 (21)	Yes	0.039
Continuing contact/ support with the hospital after treatment	8.11 (19)	6.23 (48)	5.38 (21)	Yes	0.036

3.4 Differences within regions

3.4.1 The Western Seaboard Group (WSG) data

Patients in the Western Seaboard Group ranked **"Staff inspire confidence"** as the most important aspect of care (Table 6). **"Receiving the highest level of professional care"** was the next most important aspect followed by **"Being given information about my condition"** and **"Friendliness of staff"** in joint third place. **"Waiting time from diagnosis to radiotherapy treatment"** was next, followed by **"Sympathetic approach of staff"**. The next three elements concerned **"Communication between hospital staff about patients"**, having **"enough consultation time with my radiotherapy doctor"** and **"Communication with my radiotherapy doctor"**. **"Being looked after by a team who know me"** was also important.

Comparing satisfaction ratings for these identified important elements of service revealed some interesting findings. Specifically, **"Being given information about my condition"** ranked as the third most important aspect of care with the WSG (mean 9.5) yet mean satisfaction scores were lower at 8.2 (ranked ninth). **"Waiting time from diagnosis to radiotherapy treatment"** ranked fifth in importance (mean 9.4) yet ranked only twelfth in satisfaction (mean 6.7; results statistically significant). Lower satisfaction scores were recorded for **"Communication between hospital staff about patients" "Communication with my radiotherapy doctor"** and having **"enough consultation time with the radiotherapy doctor"** and **"Being looked after by a team who knows me"** (results not statistically significant).

"Distance to travel for radiotherapy treatment" did not receive a top ten importance ranking from respondents in the WSG group – 59 per cent rated it as very important (ranked joint fifteenth, mean 8.3). However, only 19 per cent ranked this aspect of service as very satisfactory (mean 4.2) and satisfaction rated significantly lower than importance (result statistically significant). Five other aspects of service had significantly lower satisfaction as compared with importance ratings (though none belonged to the ten most important aspects). They were **"Receiving all my treatment in one site", "Availability of support services in the community for me", "Continuing contact/support with the hospital after treatment"** and **"Availability of support services in the community for my family".**

Table 6: Mean satisfaction ratings for important aspects of service within the WSG

Aspect of Care	Mean Importance Rating (max. 10)	Importance Ranking (1-10)	Mean Satisfaction Rating (max. 10)	Satisfaction Ranking (1-10)
Staff inspire confidence	9.7	1	9.8	2
Receiving the highest level of professional care	9.6	2	9.5	3
Being given information about my condition	9.5	3	8.2	9
Friendliness of staff	9.5	3	9.8	1
Waiting time from diagnosis to radiotherapy treatment* (P=0.001)	9.4	5	6.7	12
Sympathetic approach of staff to patients	9.4	5	9.4	4
Communication between hospital staff about patients	9.4	5	8.5	8
Enough consultation time with my radiotherapy doctor	9.3	8	8.6	6
Communication with my radiotherapy doctor	9.2	9	8.7	5
Being looked after by a team who knows me	9.2	9	8.6	6

*Denotes statistical significance between importance and satisfaction ratings

In the WSG, 8 respondents attended CUH and 14 St Luke's.
Sample sizes are small and the findings should be interpreted in that light.

3.4.2 SHB/SEHB data:

As Table 7 shows, there were statistically significantly lower satisfaction ratings compared with importance rankings for three of the ten most important aspects of service. These were **"Waiting time from diagnosis to radiotherapy treatment"**, (fifth in importance and thirteenth in satisfaction), **"Being given information about my condition"**, (sixth and tenth respectively) and **"Communication between hospital cancer services and your GP"** (ninth and fifteenth). Other aspects of service outside the top ten rankings showed significantly lower satisfaction compared with importance ratings also – see Appendix D. These were **"Continuing contact/support with the hospital after treatment"**, **"Availability of support services in the community for me"**, and ***"Availability of support services in the community for my family"***.

Table 7: Mean satisfaction ratings for important aspects of service within the SHB/SEHB region.

Aspect of Care	Mean Importance Rating (max. 10)	Importance Ranking (1-10)	Mean Satisfaction Rating (max. 10)	Satisfaction Ranking (1-10)
Receiving the highest level of professional care	9.8	1	9.7	1
Staff inspire confidence	9.8	2	9.7	3
Sympathetic approach of staff to patients	9.4	3	9.6	4
Friendliness of staff	9.4	4	9.7	1
Waiting time from diagnosis to radiotherapy treatment* ($p<0.001$)	9.2	5	7.6	13
Being given information about my condition* ($p=0.003$)	9.0	6	7.9	10
Communication with my radiotherapy doctor	8.9	7	8.1	8
Enough consultation time with my radiotherapy doctor	8.8	8	8.1	7
Communication between hospital cancer services and my GP* ($p<0.001$)	8.7	9	7.0	15
Waiting time for radiotherapy treatment in hospital	8.6	10	7.9	5

* Denotes statistical significance between importance and satisfaction ratings.

In the SHB/SEHB region, 54 respondents attended CUH and two St Luke's. Sample sizes are small and the findings should be interpreted in that light

3.4.3 ERHA data:

The top ten aspects of service for ERHA respondents are detailed in Table 8 below. Only one aspect had significantly lower satisfaction rating compared with importance rankings, i.e. **"Waiting time from diagnosis to radiotherapy treatment"**, ranked forth in importance and seventeenth in satisfaction. Although not statistically significant, there was also a notable difference in importance ranking and satisfaction ratings for **"Waiting time for radiotherapy treatment in hospital"** (ninth and thirteenth respectively).

Table 8: Mean satisfaction ratings for important aspects of service in the ERHA region

Aspect of Care	Mean Importance Rating (max. 10)	Importance Ranking (1-10)	Mean Satisfaction Rating (max. 10)	Satisfaction Ranking (1-10)
Receiving the highest level of professional care	10.0	1	9.4	2
Sympathetic approach of staff to patients	10.0	2	9.4	2
Friendliness of staff	9.8	3	9.6	1
Waiting time from diagnosis to radiotherapy treatment* (p = .001)	9.6	4	6.9	17
Being given information about my condition	9.5	5 (joint)	8.1	9
Staff inspire confidence	9.5	5 (joint)	9.3	4
Communication with my radiotherapy doctor	9.3	7	8.7	6
Enough consultation time with my radiotherapy doctor	9.2	8	8.6	7
Waiting time for radiotherapy treatment in hospital	9.0	9	7.9	13
Continuing contact/support with the hospital after treatment	8.7	10	8.1	11

* Denotes statistical significance between importance and satisfaction ratings.

In the ERHA, all 20 respondents attended St Luke's.
Sample sizes are small and the findings should be interpreted in that light

4. Discussion

Overall, Irish patients ranked **"Receiving the highest standard of professional care"** and **"Staff inspire confidence"** as the most important aspects of the radiotherapy service. **"Sympathetic approach of staff towards patients"** and **"Friendliness of staff"** also ranked as highly important. Satisfaction with these aspects of service was high. These findings concur with those from a number of other studies, that reported that Irish cancer patients and their relatives identified the care they received as important[13]. Doctors' technical competence was reported to be important to Australian cancer patients[14] and in a United Kingdom national study, cancer patients were reported to want optimal anti-cancer treatment[15].

Other important aspects of service identified in both quantitative and qualitative aspects of our research include the **interpersonal** and **communication skills** of healthcare professionals, including radiotherapy doctors, and **"Being given information about one's illness"**. Satisfaction with these aspects of service was significantly lower. For example, 81 per cent of respondents identified **"Being given information about my condition"** as very important yet only 54 per cent reported high satisfaction with this aspect of care. Similarly 78 per cent rate "Communication with my radiotherapy doctor" as very important with only 57 per cent being highly satisfied. Interpersonal aspects of service have been identified as important by a number of other researchers including a study evaluating hospital care in a radiotherapy unit in northern Italy which identified the "relationship between medical and nursing staff and patients" and "continuity of physician care" as priorities[16]. Irish and Australian cancer patients cited "communication with health professionals", "communication of the diagnosis" specifically and "being given an opportunity for discussion with the doctor" as important aspects of service[13,14]. Others concur that "clearly informing patients about their disease, treatment options and side effects of treatment" are important[17]. A number of other studies refer to the desire for patients to be more involved in decisions about their care[18,19]. Others go as far as to suggest that patient satisfaction with healthcare is directly linked to whether expectations of information received from doctors are fulfilled[20].

"Waiting time from diagnosis to radiotherapy treatment" was identified as important in both questionnaire and focus group aspects of our survey. In the questionnaire, it ranked sixth in importance. A marked difference was recorded between importance and satisfaction ratings for this aspect of service ($p<0.001$). Specifically, 80 per cent of respondents identified this aspect of service as very important while only 41 per cent were highly satisfied. This finding may well reflect the actual lapse of time between diagnosis and treatment; however, other factors may also be at play. These include a misperception of the actual time elapsed due to the severity of the illness and the high anxiety accompanying it; poor communication at a number of levels e.g. between GPs and patients, between GPs and hospitals or between hospitals and patients directly. Other difficulties with communications in this area were reported by respondents in our survey. These included; **"Uncertainty as to when treatment would begin, delays in getting a date for treatment, dates being cancelled, inability to get information from the hospital and difficulties arranging transport for treatment"** (Table C14). Furthermore, our survey noted a marked difference between importance and satisfaction for **"Communication between hospital cancer services and the GP"** (68 per cent and 43 per cent respectively). In another study, speed of referral to a specialist for treatment was identified as a priority by cancer patients[21]. A large-scale national United Kingdom study, noted the key role GPs played in quickly diagnosing cancer and referring patients for treatment[15]. Further exploration is required to clarify the basis for the difference in importance and satisfaction ratings relating to **"Waiting time from diagnosis to radiotherapy treatment"**. The other difficulties in communication highlighted in the survey suggest that there is scope for improving communication with patients at the pre-radiotherapy treatment stage and speeding up appointment notification.

Of respondents, 63 per cent rated the issue of **"Distance to travel for treatment"** as very important compared with 46 per cent who rated it as highly satisfactory. This aspect of service ranked thirteenth in importance for respondents overall. Where this finding is concerned, it is important to bear in mind that only 19 of the country's 26 counties are represented in the sample, with the largest representation from counties Cork (36 per cent) and Dublin (15 per cent). There was a very poor response from seven counties (one person) and a further seven counties were not represented in the sample[v] although hospital records indicate a number of patients from these counties received radiotherapy treatment. In fact, 64 per cent of respondents travelled between 0 and 60 miles one-way for treatment, with the biggest percentage (44 per cent) travelling only 0-10 miles one-way. Given that patients from these **"under-represented"** counties are likely to travel longer distances to radiotherapy treatment centres than their urban counterparts, it is reasonable to assume that a greater proportion of them would express dissatisfaction with this aspect of service.

Previous research had identified **"long journeys to OPD"** as an important aspect of care for Irish cancer patients[13]. Research has identified the importance of public transport to the radiotherapy service (especially for elderly and female patients)[16]. In our survey, 16 per cent travelled by bus/train, with the majority (70 per cent) travelling by car for radiotherapy treatment. Others suggest the physical proximity of service is more important to patients than transport to the service[14]. In our survey, patients' suggestions for service improvements included **more units/units nearer home** (40 mentions in a free-text question, Table C30). This finding is supported by focus group results. **"Receiving the highest level of professional care"** was of paramount importance to respondents in both questionnaires and focus groups; reconciling this with any planned service expansion would be essential.

In the *regional analysis*, it was found that at least seven of the top ten most important aspects of service were shared by all three regions. **"Waiting time from diagnosis to radiotherapy treatment"** scored significantly lower satisfaction compared with importance ratings in all three regions, suggesting that this is a national, rather than a regional, issue (results statistically significant; $p \leq 0.001$).

There were also region-specific differences, suggesting that respondents in different regions have different perceptions and/or expectations of the radiotherapy service, or that there are real differences in service between regions. "Distance to travel for treatment" scored significantly lower satisfaction scores amongst WSG respondents than in the ERHA and SHB/SEHB groups. Interestingly, all three regions attributed a similar importance ranking to this aspect of care. In addition to the distance itself, this finding could also reflect differences in road conditions, availability of acceptable transport or differences in availability of "outreach" radiotherapy services in the WSG area.

In the SHB/SEHB region two aspects of service **"Being given information about my condition"** and **"Communication between the hospital and my GP"** scored significantly lower satisfaction compared with importance ratings ($p=0.003$).

"Continuing contact/support with the hospital after treatment" scored significantly lower satisfaction compared with importance ratings in the WSG and the SHB/SEHB. This may be due to the relative proximity of the service to most ERHA respondents, or differences in the availability of "after-care" services provided by statutory or voluntary agencies in the different regions.

"Waiting time from diagnosis to radiotherapy treatment" was the only aspect of service with significantly lower satisfaction compared with importance ratings in the ERHA region. This suggests that, with this notable exception, there is no significant gap between respondents' expectations and the service they receive in the ERHA. This may be because of the high level of service, or the modest expectations of respondents.

[v] No representatives from Carlow, Westmeath, Longford, Galway, Roscommon, Cavan and Monaghan

5. Conclusions/Recommendations

Patients had no difficulty identifying priorities and preferences for radiotherapy care. **"Receiving the highest level of professional care"** was identified as a significant priority in both focus group and questionnaire responses. Patients appear to appreciate the importance of high quality care to favourable outcome. In general, satisfaction with the overall radiotherapy service and the level of professional care received was high. Further analysis revealed areas for improvement.

Waiting times from diagnosis to radiotherapy treatment warrants analysis to clarify the situation. If delays are confirmed, guidelines for waiting times in keeping with best practice should be instituted, together with performance measures to ensure compliance.

In the area of communication, a number of areas for improvement were identified. Strategies to improve team cohesion are recommended. Enhancing communication skills between clinicians and patients is also advocated. Adequate time for consultation with the radiotherapy doctor is advised. This might require additional staff at clinics, or service reorientation. Improvements in communication between hospitals and GPs, are recommended. These recommendations in the area of communication are especially relevant for the SHB/SEHB region.

Continuing contact/support with the hospital after treatment needs particular attention in the WSG and SHB/SEHB groups.

Any measures that might make travelling for treatment easier should be considered. In the short term, arrangements should be reviewed for patients who have to wait for others availing of health board/hospital transport to identify areas for immediate attention. We would also recommend implementing a more patient-centred health board/hospital transport system and better co-ordination between public transport timetables and appointment times for treatment.

Maximising the use of outreach clinics for diagnosis and follow-up would help cut down unnecessary additional travel for patients.

Satisfaction with current hostel facilities is high; if planning additional hostel facilities, the existing facilities provide a useful benchmark for development.

Appendix A

Report of findings from focus groups

Summary

This is the draft report of the findings from the focus groups of radiotherapy service users, held between October and December 2001. It is the first part of a comprehensive evaluation of the views of radiotherapy service users, and will be augmented by the results of a questionnaire designed to obtain the perceptions of service users.

The research aimed to determine the preferences and priorities of radiotherapy service users in Ireland. The focus groups represent the first and qualitative phase of the study.

A random sample of male and female patients over 18 years, representing all major cancer groups who had completed their first course of radiotherapy approximately three months prior to the focus group sessions was eligible to participate in the study. Following chart selection, each attending consultant sent out a letter inviting suitable patients to participate in the study. Patients who gave consent were contacted by phone to arrange the focus group sessions and details of the forthcoming focus groups were confirmed in writing.

Seven focus groups in total were held with past radiotherapy service users of the two radiotherapy centres in Dublin and Cork. Each group comprised five to ten participants, with a total of 48 participants in all. In the focus groups, patients were prompted specifically to:

(1) Discuss the best and worst aspects of the radiotherapy service
(2) Arrange service dimensions in a hierarchy of importance
(3) Make recommendations on future radiotherapy services.

The tape-recorded and written notes from the focus group sessions were analysed in order to tease out themes, patterns and categories. Concepts were categorised and supported by anecdotal evidence using language used by the participants.

Priorities for care identified included; "Highest level of professional care", "Getting information about my illness", "Communication", "Distance to travel for radiotherapy treatment", "Waiting time from diagnosis to radiotherapy treatment", and "Support services for me and my family".

A significant majority at all focus groups singled out **"hospital staff"** for commendation – "staff in general were fantastic". A significant number from three focus groups preferred **being treated with others with a similar illness** as they felt this acted as a bond. Another group liked the "getting to know " aspect while waiting for treatment in hospital as one would often meet the same patients again. **The hostel** facility was praised at the Dublin hospital by patients who had to travel some distance for treatment. **Hospice and home care, pain relief and support groups** were singled out for praise by the palliative group. One group praised the **hospital facility** itself at St Luke's. Another thought it a positive sign that you were **getting radiotherapy treatment** as this meant you were going to "get better". A small number at one focus group felt **not having to wait for treatment in hospital** on the appointment days was one of the best aspects about the service.

The worst aspects of care included car parking, machines breaking down, communication, receiving information about illness/progress, transport and waiting in hospital for treatment.

Suggestions for service improvement included having more radiotherapy machines around the country, improving the transport situation, and the patient appointment system. Some suggested improving staffing levels, and providing a weekend service for radiotherapy; others expressed a wish for more continuity of medical care and improved support services. A number of patients made recommendations about communication/information issues. Improved maintenance and reliability of radiotherapy machines was requested.

Write up: radiotherapy focus group

1. Objective

The research aimed to determine the preferences and priorities of radiotherapy service users in Ireland. The focus groups represent the first and qualitative phase of the study. Information obtained in the focus group was further explored and quantified using a detailed postal questionnaire which was sent to a larger sample of patients.

2. Methods

A random sample of male and female patients over 18 years, representing all major cancer groups who had completed their first course of radiotherapy approximately three months prior to the focus group sessions was eligible to participate in the study. Following chart selection, each attending consultant sent out a letter inviting suitable patients to participate in the study. Patients were requested to sign the enclosed consent form indicating if they were interested in getting involved in the focus group, subsequent postal questionnaire, both focus group and questionnaire, or neither part of the project. Patients who gave consent were contacted by phone to arrange the focus group sessions and details of the forthcoming focus groups were confirmed in writing.

Seven focus groups in total were held with past radiotherapy service users of the two radiotherapy centres in Dublin and Cork. Three were held in Cork, two in Dublin, one in Limerick and one in Sligo. The focus groups were held in neutral venues (hotels), over a six-week period from the last week in October to the first week in December 2001. Each group comprised five to ten participants, with a total of 48 participants in all. Each focus group session took about one and a half hours.

The focus groups aimed to explore attitudes, priorities and experiences of radiotherapy service users. In the focus groups, patients were prompted specifically to:

(1) Discuss the best and worst aspects of the radiotherapy service
(2) Arrange service dimensions in a hierarchy of importance
(3) Make recommendations on future radiotherapy services.

Responses were recorded by two facilitators using written notes and verified by tape-recorder where appropriate. The results and information obtained from the qualitative first stage were fed into the design of the quantitative second stage i.e. detailed postal questionnaire incorporating coded/structured questions, semantic differential type questions and Likert scale measurements. This method of research using multiple research methods is known as triangulation (Dodd DJ. (1979)). This approach is deemed effective because weaknesses in one research method are compensated for by the counter-balancing strengths of the other.

3. Results

The tape-recorded and written notes from the focus group sessions were analysed in order to tease out themes, patterns and categories. An open coding process was undertaken which involves seven stages most of which were used in this process. Familiarisation with the transcripts was undertaken, followed by reflection on the ideas and concepts emerging from the data. Concrete conceptualisation followed highlighting key and recurring themes as well as minority opinions. Concepts were categorised and supported by anecdotal evidence using language used by the participants.

3.1 Priorities for care:

Priorities for care identified included; "Highest level of professional care", "Getting information about my illness", "Communication", "Distance to travel for radiotherapy treatment", "Waiting time from diagnosis to radiotherapy treatment", and "Support services for me and my family".

3.1.1 **"Highest level of professional care"**
Consensus opinion from three of the focus groups gave number one priority to getting "highest level of professional care". A significant number of patients at a fourth focus group gave this dimension top priority also. Some quotes include "could wait and endure pain if got top notch professional care", "would be prepared to travel for the highest level of professional care".

3.1.2a **"Getting information about my illness"**
Consensus opinion/majority verdict from three focus groups was that this was the top priority. A majority at two further focus groups stated this dimension was very important.

3.1.2b **"Communication with radiotherapy doctor"** was deemed important for a number at one focus group. This group also prioritised communication "between radiotherapist and GP" and "radiotherapist and CUH doctors" .

3.1.3 **"Distance to travel for radiotherapy treatment"** was very important for a majority of patients at three focus groups. Although patients at a number of the other focus groups travelled long distances, distance to travel was not highlighted as a priority by these groups.

3.1.4 **"Waiting time from diagnosis to radiotherapy treatment"**
Identified as a significantly important dimension by a consensus/majority at three focus groups and by some patients at two other sessions. Another group suggested that the real issue here was the uncertainty regarding the appointment for treatment commencement and whether the delay might affect the treatment outcome, rather than delay in commencement of treatment per se.

3.1.5 **"Support services for me and my family"**
Identified as important for a significant number of patients at three focus groups containing patients attending CUH.

3.1.6 **Facilities** e.g. availability of tea, coffee in the waiting area, décor and atmosphere in the hospital in general, activities like arts and crafts classes, were considered important for some patients at one focus group.

A number of these aspects of care concur with findings in the literature: Talamini R., et al (1991), Herity B., et al (1987), Bonnet et al (2000), Wiggers J.H., et al (1990), Bain N.S.C. & Campbell N.C., (2000), Turner et al (1996).

3.2 Best and worst aspects:

A significant majority at all focus groups singled out **"hospital staff"** for commendation – "staff in general were fantastic". A significant number from three focus groups preferred **being treated with others with a similar illness** as they felt this acted as a bond. Another group liked the "getting to know " aspect while waiting for treatment in hospital as one would often meet the same patients again. **The hostel** facility was praised at the Dublin hospital by patients who had to travel some distance for treatment. **Hospice and home care, pain relief and support groups** were singled out for praise by the palliative group. One group praised the **hospital facility** itself at St Luke's. Another thought it a positive sign that you were **getting radiotherapy treatment** as this meant you were going to "get better". A small number at one focus group felt **not having to wait for treatment in hospital** on the appointment days was one of the best aspects about the service.

The worst aspects of care included **car parking, machines breaking down, communication, receiving information about illness/progress, transport and waiting in hospital for treatment.**

3.2.1 A majority/consensus of patients at five focus groups across the two sites stated that **frequent breaking down of radiotherapy machines** was one of the worst aspects of the service.

3.2.2 **Car Parking** was voted one of the worst aspects of service by a consensus of two focus groups from CUH. Quotes include; "parking facilities appalling" (car park far away); "most stressful part of the whole treatment"; "most expensive part of my treatment".

3.2.3 **Side effects of the treatment** itself were singled out by some patients from the general group and by a significant number of the palliative group who were unwell and in pain while on chemotherapy and radiotherapy. Others mentioned the constant fatigue, which took them by surprise.

3.2.4 **Communication** was said to be lacking by a significant number of patient focus groups at CUH. This included:

- Doctor-patient communication, e.g. providing information about illness and side effects of treatment; information about progress, including obtaining test results, interpersonal communication, especially at follow-up clinics and continuity of care. One patient described that she "felt like a number" at review clinics when seen by the doctor. One felt that the doctor "did not know who you were, did not have time for you" (the junior doctors). One patient was angry that he "never saw consultant radiologist" and said, "I'm in the complete dark". A significant number of patients at a focus group from CUH stated that "seeing different members of the team was not helpful".

- Poor communication between the hospital and the GP. This made some patients feel that the GP had lost interest in them; "GP seems to lose interest in you when you go to the hospital…..never rang back…. not doing what he should be doing….very disappointed over that…..learned more about cancer on the Pat Kenny show than from my GP". This could also be due to the possibility that the GP has limited experience and expertise in cancer and cancer treatment.

- Poor hospital-to-hospital communication. This related to passing on information on test results and sharing information about patient progress.

3.2.5 Communication difficulties were also highlighted by some from the St Luke's focus groups. A majority reported that "communication in general was lacking between patients and radiotherapists" and some complained about communication with the GP and the hospital. Some thought that although staff would answer questions they were not proactive in providing information about the illness or treatment; one patient from St Luke's "preferred it that way". Communication between staff about patients seemed good at St Luke's, however. Some patients in the palliative group were not told about side effect severity or pain associated with the illness/treatment and would have preferred to be prepared.

3.2.6 **Transport and having to travel for treatment** was important to a majority of patients at three focus groups at CUH. Quotes include –"getting relatives/neighbours to drive you" "within the city are ok", "taxis expensive, buses take the long route"–"people should be compensated for their travel" – "dedicated bus would not work – taxis better". Similarly, a number of patients attending St Luke's thought that if one used hospital transport, one "went around the world" to collect everyone first. The concept of dedicated transport was good but the time taken and circuitous routes were unattractive to patients. Distance travelled was identified as one of the worst aspects of care for one focus group. Some patients living in Dublin felt sympathy for those living elsewhere and said they were "lucky to be living in Dublin".

3.2.7 **Waiting in hospital** especially as an inpatient **for treatment** was a problem for some patients at three focus groups. (The palliative group were one of the three). Patients noted that machines at St Luke's were under pressure.

3.2.8 **Noise on public wards** was a problem for some patients at one focus group from St Luke's; "there are sometimes visitors all day". They sympathised with the notion of free access for family members and friends but were sometimes "worn out" by (other people's) visitors on the ward from early in the morning until late at night.

3.2.9 **Waiting for treatment to begin** was a problem for two focus groups. Others were concerned over not knowing when treatment would begin rather than having to wait for treatment.

3.2.10 **Having to pay for treatment**

Some patients at one focus group were confused about payment for radiotherapy treatment and did not know whether or not it was covered with private health insurance. Some resented having to pay for treatment.

4. Suggestions for service improvement

4.1 Majority opinions

4.1.1 Six focus groups highlighted the importance of having **more radiotherapy machines around the country.** "Every major hospital if possible should have a radiotherapy machine"; "it's prehistoric to have just one centre in Dublin"; "another radiotherapy machine, perhaps in the centre of the country"; "the government should get its priorities right"; "people from the country should not have to travel for radiotherapy"; "cancer is serious – it will kill you".

4.1.2 Closely related to this was the recommendation that something should be done with the transport situation for radiotherapy (three focus groups). "People have to depend on family and neighbours – it can be very awkward". Suggestions for improvement included providing "first class rail tickets – to guarantee a seat and some comfort on the journey" – and the "government should pay for this". Some patients did say "it's terrible the distances people have to travel but (they) can't put machines everywhere", and "provide more local radiotherapy care" but "are aware of the staff and financial constraints". An alternative was suggested of providing places to stay for patients and relatives. More information about the availability of hostels was requested.

4.1.3 The **appointment system** could be improved further (three focus groups). Patients would appreciate advance warning of appointments being cancelled/delayed, being given slots for appointments rather than a block booking, earlier appointments for the elderly. Patients did appreciate that with the mini-bus transport system, it was difficult to allocate patients an exact appointment time but perhaps something could be done here?

4.1.4 **Staffing issues.** Three focus groups remarked that more staff was needed to operate machines. Another group remarked that the nurses in radiotherapy work "long hours 12hrs/day for two days" and that "this is too much". Another group remarked that the junior doctors running the follow-up clinic were also covering the wards. This was offered by way of explanation for the sense of urgency and poor communication sometimes experienced by patients. Some suggested improving staffing levels and providing a weekend service for radiotherapy – this would mean "patients got through the treatment quicker" – it was argued.

4.2 **The following sentiments/recommendations for improvements were made by some patients at the focus groups:**

4.2.1 A consensus at one focus group expressed a wish for more **continuity of medical care** – quotes included " better to get familiarity with one doctor and not be repeating yourself each week". Another group recommended increased "contact with the consultant radiotherapist – certainly at least once".

4.2.2 One focus group from CUH suggested more consultant-led outreach clinics in the region.

4.2.3 Some patients requested improvements in support services. Access to counselling services (including psychotherapy) was requested. Some spoke of the pain of feeling "very much alone", and wanting to say "actually, I'm falling apart" when asked how they were, but being conscious of the time pressure on the doctor. Some requested an extension of complementary therapy services e.g. reflexology, visualisation.

4.2.4 One patient remarked that some cancers are familial in nature and that doctors need to alert patients so that family members could get screened and detected early if they have cancer.

4.2.5 A number of patients at the CUH site made recommendations regarding **communication/information issues.** These include:

- providing early information regarding when radiotherapy treatment would start, explaining why there is a delay if that is the case, ensuring all staff give a coherent, consistent message regarding treatment, progress of disease, appointments etc.

- A number of patients would welcome information about what to expect when getting radiotherapy, length of treatment, continuous nature of treatment, marking process, possible side effects, what happens if machines break down. It might be appropriate for a staff member to be designated to meet first time patients to explain some of these aspects to patients.

- Regarding information about disease progession/regression and test results, it was felt that the GP could be a good source of information but "you should not have to pay £25 for the information". Some patients also wanted to be able to explain their illness and treatment to family and friends and would appreciate some help with this.

- A number of patients at some of the focus groups would recommend enhancing the communication links between service providers in the radiotherapy centre, peripheral hospitals and GPs. At one hospital, a significant number of patients recommend that junior doctors communication skills at follow-up clinics be improved.

Other research highlights the importance from a patient's perspective of the amount, content and method of delivery of information about their illness: Tuckett & Williams (1984) and that patient satisfaction with healthcare is directly linked to whether expectations of information from doctors are fulfilled: Degner & Aquino Russell (1988).

4.2.6 At both hospital sites, a number of patients recommend that the reliability of radiotherapy machines be improved (the perception was that these machines break down frequently) and are serviced at inconvenient times from a patient's perspective. In order to prevent this, some suggested that machines could be serviced at more appropriate times – evenings or weekends in order not to interrupt treatment. In addition, patients felt that machines could be used more e.g. over the weekend – one patient remarked that this could "provide 100 days additional radiotherapy treatment".

4.2.7 Some patients commented on the hospital facilities:

- Specifically, sufficient space for giving the diagnosis in private was required. A number of patients remembered vividly the day they got their diagnosis and how and where the news was broken is "printed indelibly" on their minds.

- Car parking was an issue at CUH especially. Patients here requested protected car parking spaces for radiotherapy patients attending treatment.

- Patients requested that facilities in the waiting areas for treatment and clinic be repaired/maintained on a regular basis e.g. TV, water dispensers. Some would appreciate music in the waiting areas.

- Others recommended the use of disposable gowns in the treatment areas.

- One patient in the palliative group requested a "rest time" on the wards where no visitors were allowed but another remarked that this might not suit some people.

A number of the patient recommendations are similar to those obtained in research in the United Kingdom Friend B. (1997)

5. Conclusions

The qualitative findings of the focus groups suggest which aspects of service might be important to service users and how patients rated the service they received. Suggestions for service improvement were also obtained. To validate the focus group findings, we are proceeding to the qualitative part of the study. Detailed questionnaires are being sent to patients to explore issues raised at the focus group sessions among a wider patient group. Combining research methods is deemed effective because the weaknesses in one research method are compensated for by the counter balancing strengths of the other (Dodd, 1979).

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Appendix B

Radiotherapy services questionnaire

Radiotherapy services questionnaire

1. Please tick your approximate age:
   - ☐ 18-30
   - ☐ 31-45
   - ☐ 46-59
   - ☐ 60-75
   - ☐ 75+

2. Are you:
   - ☐ Male
   - ☐ Female

3. Are you a:
   - ☐ Public Patient
   - ☐ Private Patient

4a. Please state the county you live in:

_____

4b. If your answer to question 4a was Dublin, please give your postal code/area:

_____

5a. Please state your occupation (current or past):

_____

5b. Please state your partner's occupation (if you have not worked outside the home)

_____

6. Did you take part in a focus group session for radiotherapy service users?
   - ☐ Yes
   - ☐ No

7. Were you:
   - ☐ An in-patient
   - ☐ An out-patient
   - ☐ An in-patient and out-patient

IF YOU WERE AN IN-PATIENT FOR RADIOTHERAPY
Please skip to Question 11

8. What was the approximate distance you travelled for radiotherapy treatment daily (one way trip):
   - ☐ 0-10 miles
   - ☐ 11-30 miles
   - ☐ 31-60 miles
   - ☐ 61-100 miles
   - ☐ 101-150 miles
   - ☐ 151-200 miles
   - ☐ greater than 200 miles

9. How long did the journey from home for radiotherapy treatment take typically (one way trip):
   - ☐ Less than half an hour
   - ☐ About 1 hour
   - ☐ 1-2 hours
   - ☐ 2-3 hours
   - ☐ 3-4 hours
   - ☐ 4-5 hours
   - ☐ More than 5 hours

10. How often did you make this journey from home to radiotherapy treatment over the treatment period?
    - ☐ Daily
    - ☐ Twice weekly
    - ☐ Weekly
    - ☐ Monthly
    - ☐ Other

    (please specify) _____

11. How long after being referred for radiotherapy treatment by your doctor were you seen approximately?
    - ☐ Within a week
    - ☐ 1-4 weeks
    - ☐ 4-8 weeks
    - ☐ more than 8 weeks

12. While you were waiting to begin your radiotherapy treatment, did you experience any of the following: (Please tick any/all if appropriate)
    - ☐ Delays with getting a date for treatment
    - ☐ Date cancelled
    - ☐ Unable to get information from the hospital
    - ☐ Difficulty arranging transport
    - ☐ Uncertainty about when the treatment would begin

13. The following questions are designed to find out as much as possible about your typical journey/travel arrangements to the hospital for radiotherapy treatment.
Please tick the relevant yes/no response in each case:

		YES	NO
(a)	Did you typically use health board transport or hospital transport?		
(b)	Did you typically use public transport? E.g. Bus, Train		
(c)	Did you typically travel by taxi?		
(d)	Did you typically travel by car?		
(e)	Did you have to stay over because of the distance you travelled?		
(f)	If you answered "yes" to 13 (e), did you stay: With relatives/friends/in a B & B/hotel?		
(g)	If you answered "yes" to 13 (e), did you stay: In the hospital/hospital hostel?		
(h)	Were you accompanied on the journey by a relative/friend?		
(i)	Did your relative/friend have to take time off work to accompany you for radiotherapy treatment?		
(j)	Did you have to make special arrangements: child minding/care of a partner in order to have radiotherapy treatment?		

14. What might help make the experience of travelling for radiotherapy treatment easier for you?
Please tick any of the suggestions below:
- ☐ I typically had no difficulties travelling for radiotherapy treatment
- ☐ Availability of hostel facilities
- ☐ Assistance with transport
- ☐ More control over the timing of radiotherapy treatment
- ☐ Other (please specify) _____

Please tick the relevant boxes in Questions 15, 16 and 17.

15. In general, the overall radiotherapy service I received was:
- ☐ Excellent
- ☐ Very good
- ☐ Moderately good
- ☐ Poor
- ☐ Very poor

16. In general the professional care I received from the radiotherapy staff at the hospital was:
- ☐ Excellent
- ☐ Very good
- ☐ Moderately good
- ☐ Poor
- ☐ Very poor

17. In general the facilities (rooms/showers/toilets etc.) at the hospital were:
- ☐ Excellent
- ☐ Very good
- ☐ Moderately good
- ☐ Poor
- ☐ Very poor

18. The following questions are designed to find out which aspects of the radiotherapy service you think are **important**. (Your actual experience of the service will be explored in the next question.)
Please tick the relevant box from 1 to 10 in each case where 1 means you think the aspect of service was not important at all, 5 or 6 means it is of some importance and 10, it is very important.
Please remember to score every question. Please do not skip any.

How important to you is:	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sympathetic approach of staff to patients										
Friendliness of staff										
Receiving the highest level of professional care										
Being looked after by a team who know me										
Staff inspire confidence – you feel he/she is competent to treat you										
Being given information about my condition										
Communication with my radiotherapy doctor										
Enough consultation time with my radiotherapy doctor										
Communication with other professional staff at the hospital										
Communication between hospital cancer services and your general practitioner										
Communication between hospital staff about patients										
Waiting time from diagnosis to radiotherapy treatment										
Distance to travel for treatment										
Waiting time for radiotherapy treatment in the hospital										
Receiving all my treatment in one site e.g. surgery, radiotherapy, chemotherapy										
Availability of clinical support services while in the hospital e.g. physiotherapy, social work										
Continuing contact/support with the hospital after treatment										
Availability of support services in the community for me e.g. Public health nurse, support groups										
Availability of support services in the community for my family										

19. From the list above, can you list what you consider the three most important things to you:

1: _____

2: _____

3: _____

20. Please rate/score the following aspects of the radiotherapy services as experienced by you by ticking the relevant box from 1 to 10 in each case. For example tick box 1 if you found that your experience of that particular aspect of service to be very poor, tick 5 or 6 if the service was passable and tick 10 if you found that aspect of service to be excellent.
Please remember to score every question. Please do not skip any.

My experience of the service	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**
Sympathetic approach of staff to patients										
Friendliness of staff										
Receiving the highest level of professional care										
Being looked after by a team who know me										
Staff inspire confidence – you feel he/she is competent to treat you										
Being given information about my condition										
Communication with my radiotherapy doctor										
Enough consultation time with my radiotherapy doctor										
Communication with other professional staff at the hospital										
Communication between hospital cancer services and your general practitioner										
Communication between hospital staff about patients										
Waiting time from diagnosis to radiotherapy treatment										
Distance to travel for treatment										
Waiting time for radiotherapy treatment in the hospital										
Receiving all my treatment in one site e.g. surgery, radiotherapy, chemotherapy										
Availability of clinical support services while in the hospital e.g. physiotherapy, social work										
Continuing contact/support with the hospital after treatment										
Availability of support services in the community for me e.g. Public health nurse, support groups										
Availability of support services in the community for my family										

21. Would you be willing to have radiotherapy treatment in the evenings?
☐ Yes
☐ No

22. What was the best aspect of the whole radiotherapy service experience? Please specify

23. What was the worst aspect of the whole radiotherapy service experience? Please specify

24. Please include below any other comments regarding the services you received or the questions above:

25. From your own experience, what (if any) changes would you like to see in radiotherapy services in the future?

Please post the completed questionnaire in the stamped addressed envelope provided.
Thank you for taking part in the survey.

Appendix C
National statistical tables

Table C 1: County of residence of respondents

County	Number	Percentage
Clare	6	5.4
Limerick	7	6.3
Mayo	1	.9
Donegal	4	3.6
Leitrim	1	.9
Sligo	3	2.7
Cork	40	35.7
Kerry	10	8.9
Kilkenny	1	.9
Waterford	4	3.6
Wexford	1	.9
Dublin	17	15.2
Kildare	2	1.8
Wicklow	1	.9
Laois	1	.9
Offaly	3	2.7
Louth	2	1.8
Meath	1	.9
Tipperary	4	3.6
Not recorded accurately*	2	1.8
Deceased	1	.9
Total**	**112**	**100.0**

Table C 2: Postal codes of Dublin respondents

Postal Code/Area	Number	Percentage
1	1	5.9
10	3	17.6
12	3	17.6
16	1	5.9
22	1	5.9
24	1	5.9
3	1	5.9
6W	1	5.9
7	1	5.9
8	2	11.8
County	1	5.9
Unrecorded	1	5.9
Total	***17***	***100.0***

* Both patients responded 'Ireland', suggesting they misread the question as "Which *country* do you live in?"

** All categories are not mutually exclusive, therefore totals may not tally.

Table C 3: Approximate age of respondents

Age (years)	Number	Percentage
18-30	4	3.6
31-45	10	8.9
46-59	40	35.7
60-75	50	44.6
75+	8	7.1
Total	***112***	***100.0***

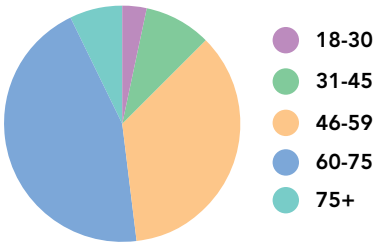


Table C 4: Gender of respondents

Gender	Number	Percentage
Male	45	40.2
Female	66	58.9
Unrecorded	1	.9
Total	***112***	***100.0***

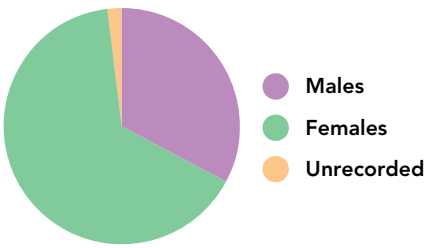


Table C 5: Public/Private healthcare

Public/Private	Number	Percentage
Public Patients	58	51.8
Private Patients	50	44.6
Unrecorded	4	3.6
Total	***112***	***100.0***

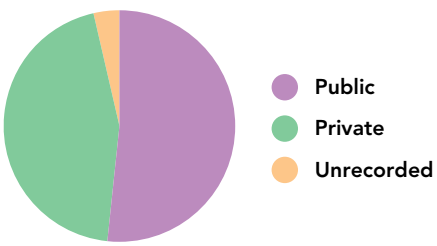


Table C 6: Occupations of Respondents

Own Occupation	Number	Percent
Accountant	1	0.9
Administrator	1	0.9
Air Hostess	1	0.9
Bank Official	2	1.8
Banker	1	0.9
Builder	1	0.9
Butcher	1	0.9
Care Worker	1	0.9
Carer	1	0.9
Carpenter	1	0.9
Clerical Officer	1	0.9
Company Director	2	1.8
Computer Programmer	1	0.9
Cook	1	0.9
Director	1	0.9
Dressmaker	1	0.9
Electrician	1	0.9
Eng Officer ESB	1	0.9
Enrolled Nurse	1	0.9
Factory Worker	2	1.8
Farmer	5	4.5
General Operator	1	0.9
General Practitioner	1	0.9
Grounds man	1	0.9
Hairstylist	1	0.9

Own Occupation	Number	Percent
Homemaker	24	21.4
Horticulturist	1	0.9
Housewife/Sales	1	0.9
Lab Manager	1	0.9
Labourer	1	0.9
Lorry Driver	2	1.8
Master Mariner	1	0.9
Milkman	1	0.9
Nurse	1	0.9
Nurse/Housewife	1	0.9
Nursing Home Owner	1	0.9
Production Factory	1	0.9
Psychiatric Nurse	1	0.9
Public Health Nurse	1	0.9
Quantity Surveyor	1	0.9
Record Shop Manager	1	0.9
Religious Sister	1	0.9
Childcare Leader	1	0.9
Restaurateur	1	0.9
Sales	1	0.9
Salesperson	1	0.9
Seamstress	1	0.9
Secretary	3	2.7
Shop Assistant	2	1.8
Shopkeeper	1	0.9

Table C 6: Occupations of Respondents

Own Occupation	Number	Percent
Sign writer	1	0.9
Soldier	1	0.9
Supermarket Director	1	0.9
Supervisor	1	0.9
Teacher (Not specified)	1	0.9
Teacher (Nat)	1	0.9
Teacher (Sec)	1	0.9
Telecom Tech	1	0.9
Typist	1	0.9
Waitress	1	0.9
Wool Worker	1	0.9
Unemployed	1	0.9
Retired (Not specified)	5	4.5
Retired Company Director	1	0.9
Retired Farmer	3	2.7
Retired Garda	1	0.9
Retired Nurse	1	0.9
Retired Sales Manager	1	0.9
Retired Teacher	2	1.8
Unrecorded	2	1.8
Total*	***112***	***100.0***

Table C 7: Partner's Occupation

Partner's Occupation	Number	Percent
Agent	1	0.9
Branch Manager	2	1.8
Bricklayer	1	0.9
Bus Conductor	1	0.9
Cargo Sales Manager	1	0.9
Clerical Officer	1	0.9
Electrician	1	0.9
Farmer	1	0.9
Forestry Manager	1	0.9
Homemaker	15	13.4
Insurance Official	1	0.9
Labourer	1	0.9
Lorry Driver	2	1.8
Mill Manager	1	0.9
Nurse	1	0.9
Nursing Home Owner	1	0.9
Ormond Brick	1	0.9
Radiographer	1	0.9
Sales Manager	1	0.9
Salesperson	2	1.8
Security Guard	1	0.9
Self-employed Taxi	1	0.9
Sign Writer	1	0.9
Supermarket Director	1	0.9
Tailor	1	0.9
Unemployed	3	2.7
Retired (Not specified)	1	0.9
Retired Electrician	1	0.9
Retired Teacher	1	0.9
Deceased	3	2.7
No Partner	1	0.9
Unrecorded	60	53.6
Total	***112***	***100.0***

Table C 8: Respondents who took part in the focus groups

Focus Group?	Number	Percentage
Yes	37	33.0
No	73	65.2
Unrecorded	2	1.8
Total	***112***	***100.0***

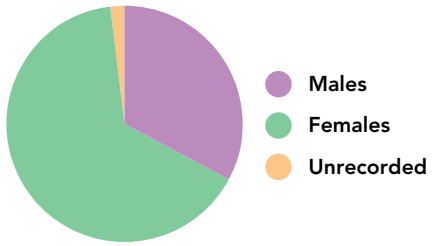


Table C 9: Respondents' treatment setting

Inpatient or Outpatient?	Number	Percentage
Inpatient	19	17.0
Outpatient	77	68.8
Both	14	12.5
Unrecorded	2	1.8
Total	***112***	***100.0***

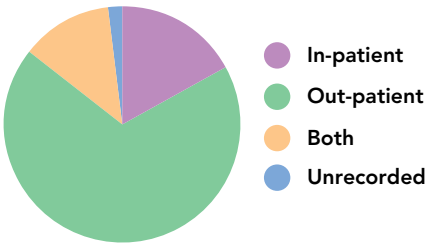


Table C 10: Respondents' perceptions of the overall radiotherapy service they received

Response	Number	Percentage
Excellent	92	82.1
Very Good	17	15.2
Moderately Good	1	.9
Poor	0	.0
Very Poor	0	.0
Unrecorded	2	1.8
Total	***112***	***100.0***

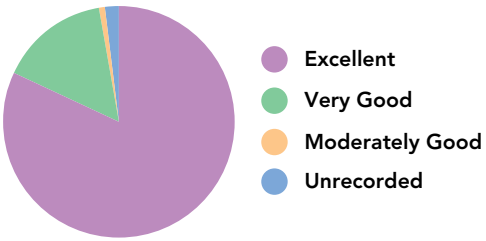


Table C 11: Respondents' perceptions of the professional care they received from the radiotherapy staff at the hospital

Response	Number	Percentage
Excellent	98	87.5
Very Good	11	9.8
Moderately Good	2	1.8
Poor	0	.0
Very Poor	0	.0
Unrecorded	1	.9
Total	***112***	***100.0***

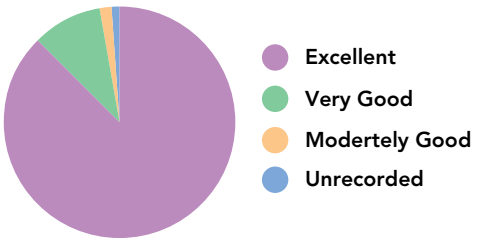


Table C 12: Respondents' perceptions of the facilities in general (rooms/showers/toilets, etc.) at the hospital

Response	Number	Percentage
Excellent	50	44.6
Very Good	31	27.7
Moderately Good	23	20.5
Poor	6	5.4
Very Poor	0	.0
Unrecorded	2	1.8
Total	***112***	***100.0***

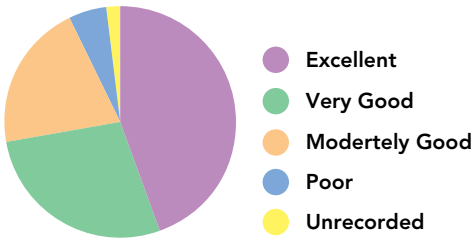


Table C 13: Waiting time from diagnosis to radiotherapy treatment

Waiting Time	Number	Percentage
Within a week	6	5.4
1-4 weeks	40	35.7
4-8 weeks	40	35.7
More than 8 weeks	23	20.5
Unrecorded	3	2.7
Total	***112***	***100.0***

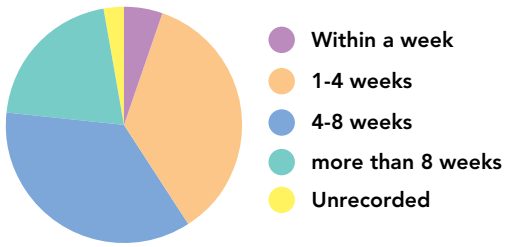
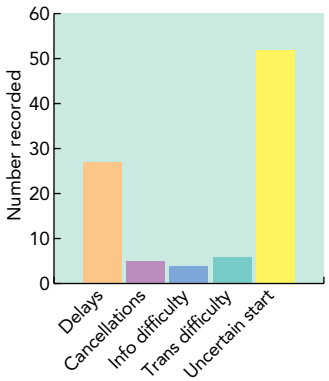


Table C 14: Respondents' experience while waiting to begin treatment

Experience	Number of Respondents
Delays getting a date for treatment	27
Date cancelled	5
Unable to get information from the hospital	4
Difficulty arranging transport	6
Uncertainty about when the treatment would begin	52



Note: Tables C15-C18 refer to out-patients only (n = 77)

Table C 15: Frequency of journeys for radiotherapy treatment

Frequency of Journeys	Number	Percentage
Daily	61	79.2
Twice weekly	8	10.4
Weekly	4	5.2
Other	1	1.3
Unrecorded	3	3.9
Total	***77***	***100.0***

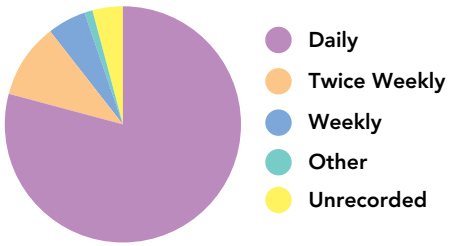


Table C 16: Approximate daily travelling distance for radiotherapy (one-way)

Distance	Number	Percentage
0-10 miles	34	44.2
11-30 miles	12	15.6
31-60 miles	15	19.5
61-100 miles	11	14.3
101-150 miles	2	2.6
151-200 miles	0	0.0
More than 200 miles	0	0.0
Unrecorded	3	3.9
Total	***77***	***100.0***

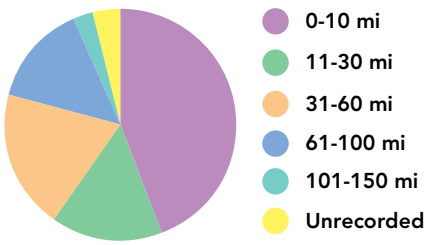


Table C 17: Approximate daily travelling time (one-way)

Time	Number	Percentage
Less than 0.5 hr	27	35.1
Around 1 hr	22	28.6
1-2 hrs	17	22.1
2-3 hrs	5	6.5
3-4 hrs	4	5.2
4-5 hrs	1	1.3
Unrecorded	1	1.3
Total	***77***	***100.0***

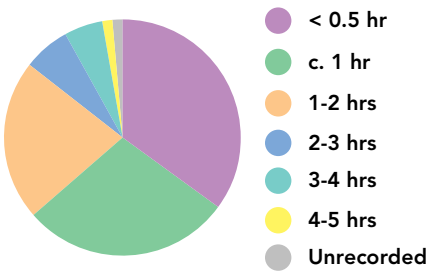


Table C 18: Typical journey/travel arrangements to the hospital for radiotherapy treatment

Question	Response	Number	Percentage
Q.18(a) Did you typically use health board transport or hospital transport?	Yes	8	7.1
	No	86	76.8
	Unrecorded	18	16.1
	Total	***112***	***100.0***
Q.18(b) Did you typically use public transport (e.g., bus, train)?	Yes	18	16.1
	No	76	67.9
	Unrecorded	18	16.1
	Total	***112***	***100.0***
Q.18(c) Did you typically travel by taxi?	Yes	8	7.1
	No	83	74.1
	Unrecorded	21	18.8
	Total	***112***	***100.0***
Q.18(d) Did you typically travel by car?	Yes	78	69.6
	No	17	15.2
	Unrecorded	17	15.2
	Total	***112***	***100.0***
Q.18(e) Did you have to stay over because of the distance you travelled?	Yes	25	22.3
	No	76	67.9
	Unrecorded	11	9.8
	Total	***112***	***100.0***
Q.18(f) If you answered "yes" to 18(e), did you stay with relatives/friends/in a B&B/hotel?	Yes	7	28.0
	No	10	40.0
	Unrecorded	8	32.0
	Total	***25***	***100.0***
Q.18(g) If you answered "yes" to 18(e), did you stay in the hospital/hospital hostel?	Yes	17	68.0
	No	5	20.0
	Unrecorded	3	12.0
	Total	***25***	***100.0***
Q.18(h) Were you accompanied on the journey by a relative/friend?	Yes	61	54.5
	No	41	36.6
	Unrecorded	10	8.9
	Total	***112***	***100.0***
Q.18(i) Did your relative/friend have to take time off work to accompany you for radiotherapy treatment?	Yes	28	45.9
	No	31	50.8
	Unrecorded	2	3.3
	Total	***61***	***100.0***
Q.18(j) Did you have to make special arrangements regarding child minding/care of a partner, in order to have radiotherapy treatment?	Yes	10	8.9
	No	93	83.0
	Unrecorded	9	8.0
	Total	***112***	***100.0***

Table C 19: What might help make the experience of radiotherapy treatment easier for you? (Tick as appropriate)

Experience	Number
I typically had no difficulties travelling for radiotherapy treatment	72
Availability of hostel facilities	12
Assistance with transport	12
More control over the timing of radiotherapy treatment	7
Other	6

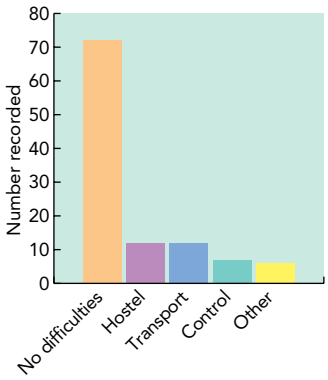


Table C 20: Respondents' perceptions of the best aspect of their radiotherapy service experience

Response	Number of mentions
Staff good/excellent/professional	73
Short waiting time for treatment	23
Good service/treatment	11
Accommodation provided	4
Information available	2

Table C 21: Respondents' perceptions of the worst aspect of their radiotherapy service experience

Response	Number of mentions
Delays in appointments/results	25
Travelling	23
Felt bad/in pain/fearful	14
Poor facilities/faulty machines	12
Lack of parking	8
Not enough information available	2
Had to attend every day	2
Lack of communication	1

Table C 22: Respondents' perceptions of importance of aspects of the radiotherapy service

Aspect of service	Number of responses (out of 112)	Ratings 1-4: Not important	Ratings 7-10: Important	Ratings 9-10: Very Important
Sympathetic approach of staff to patients	112	0 (0%)	105 (93.8%)	96 (85.7%)
Friendliness of staff	112	0 (0%)	106 (94.6%)	96 (85.7%)
Receiving the highest level of professional care	112	0 (0%)	110 (98.2%)	106 (94.6%)
Being looked after by a team who know me	106	8 (7.5%)	85 (80.2%)	69 (65.1%)
Staff inspire confidence – you feel he/she is competent to treat you	111	0 (0%)	108 (96.4%)	100 (90.1%)
Being given information about my condition	111	3 (2.7%)	102 (91.2%)	90 (81.1%)
Communication with my radiotherapy doctor	111	4 (3.6%)	99 (89.2%)	87 (78.4%)
Enough consultation time with my radiotherapy doctor	110	2 (1.8%)	98 (89.1%)	81 (73.6%)
Communication with other professional staff at the hospital	107	10 (9.3%)	76 (71.0%)	51 (47.7%)
Communication between hospital cancer services and your GP	109	5 (4.6%)	90 (82.6%)	74 (67.9%)
Communication between hospital staff about patients	107	3 (2.8%)	92 (86.0%)	71 (66.4%)
Waiting time from diagnosis to radiotherapy treatment	107	6 (5.6%)	98 (91.6%)	86 (80.4%)
Distance to travel for treatment	108	9 (8.3%)	84 (77.8%)	68 (63.0%)
Waiting time for radiotherapy treatment in the hospital	108	4 (3.7%)	87 (80.6%)	67 (62.0%)
Receiving all my treatment in one site, e.g., surgery, radiotherapy, chemotherapy	110	11 (10.0%)	83 (75.5%)	72 (65.5%)

Availability of clinical support services while in the hospital, e.g., physiotherapy, social work	109	8 (8.3%)	76 (69.7%)	56 (51.4%)
Continuing contact/support with the hospital after treatment	110	7 (6.4%)	78 (70.9%)	61 (55.5%)
Availability of support services in the community for me, e.g., public health nurse, support groups	109	15 (13.8%)	67 (61.5%)	50 (45.9%)
Availability of support services in the community for my family	111	25 (22.5%)	59 (53.2%)	46 (41.4%)

Table C 23: Ranking of aspects of radiotherapy service by order of importance.
(Based on percentage of respondents ranking aspects of service in 9-10 range)

Aspect of service	Number of responses (out of 112)	Ratings 1-4: Not important	Ratings 7-10: Important	Ratings 9-10: Very Important
Receiving the highest level of professional care	112	0 (0%)	110 (98.2%)	106 (94.6%)
Staff inspire confidence – you feel he/she is competent to treat you	111	0 (0%)	108 (97.3%)	100 (90.1%)
Sympathetic approach of staff to patients	112	0 (0%)	105 (93.8%)	96 (85.7%)
Friendliness of staff	112	0 (0%)	106 (94.6%)	96 (85.7%)
Being given information about my condition	111	3 (2.7%)	102 (91.9%)	90 (81.1%)
Waiting time from diagnosis to radiotherapy treatment	107	6 (5.6%)	98 (91.6%)	86 (80.4%)
Communication with my radiotherapy doctor	111	4 (3.6%)	99 (89.2%)	87 (78.4%)
Enough consultation time with my radiotherapy doctor	110	2 (1.8%)	98 (89.1%)	81 (73.6%)
Communication between hospital cancer services and your GP	109	5 (4.6%)	90 (82.6%)	74 (67.9%)
Communication between hospital staff about patients	107	3 (2.8%)	92 (86.0%)	71 (66.4%)

Receiving all my treatment in one site, e.g., surgery, radiotherapy, chemotherapy	110	11 (10.0%)	83 (75.5%)	72 (65.5%)
Being looked after by a team who know me	106	8 (7.5%)	85 (80.2%)	69 (65.1%)
Distance to travel for treatment	108	9 (8.3%)	84 (77.8%)	68 (63.0%)
Waiting time for radiotherapy treatment in the hospital	108	4 (3.7%)	87 (80.6%)	67 (62.0%)
Continuing contact/support with the hospital after treatment	110	7 (6.4%)	78 (70.9%)	61 (55.5%)
Availability of clinical support services while in the hospital, e.g., physiotherapy, social work	109	8 (7.3%)	76 (69.7%)	56 (51.4%)
Communication with other professional staff at the hospital	107	10 (9.3%)	76 (71.0%)	51 (47.7%)
Availability of support services in the community for me, e.g., public health nurse, support groups	109	15 (13.8%)	67 (61.5%)	50 (45.9%)
Availability of support services in the community for my family	111	25 (22.5%)	59 (53.2%)	46 (41.4%)

Table C 24: Mean ratings of importance of aspects of radiotherapy services, 10 is very important

Aspect of service	Number of responses (out of 112)	Mean rating	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Sympathetic approach of staff to patients	112	9.51									O	
Friendliness of staff	112	9.49									O	
Receiving the highest level of professional care	112	9.80										O
Being looked after by a team who know me	106	8.37							O			
Staff inspire confidence – you feel he/she is competent to treat you	111	9.63									O	
Being given information about my condition	111	9.23								O		
Communication with my radiotherapy doctor	111	9.09								O		
Enough consultation time with my radiotherapy doctor	110	9.01								O		
Communication with other professional staff at the hospital	107	7.71					O					
Communication between hospital cancer services and your GP	109	8.61							O			
Communication between hospital staff about patients	107	8.72							O			
Waiting time from diagnosis to radiotherapy treatment	107	9.15								O		
Distance to travel for treatment	108	8.22						O				
Waiting time for radiotherapy treatment in the hospital	108	8.44							O			
Receiving all my treatment in one site, e.g. surgery, radiotherapy, chemotherapy	110	8.22						O				
Availability of clinical support services while in the hospital, e.g. physiotherapy, social work	109	7.91						O				
Continuing contact/support with the hospital after treatment	110	7.95						O				
Availability of support services in the community for me, e.g. public health nurse, support groups	109	7.35					O					
Availability of support services in the community for my family	111	6.74			O							

Table C 25: From the list above, can you list what you consider are the three most important things to you?

Most selected as first choice: "Receiving the highest level of professional care"
(49 selections)
Most selected as second choice: *same as above*
(16 selections)
Most selected as third choice: "Being given information about my condition"
(13 selections)

Table C 26: Respondents' satisfaction ratings with aspects of radiotherapy service

Aspect of service	Number of responses (out of 112)	Ratings 1–4: Un-satisfactory	Ratings 7–10: Satisfactory	Ratings 9–10: Very Satisfactory
Sympathetic approach of staff to patients	103	0 (0%)	97 (94.2%)	90 (87.4%)
Friendliness of staff	103	0 (0%)	102 (99.0%)	97 (94.2%)
Receiving the highest level of professional care	100	0 (0%)	96 (96.0%)	89 (89.0%)
Being looked after by a team who know me	102	4 (3.9%)	82 (80.4%)	69 (67.6%)
Staff inspire confidence – you feel he/she is competent to treat you	100	0 (0%)	98 (98.0%)	90 (90.0%)
Being given information about my condition	102	6 (5.9%)	77 (75.5%)	55 (53.9%)
Communication with my radiotherapy doctor	101	8 (7.9%)	81 (80.2%)	58 (57.4%)
Enough consultation time with my radiotherapy doctor	99	8 (8.1%)	78 (78.8%)	60 (60.6%)
Communication with other professional staff at the hospital	99	13 (13.1%)	63 (63.6%)	42 (42.4%)
Communication between hospital cancer services and your GP	98	21 (21.4%)	60 (61.2%)	42 (42.9%)
Communication between hospital staff about patients	94	6 (6.4%)	73 (77.7%)	53 (56.4%)
Waiting time from diagnosis to radiotherapy treatment	100	16 (16.0%)	58 (58.0%)	41 (41.0%)
Distance to travel for treatment	97	24 (24.7%)	57 (58.8%)	45 (46.4%)
Waiting time for radiotherapy treatment in the hospital	100	6 (6.0%)	80 (80.0%)	65 (65.0%)
Receiving all my treatment in one site, e.g. surgery, radiotherapy, chemotherapy	97	20 (20.6%)	56 (57.7%)	63 (64.9%)
Availability of clinical support services while in the hospital, e.g. physiotherapy, social work	96	20 (20.8%)	54 (56.3%)	41 (42.7%)
Continuing contact/support with the hospital after treatment	101	28 (27.7%)	52 (51.5%)	43 (42.6%)
Availability of support services in the community for me, e.g. public health nurse, support groups	96	43 (44.8%)	30 (31.3%)	23 (23.4%)

Table C 27: Ranking of aspects of radiotherapy service by satisfaction ratings
(Based on percentage of respondents ranking aspects of service in the 9 – 10 category)

Aspect of service	Number of responses (out of 112)	Ratings 1–4: Un-satisfactory	Ratings 7–10: Satisfactory	Ratings 9–10: Very Satisfactory
Friendliness of staff	103	0 (0%)	102 (99.0%)	97 (94.2%)
Staff inspire confidence – you feel he/she is competent to treat you	100	0 (0%)	98 (98.0%)	90 (90.0%)
Availability of support services in the community for my family	95	52 (54.7%)	24 (25.3%)	17 (17.9%)
Receiving the highest level of professional care	100	0 (0%)	96 (96.0%)	89 (89.0%)
Sympathetic approach of staff to patients	103	0 (0%)	97 (94.2%)	90 (87.4%)
Being looked after by a team who know me	102	4 (3.9%)	82 (80.4%)	69 (67.6%)
Waiting time for radiotherapy treatment in the hospital	100	6 (6.0%)	80 (80.0%)	65 (65.0%)
Receiving all my treatment in one site, e.g. surgery, radiotherapy, chemotherapy	97	20 (20.6%)	56 (57.7%)	63 (64.9%)
Enough consultation time with my radiotherapy doctor	99	8 (8.1%)	78 (78.8%)	60 (60.6%)
Communication with my radiotherapy doctor	101	8 (7.9%)	81 (80.2%)	58 (57.4%)
Communication between hospital staff about patients	94	6 (6.4%)	73 (77.7%)	53 (56.4%)
Being given information about my condition	102	6 (5.9%)	77 (75.5%)	55 (53.9%)
Distance to travel for treatment	97	24 (24.7%)	57 (58.8%)	45 (46.4%)
Communication between hospital cancer services and your GP	98	21 (21.4%)	60 (61.2%)	42 (42.9%)
Availability of clinical support services while in the hospital, e.g. physiotherapy, social work	96	20 (20.8%)	54 (56.3%)	41 (42.7%)
Continuing contact/support with the hospital after treatment	101	28 (27.7%)	52 (51.5%)	43 (42.6%)
Communication with other professional staff at the hospital	99	13 (13.1%)	63 (63.6%)	42 (42.4%)
Waiting time from diagnosis to radiotherapy treatment	100	16 (16.0%)	58 (58.0%)	41 (41.0%)
Availability of support services in the community for me, e.g. public health nurse, support groups	96	43 (44.8%)	30 (31.3%)	23 (23.4%)
Availability of support services in the community for my family	95	52 (54.7%)	24 (25.3%)	17 (17.9%)

Table C 28: Mean satisfaction ratings for aspects of radiotherapy service

Aspect of service responses	Number of responses (out of 112)	Mean rating	4.5	5	5.5	6	6.5	7	7.5	8	8.5	9	9.5	10
Sympathetic approach of staff to patients	103	9.50											O	
Friendliness of staff	103	9.75												O
Receiving the highest level of professional care	100	9.58											O	
Being looked after by a team who know me	102	8.67									O			
Staff inspire confidence – you feel he/she is competent to treat you	100	9.62											O	
Being given information about my condition	102	8.06								O				
Communication with my radiotherapy doctor	101	8.26									O			
Enough consultation time with my radiotherapy doctor	99	8.27									O			
Communication with other professional staff at the hospital	99	7.37							O					
Communication between hospital cancer services and your GP	98	7.04						O						
Communication between hospital staff about patients	94	8.17								O				
Waiting time from diagnosis to radiotherapy treatment	100	7.05						O						
Distance to travel for treatment	97	6.82						O						
Waiting time for radiotherapy treatment in the hospital	100	8.47									O			
Receiving all my treatment in one site, e.g. surgery, radiotherapy, chemotherapy	97	7.40							O					
Availability of clinical support services while in the hospital, e.g. physiotherapy, social work	96	6.95						O						
Continuing contact/support with the hospital after treatment	101	6.51					O							
Availability of support services in the community for me, e.g. public health nurse, support groups	96	4.95		O										
Availability of support services in the community for my family	95	4.36	O											

Table C 29: Respondents' comments regarding the services received or the questions asked in the questionnaire

Response	Number of mentions
Satisfactory/good/excellent services	30
Good/excellent staff	12
Facilities need to be upgraded	5
Had to travel	2
Received meal allowance	1
Needed more information	1
Accommodation was good	1

Table C 30: Respondents' suggestions for changes they would like to see in radiotherapy services in the future

Response	Number of mentions
More units/Units nearer home	40
Better facilities/equipment	11
Shorter lists/Shorter waiting times	11
More information needed	5
Quicker referrals	3
In need of government funding	3
More time with doctors	2
Services should be covered by VHI	2
Poor after-care	1

Appendix D
Regional statistical tables

Table D1: Eastern Regional Health Authority Group
Importance versus satisfaction ratings*

Aspect of service	*N*[1]	Mean ratings IMP.	SAT.	*t*	*p*	Statistically significant?[2]
Receiving the highest level of professional care	19	10.00	9.42	1.934	.069	No
Sympathetic approach of staff to patients	19	9.95	9.42	2.137	.047	No
Friendliness of staff	19	9.80	9.63	.615	.546	No
Staff inspire confidence – you feel he/she is competent to treat you	19	9.45	9.26	.615	.546	No
Waiting time from diagnosis to radiotherapy treatment	17	9.63	6.89	4.165	.001	Yes
Being given information about my condition	19	9.45	8.26	1.659	.114	No
Communication with my radiotherapy doctor	18	9.26	8.68	.752	.463	No
Enough consultation time with my radiotherapy doctor	18	9.15	8.61	.566	.579	No
Waiting time for radiotherapy treatment in the hospital	19	8.95	7.89	1.363	.190	No
Continuing contact/support with the hospital after treatment	18	8.74	8.11	.940	.361	No
Being looked after by a team who know me	18	8.58	8.95	.236	.816	No
Distance to travel for treatment	18	8.55	8.17	.316	.756	No
Communication between hospital staff about patients	18	8.50	8.33	.000	1.000	No
Availability of clinical support services while in the hospital, e.g., physiotherapy, social work	17	8.42	7.88	1.376	.188	No
Receiving all my treatment in one site, e.g., surgery, radiotherapy, chemotherapy	18	8.15	7.50	1.106	.284	No
Communication with other professional staff at the hospital	19	8.05	7.95	.132	.897	No

Aspect of service	*N*[1]	Mean ratings IMP.	Mean ratings SAT.	*t*	*p*	Statistically significant?[2]
Communication between hospital cancer services and your GP	17	8.05	7.44	.829	.420	No
Availability of support services in the community for me, e.g., public health nurse, support groups	17	7.89	6.41	1.586	.132	No
Availability of support services in the community for my family	15	7.53	5.53	2.817	.014	No

* Aspects ranked in order of importance, from highest to lowest

Note: [1] *N* refers to the number of patients who gave a response to *both* questions for each aspect of service;
[2] Given the large number of comparisons being made (19), statistical significance is determined at the .01 level (i.e., α= .01)

Table D2: South/South Eastern Group
Importance versus satisfaction ratings*

Aspect of service	*N*[1]	Mean ratings IMP.	Mean ratings SAT.	*t*	*p*	Statistically significant?[2]
Receiving the highest level of professional care	48	9.82	9.71	.645	.522	No
Staff inspire confidence – you feel he/she is competent to treat you	48	9.76	9.69	.423	.674	No
Sympathetic approach of staff to patients	49	9.43	9.61	-1.278	.207	No
Friendliness of staff	49	9.41	9.71	-1.910	.062	No
Waiting time from diagnosis to radiotherapy treatment	46	**9.15**	**7.56**	3.853	**< .001**	**Yes**
Being given information about my condition	49	**9.00**	**7.94**	3.158	**.003**	**Yes**
Communication with my radiotherapy doctor	49	8.89	8.02	2.431	.019	No
Enough consultation time with my radiotherapy doctor	47	8.84	8.06	2.293	.026	No
Communication between hospital cancer services and your GP	47	**8.69**	**7.04**	3.843	**< .001**	**Yes**
Waiting time for radiotherapy treatment in the hospital	47	8.56	9.13	-2.287	.027	No
Communication between hospital staff about patients	43	8.47	7.86	.995	.325	No
Distance to travel for treatment	47	8.15	7.94	1.033	.307	No
Receiving all my treatment in one site, e.g., surgery, radiotherapy, chemotherapy	46	8.07	8.02	.196	.845	No
Being looked after by a team who know me	47	7.81	8.41	-1.526	.134	No
Continuing contact/support with the hospital after treatment	47	**7.60**	**6.23**	2.990	**.004**	**Yes**
Availability of clinical support services while in the hospital, e.g., physiotherapy, social work	45	7.57	6.69	1.671	.102	No
Communication with other professional staff at the hospital	45	7.46	7.19	.317	.753	No
Availability of support services in the community for my family	48	**5.98**	**4.19**	3.521	**< .001**	**Yes**

* Aspects ranked in order of importance, from highest to lowest

Note: [1]*N* refers to the number of patients who gave a response to *both* questions for each aspect of service;
[2]Given the large number of comparisons being made (19), statistical significance is determined at the .01 level (i.e., $\alpha = .01$)

Table D3: Western Seaboard Group
Importance versus Satisfaction ratings*

Aspect of service	*N*[1]	Mean ratings IMP.	SAT.	*t*	*p*	Statistically significant?[2]
Staff inspire confidence – you feel he/she is competent to treat you	20	9.68	9.75	-.809	.428	No
Receiving the highest level of professional care	21	9.64	9.52	.302	.766	No
Being given information about my condition	21	9.50	8.19	2.487	.022	No
Friendliness of staff	22	9.45	9.82	-1.402	.176	No
Waiting time from diagnosis to radiotherapy treatment	20	**9.43**	**6.71**	3.885	**.001**	**Yes**
Sympathetic approach of staff to patients	22	9.41	9.36	.123	.903	No
Communication between hospital staff about patients	19	9.36	8.53	1.681	.110	No
Enough consultation time with my radiotherapy doctor	20	9.29	8.57	1.270	.219	No
Communication with my radiotherapy doctor	20	9.23	8.70	1.269	.220	No
Being looked after by a team who know me	21	9.23	8.57	1.393	.179	No
Receiving all my treatment in one site, e.g., surgery, radiotherapy, chemotherapy	21	**8.73**	**6.14**	2.859	**.010**	**Yes**
Communication between hospital cancer services and your GP	20	8.59	6.70	2.698	.014	No
Availability of clinical support services while in the hospital, e.g., physiotherapy, social work	20	8.33	6.71	2.474	.023	No
Availability of support services in the community for me, e.g., public health nurse, support groups	19	**8.33**	**4.15**	5.544	**< .001**	**Yes**
Distance to travel for treatment	21	**8.32**	**4.19**	5.444	**< .001**	**Yes**
Continuing contact/support with the hospital after treatment	21	**8.09**	**5.38**	3.250	**.004**	**Yes**
Waiting time for radiotherapy treatment in the hospital	20	7.71	7.95	-.270	.790	No
Availability of support services in the community for my family	20	**7.68**	**3.40**	4.857	**< .001**	**Yes**
Communication with other professional staff at the hospital	19	7.67	7.05	2.344	.031	No

*Aspects ranked in order of importance, from highest to lowest

Note: [1]*N* refers to the number of patients who gave a response to *both* questions for each aspect of service;
[2]Given the large number of comparisons being made (19), statistical significance is determined at the .01 level (i.e., $\alpha = .01$)

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Appendix 3

Determination of catchment populations within specified travel times and distances of particular hospitals

Prepared by

Small Area Health Research Unit (SAHRU)

Proposal

The SAHRU study proposal and design estimated the population and travel times for a number of potential hospital locations within the Republic of Ireland. A number of potential hospital sites were identified to enable the preliminary assessment of several factors associated with patient travel to be examined. The identification of the hospital sites within this study does not indicate the Expert Group's endorsement for radiation oncology service development at the specific hospital location.

Study/Analysis

In order to analyse the issues of geographic access, travelling times and proximity to a potential radiation oncology centre, the following illustrative hospital and potential catchment areas were considered:

1. For the two Dublin radiation oncology centre options, these to be computed according to the following different scenarios:

    a) Where St. Luke's Hospital remained as the south-side point
    b) Where St. James's Hospital is the Southside point and Mater Hospital is the north-side point
    c) Where St. James's Hospital is the Southside point and Beaumont is the north-side point
    d) Where St. Vincent's Hospital is the Southside point and Mater Hospital is the north-side point
    e) Where St. Vincent's Hospital is the south-side point and Beaumont Hospital is the north-side point.

2. The original set of centres (i.e. Dublin (2), Cork and Galway) to be recomputed in terms of travelling times.

3. To estimate the impact of additional potential locations on patients travelling times and distances, for example in the SEHB and the MWHB.

4. Results will be computed in terms of both distance to travel and travelling time by road.

5. Travel times – based on average speeds attained on stretches of road within the study region – will be computed based on current estimates of average attained speed on all relevant roads obtained courtesy of the National Roads Authority.

6. Scenarios developed.

The following hospitals were to be included in the study in a number of different combinations:

- St Luke's Hospital, Dublin
- Beaumont Hospital, Dublin
- Mater Hospital, Dublin
- St James's Hospital, Dublin
- St Vincent's Hospital, Dublin
- Limerick Regional Hospital
- Ardkeen Hospital, Waterford
- Cork University Hospital
- University College Hospital Galway

A total of 32 combinations were defined, each including between 4 and 7 hospitals from the above list. For each combination the number of persons living within specified travel times and distances of the hospitals in each scenario would have to be determined.

Technical considerations

Analysis will be undertaken using population figures at the small-area level (i.e. Ward and DED) essential for purposes of accuracy. The latest available official figures for population at this spatial level is for 1996. In view of this, it is proposed to also undertake computations on the basis of the latest official population estimates from the CSO at county level and apply a suitable proportional multiplier to the DED-level numbers.

Travel times – based on average speeds attained on stretches of road within the study region – will be computed based on current estimates of average attained speed on all relevant roads obtained courtesy of the National Roads Authority.

Report

The above work to be fully reported and documented.

Timeframe

Five person-days; work to be undertaken during August and September.
The report will be presented by the 1st week in September.

Budget

Total = €3,810 (5 person days at €762/day)

Study

DED populations for 2000

The most recent census data were collected in 1996. In the years since then population growth has been substantial in Ireland, especially in and around the main cities, particularly. Therefore, the use of 1996 census data is likely to give a false indication of where the population now resides. To account for this, 1996 population figures for DEDs were adjusted using 2000 region level estimates published by the Central Statistics Office in 2001. Region level growth rates were calculated and then applied to the 1996 populations for DEDs in each region. This resulted in a national population of 3,786,898 persons.

The national road network

The road network was obtained from Bartholomew Maps Ltd. which distinguished between motorway, primary, secondary, regional and third class route ways. The road network for Northern Ireland was included as people may cross the border in travelling from the North West to Dublin.

Average road speeds

Publications were sourced from the National Roads Authority which contained data on 'free' speeds on urban and rural roads. Free speeds are distinct from speed limits as they are the speeds at which drivers choose to travel. This is more realistic than using road-specific speed limits as these are rarely observed, particularly in rural areas.

A further distinction was made between urban areas and city areas, with specific regard to the cities of Dublin, Cork, Limerick, Galway and Waterford. Nominally attainable speeds for these areas were reduced to account for traffic congestion. Therefore the calculated travel times could be deemed conservative or generous depending on the time of day or day of the week being considered. Very different travel times would be expected for the same journey on a Monday morning and a Sunday morning. This is particularly the case in urban areas and all of the hospitals included in this study are situated in major urban centres so clearly, access to these service points will be affected to a greater or lesser degree by urban traffic congestion.

Travel time and distance calculations

Attainable speeds were allocated to each road type based on the above work. Having defined the travel distances for consideration as being 30, 50 and 75 miles, the area within those distances from each hospital was calculated. Similarly, the area within 30, 60, 90 and 120 minutes travel time was calculated for each hospital. The times included a 10 minutes 'intrazonal' time. This is used to account for start-up time (getting onto the road network) and end time (to find a parking space and get from there to the hospital).

Catchment DEDs

For each hospital the DEDs that fell within each of the specified distances and travel times were identified. For each scenario in turn, the population of the DEDs within each distance and time bands were aggregated to give total population coverage. These were then converted into percentages of the national population and tabulated.

Results

Table 1 below provides estimates of percentage of the national population covered for each specified combination of hospital by distance travelled. Table 2 provides estimates of percentage of the national population covered for each specified combination of hospital by time bands. Tables 3 and 4 are ranked versions of Tables 1 and 2, respectively. These tables are colour-coded (dark green, light green and pink) to correspond to the three sub-groups identified in the commentary.

Table 1: Percentage of the national population within specified distance bands for each scenario

Scenario	Hospitals	30 miles	50 miles	75 miles
1	Beaumont, St James's, Cork, Galway	51	66	90
2	Beaumont, St Vincent's, Cork, Galway	50	65	90
3	Beaumont, St James's, Waterford, Cork, Galway	55	75	93
4	Beaumont, St Vincent's, Waterford, Cork, Galway	55	74	93
5	Beaumont, St James's, Limerick, Cork, Galway	58	74	91
6	Beaumont, St Vincent's, Limerick, Cork, Galway	57	73	91
7	Beaumont, St James's, Limerick, Waterford, Cork, Galway	62	82	93
8	Beaumont, St Vincent's, Limerick, Waterford, Cork, Galway	62	81	93
9	Beaumont, St James's, St Luke's, Cork, Galway	51	66	90
10	Beaumont, St Vincent's, St Luke's, Cork, Galway	51	66	90
11	Beaumont, St James's, St Luke's, Waterford, Cork, Galway	56	75	93
12	Beaumont, St Vincent's, St Luke's, Waterford, Cork, Galway	55	75	93
13	Beaumont, St James's, St Luke's, Limerick, Cork, Galway	58	75	91
14	Beaumont, St Vincent's, St Luke's, Limerick, Cork, Galway	58	74	91
15	Beaumont, St James's, St Luke's, Limerick, Waterford, Cork, Galway	63	82	93
16	Beaumont, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	62	82	93
17	Mater, St James's, Cork, Galway	51	66	90
18	Mater, St Vincent's, Cork, Galway	51	65	90
19	Mater, St James's, Waterford, Cork, Galway	55	75	93
20	Mater, St Vincent's, Waterford, Cork, Galway	55	75	93
21	Mater, St James's, Limerick, Cork, Galway	57	74	91
22	Mater, St Vincent's, Limerick, Cork, Galway	58	74	91
23	Mater, St James's, Limerick, Waterford, Cork, Galway	62	82	93
24	Mater, St Vincent's, Limerick, Waterford, Cork, Galway	62	82	93
25	Mater, St James's, St Luke's, Cork, Galway	51	66	90
26	Mater, St Vincent's, St Luke's, Cork, Galway	51	66	90
27	Mater, St James's, St Luke's, Waterford, Cork, Galway	56	75	93
28	Mater, St Vincent's, St Luke's, Waterford, Cork, Galway	56	75	93
29	Mater, St James's, St Luke's, Limerick, Cork, Galway	58	74	91
30	Mater, St Vincent's, St Luke's, Limerick, Cork, Galway	58	74	91
31	Mater, St James's, St Luke's, Limerick, Waterford, Cork, Galway	62	82	93
32	Mater, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	62	82	93
33	Dublin, Limerick, Waterford, Cork, Galway	61	81	93

Table 2: Percentage of the national population within a specified travel time for each scenario

Scenario	Hospitals	30 minutes	60 minutes	90 minutes	120 minutes
1	Beaumont, St James's, Cork, Galway	38	53	75	91
2	Beaumont, St Vincent's, Cork, Galway	37	52	74	91
3	Beaumont, St James's, Waterford, Cork, Galway	40	60	83	93
4	Beaumont, St Vincent's, Waterford, Cork, Galway	39	58	83	93
5	Beaumont, St James's, Limerick, Cork, Galway	41	60	80	91
6	Beaumont, St Vincent's, Limerick, Cork, Galway	41	59	79	91
7	Beaumont, St James's, Limerick, Waterford, Cork, Galway	43	67	87	93
8	Beaumont, St Vincent's, Limerick, Waterford, Cork, Galway	43	66	87	93
9	Beaumont, St James's, St Luke's, Cork, Galway	39	53	75	91
10	Beaumont, St Vincent's, St Luke's, Cork, Galway	39	53	75	91
11	Beaumont, St James's, St Luke's, Waterford, Cork, Galway	41	60	83	93
12	Beaumont, St Vincent's, St Luke's, Waterford, Cork, Galway	41	60	83	93
13	Beaumont, St James's, St Luke's, Limerick, Cork, Galway	42	60	80	92
14	Beaumont, St Vincent's, St Luke's, Limerick, Cork, Galway	42	60	80	92
15	Beaumont, St James's, St Luke's, Limerick, Waterford, Cork, Galway	44	67	87	93
16	Beaumont, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	44	67	87	93
17	Mater, St James's, Cork, Galway	38	53	75	91
18	Mater, St Vincent's, Cork, Galway	38	52	75	91
19	Mater, St James's, Waterford, Cork, Galway	40	59	83	93
20	Mater, St Vincent's, Waterford, Cork, Galway	40	59	83	93
21	Mater, St James's, Limerick, Cork, Galway	41	60	80	91
22	Mater, St Vincent's, Limerick, Cork, Galway	41	60	80	91
23	Mater, St James's, Limerick, Waterford, Cork, Galway	43	67	87	93
24	Mater, St Vincent's, Limerick, Waterford, Cork, Galway	44	66	87	93
25	Mater, St James's, St Luke's, Cork, Galway	38	53	75	91
26	Mater, St Vincent's, St Luke's, Cork, Galway	38	53	75	91
27	Mater, St James's, St Luke's, Waterford, Cork, Galway	40	60	83	93
28	Mater, St Vincent's, St Luke's, Waterford, Cork, Galway	40	60	83	93
29	Mater, St James's, St Luke's, Limerick, Cork, Galway	41	60	80	92
30	Mater, St Vincent's, St Luke's, Limerick, Cork, Galway	42	60	80	92
31	Mater, St James's, St Luke's, Limerick, Waterford, Cork, Galway	43	67	87	93
32	Mater, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	44	67	87	93
33	Dublin, Limerick, Waterford, Cork, Galway	42	66	86	93

Table 3: Percentage of the national population living within 30, 50 and 75 miles of a hospital for each scenario, ranked by size of catchment

Scenario	Hospitals	30 miles	50 miles	75 miles
15	Beaumont, St James's, St Luke's, Limerick, Waterford, Cork, Galway	62.5	82.3	93.3
7	Beaumont, St James's, Limerick, Waterford, Cork, Galway	62.1	82.2	93.3
31	Mater, St James's, St Luke's, Limerick, Waterford, Cork, Galway	62.5	82.2	93.3
23	Mater, St James's, Limerick, Waterford, Cork, Galway	62.1	82.1	93.3
32	Mater, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	62.4	82.1	93.3
16	Beaumont, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	62.4	82.1	93.2
24	Mater, St Vincent's, Limerick, Waterford, Cork, Galway	62.3	81.7	93.3
8	Beaumont, St Vincent's, Limerick, Waterford, Cork, Galway	61.7	81.3	93.2
33	Dublin, Limerick, Waterford, Cork, Galway	61.0	81.0	92.9
11	Beaumont, St James's, St Luke's, Waterford, Cork, Galway	55.6	75.1	93.1
3	Beaumont, St James's, Waterford, Cork, Galway	55.2	75.0	93.1
27	Mater, St James's, St Luke's, Waterford, Cork, Galway	55.5	75.0	93.0
19	Mater, St James's, Waterford, Cork, Galway	55.2	74.9	93.0
28	Mater, St Vincent's, St Luke's, Waterford, Cork, Galway	55.5	74.8	93.0
12	Beaumont, St Vincent's, St Luke's, Waterford, Cork, Galway	55.4	74.8	93.0
13	Beaumont, St James's, St Luke's, Limerick, Cork, Galway	57.9	74.6	91.0
20	Mater, St Vincent's, Waterford, Cork, Galway	55.3	74.5	93.0
29	Mater, St James's, St Luke's, Limerick, Cork, Galway	57.8	74.5	90.9
5	Beaumont, St James's, Limerick, Cork, Galway	57.5	74.4	90.8
30	Mater, St Vincent's, St Luke's, Limerick, Cork, Galway	57.8	74.3	91.0
14	Beaumont, St Vincent's, St Luke's, Limerick, Cork, Galway	57.7	74.3	91.0
21	Mater, St James's, Limerick, Cork, Galway	57.5	74.3	90.7
4	Beaumont, St Vincent's, Waterford, Cork, Galway	54.8	74.1	93.0
22	Mater, St Vincent's, Limerick, Cork, Galway	57.6	73.8	90.9
6	Beaumont, St Vincent's, Limerick, Cork, Galway	57.1	73.0	90.8
9	Beaumont, St James's, St Luke's, Cork, Galway	50.9	66.2	90.3
25	Mater, St James's, St Luke's, Cork, Galway	50.9	66.1	90.3
1	Beaumont, St James's, Cork, Galway	50.6	66.0	90.0
26	Mater, St Vincent's, St Luke's, Cork, Galway	50.9	66.0	90.3
10	Beaumont, St Vincent's, St Luke's, Cork, Galway	50.8	66.0	90.3
17	Mater, St James's, Cork, Galway	50.5	65.9	90.0
18	Mater, St Vincent's, Cork, Galway	50.7	65.4	90.1
2	Beaumont, St Vincents, Cork, Galway	50.2	64.7	89.9

Note: This table has been sorted by the 50 mile values, then 30 mile and 75 mile values.

Table 4: Percentage of the national population living within 30, 60, 90 and 120 minutes of a hospital for each scenario, ranked by size of catchment

Scenario	Hospitals	30 minutes	60 minutes	90 minutes	120 minutes
15	Beaumont, St James's, St Luke's, Limerick, Waterford, Cork, Galway	44.1	67.0	87.0	93.3
31	Mater, St James's, St Luke's, Limerick, Waterford, Cork, Galway	43.5	67.0	86.8	93.2
16	Beaumont, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	44.5	67.0	86.9	93.3
32	Mater, St Vincent's, St Luke's, Limerick, Waterford, Cork, Galway	43.8	66.9	86.8	93.2
7	Beaumont, St James's, Limerick, Waterford, Cork, Galway	43.2	66.8	87.0	93.3
23	Mater, St James's, Limerick, Waterford, Cork, Galway	43.0	66.8	86.8	93.2
33	Dublin, Limerick, Waterford, Cork, Galway	42.1	66.4	86.4	93.0
24	Mater, St Vincent's, Limerick, Waterford, Cork, Galway	43.5	66.4	86.8	93.2
8	Beaumont, St Vincent's, Limerick, Waterford, Cork, Galway	42.8	65.8	86.7	93.3
13	Beaumont, St James's, St Luke's, Limerick, Cork, Galway	42.0	60.4	80.2	91.8
29	Mater, St James's, St Luke's, Limerick, Cork, Galway	41.3	60.3	80.1	91.7
14	Beaumont, St Vincent's, St Luke's, Limerick, Cork, Galway	42.4	60.3	80.2	91.7
30	Mater, St Vincent's, St Luke's, Limerick, Cork, Galway	41.7	60.3	80.1	91.7
5	Beaumont, St James's, Limerick, Cork, Galway	41.0	60.2	80.0	91.4
21	Mater, St James's, Limerick, Cork, Galway	40.9	60.1	79.9	91.3
22	Mater, St Vincent's, Limerick, Cork, Galway	41.4	59.8	79.7	91.4
11	Beaumont, St James's, St Luke's, Waterford, Cork, Galway	40.7	59.7	83.1	93.1
27	Mater, St James's, St Luke's, Waterford, Cork, Galway	40.1	59.7	83.0	93.1
12	Beaumont, St Vincent's, St Luke's, Waterford, Cork, Galway	41.1	59.7	83.0	93.1
28	Mater, St Vincent's, St Luke's, Waterford, Cork, Galway	40.5	59.6	82.9	93.1
3	Beaumont, St James's, Waterford, Cork, Galway	39.8	59.5	83.1	93.1
19	Mater, St James's, Waterford, Cork, Galway	39.6	59.5	83.0	93.1
6	Beaumont, St Vincent's, Limerick, Cork, Galway	40.7	59.1	79.2	91.4
20	Mater, St Vincent's, Waterford, Cork, Galway	40.2	59.1	82.9	93.1
4	Beaumont, St Vincent's, Waterford, Cork, Galway	39.4	58.5	82.9	93.1
9	Beaumont, St James's, St Luke's, Cork, Galway	38.6	53.1	75.1	91.4
25	Mater, St James's, St Luke's, Cork, Galway	38.0	53.0	74.9	91.4
10	Beaumont, St Vincent's, St Luke's, Cork, Galway	39.0	53.0	75.0	91.4
26	Mater, St Vincent's, St Luke's, Cork, Galway	38.4	53.0	74.9	91.4
1	Beaumont, St James's, Cork, Galway	37.7	52.9	74.8	91.0
17	Mater, St James's, Cork, Galway	37.5	52.8	74.7	90.9
18	Mater, St Vincent's, Cork, Galway	38.1	52.5	74.6	91.0
2	Beaumont, St Vincent's, Cork, Galway	37.3	51.8	74.0	90.8

Note: This table has been sorted by the 60 minute values, then 90 minute and 30 minute values.

Commentary

All of the scenarios considered above contain the hospitals in Cork, Galway and a northside and southside Dublin hospital. As such, this grouping might be considered as a basic set providing a minimal population coverage.

The five Dublin hospitals included in the study are all within 8 miles of each other and as a consequence cover approximately the same catchment area from the regional perspective. This implies that the inclusion or exclusion of St. Luke's in the equation does not have any significant impact on the population covered in the Dublin area. An additional scenario was tested which included a single Dublin location (St. Luke's) along with the hospitals in Cork, Galway, Limerick and Waterford.

The scenarios can be divided into three subsets:

- The basic scenarios that only include Cork, Galway and selected Dublin hospitals
- Scenarios that, in addition to the basic scenarios, include either Limerick **or** Waterford hospitals
- The addition of **both** the Limerick and Waterford hospitals to the basic scenarios.

In consideration of a less than or equal to 60 minute travel time allowance:

- the basic scenarios (1) give a coverage of between 52 – 53% of the national population (shaded pink in Tables 3 & 4)
- The addition of Limerick **or** Waterford hospitals raises the coverage to 58 – 60% of the population (shaded light green in Tables 3 & 4)
- Finally, including both Limerick **and** Waterford hospitals increases the coverage to 66 – 67% of the population (shaded dark green in Tables 3 & 4).

Therefore the inclusion of both Limerick **and** Waterford hospitals would increase the population within 60 minutes travel time by up to 15 per cent.

It is important to note that the population catchment for Waterford hospital with an allowance of 60 minutes travel time would embrace the towns of Enniscorthy, Kilkenny and Wexford which, in terms of their contribution to coverage is relatively large – much larger than Waterford city alone.

In consideration of the addition of Limerick hospital, the 60 minute travel time limit takes in the towns/areas of Ennis, Shannon and the satellite towns around Limerick. The extra population thus included make the contributions of Limerick and Waterford hospitals much more significant than they would be if a 30 minute limit on travel time is to be considered, as this would preclude the population in the towns/areas of Ennis, Shannon, etc.

At a 90 minute travel time band, the inclusion of the hospitals at Limerick and Waterford increases the catchment population by 12 per cent from when both are excluded. At this travel time band, Waterford encompasses a larger population than Limerick to the order of 3 per cent. This reflects the fact that there are numerous large satellite towns between Dublin and Waterford which are within 90 minutes of the latter.

When considering the 120 minute travel time band, the differences in catchment populations across scenarios are much smaller. This is due to the fact that 93 per cent of the national population lives within 120 minutes of one of the major cities. The cities are also within 240 minutes of each other so the catchments of the hospitals would overlap at this extreme to the extent that 43 per cent of the population lives within 120 minutes of more than one of the main cities. If one hospital is excluded, the population it would have encompassed is mostly within 120 minutes of one of the other hospitals.

In terms of maximising the catchment population, there is no significant advantage to including three Dublin hospitals as opposed to one. The addition of two Dublin hospitals increases the catchment population by under 1% in each travel time band.

It is important to note that all calculations are based on car travel alone and public transport was not considered. Interpretation of the results also depends on the assumption that people will travel to the nearest hospital. While this may broadly be true it is likely that instances will arise where people will travel a greater distance than is necessary. This is often due to personal preference or other unaccountable reasons. The results do not account for the capacity at any of the hospitals included in a particular scenario.

Glossary

Accelerated Fractionation – The use of multiple daily increments, each equal to or less than a standard daily increment (i.e. 180-200 cGy) for an overall time which is shorter than standard.

Betatron – An accelerator first used for radiotherapy in the 1950s prior to the introduction of linear accelerators. Although X-ray and electron beams can be provided over a wide range of energies, the low dose rates and limited field sizes result in an unfavourable comparison with modern linear accelerators.

Brachytherapy – A method of treatment using sealed radioactive sources to deliver radiations at short distances by interstitial, intracavitary or surface applications.

Cancer – A term inclusive of a variety of malignant neoplasms; derived from the Latin word for crab.

Cesium-137 – A radioactive isotope with a half life of 30 years; emits gamma radiations with an energy of 660 keV most commonly used in intracavitary sources; found early use as teletherapy sources and in interstitial needle sources; sometimes used in remote afterloading brachytherapy.

Cobalt-60 – A radioactive isotope with a half life of 5.3 years; emits gamma radiations (1.17 and 1.33 MeV); used as a teletherapy source; found early use in interstitial and intracavitary needle sources; sometimes used in remote afterloading brachytherapy.

Cure – Actually implies complete restitution to pre-disease status; may be used for that situation when, after a disease-free, post-treatment interval, the survivors have a progressive death rate from *all* causes similar to that of a normal population of the same age and sex.

Dosimetrist – A member of the radiation therapy planning team who must be familiar with the physical characteristics of the radiation generators and radioactive sources used to treat patients; training and expertise necessary to generate and calculate radiation dose distributions, under the direction of the medical physicist and radiation oncologist, are necessary.

Electron – An atomic particle with a negative electric charge which may be accelerated to strike a target and produce X-rays or used collectively as a beam for treatment.

Gamma Rays – Electromagnetic (photon) radiations which are emitted from an unstable atomic nucleus; for example, gamma rays are emitted from Cesium-137, Cobalt-60 and Radium-226.

Hyperfractionation – The use of multiple daily increments, each considerably smaller than a standard daily increment over a conventional period.

Hyperthermia – Elevation of the body temperature regionally (i.e., 42-45°C) or systemically (i.e. 41.8°C) resulting in direct cell killing and augmentation of the effects of the other cytotoxic agents.

Interstitial Radiation Therapy – Sealed radioactive sources within special applicators placed in tissue in a preconceived pattern.

Intracavitary Radiation Therapy – Radioactive sources in closed containers placed in body cavities, i.e. uterus, vagina.

Ionizing Radiations – Radiant energy, which is absorbed by a process of imparting its energy to atoms through the removal of orbital electrons.

Iridium-192 – A radioactive isotope with a half life of 74 days; emits gamma (300-600 keV) radiations; used in interstitial therapy; sometimes used in remote afterloading brachytherapy.

Linear Accelerator – A device in which particles (i.e. electrons, protons) can be accelerated to high energies along a straight path using microwave technology.

Linear Energy Transfer (L.E.T.) – A measure of the average rate of energy loss along the track of a charged particle, expressed as energy units per unit track length.

Medical Radiation Physicist – A professional with at least a master's degree and usually a PhD in physics plus additional training and experience in diagnostic and/or therapeutic radiologic physics; most are certified by the American Board of Radiology or its equivalent.

Megavoltage Radiations – An ill-defined, frequently used term for ionising radiations with energies equal to or greater than 1 MV.

Microtron – An electronic generator similar in principle to a linear accelerator but with magnetic bending of the electron paths into circular orbits; a single generator may supply beams to several treatment rooms.

Oncology – The study of tumours; no specific relationship to a medical discipline; applies to surgery, radiology, internal medicine, paediatrics and gynaecology.

Ortho-voltage X-rays – A term which applies to X-rays of insufficient energy to be 'skin sparing' or to avoid preferential absorption in bone; usually generated at 150-400 kVp; may be divided into superficial and deep X-rays although often used interchangeably with deep X-ray.

Palliation – Relief or prevention of symptoms or signs caused by disease.

Penumbra – Those radiations just outside and adjacent to the full beam including components from incomplete beam collimation and scatter from the primary beam.

Radiation Dose – Energy imparted per unit mass of absorber at a specific site under certain conditions (absorbed dose, threshold dose, tumour dose, depth dose, permissible dose).

Radiation Oncologist – A physician with a special interest and competence in managing patients with cancer; minimal requirements include the FFRRCSI or equivalent and the completion of a CCST/CSD (see section 6).

Radiation Oncology – A clinical medical speciality with a specific involvement with tumours, particularly as they relate to treatment with ionising radiations.

Radiation Oncology Nurse – A registered professional nurse who, as part of the radiation oncology team, provides appropriate direct intervention to aid the patient and family with problems related to the disease, treatment and follow-up evaluation; recommended minimal qualifications include a baccalaureate degree in nursing, two years' experience in medical-surgical nursing and at least one year's experience in oncology nursing.

Radiation Therapy – Treatment of tumours and a few specific non-neoplastic diseases with ionising radiations.

Radiation Therapy Technologist – A highly skilled professional who is qualified by training and experience to provide treatment with ionising radiations under the supervision of a radiation oncologist.

Radioactivity – Emission of radiations from the breakdown of unstable nuclei, which occurs naturally or is artificially produced.

Radionuclide – A radioactive form of a nuclide, which is any nuclear species of a chemical element capable of existing for a measurable time; often an isotope, with the same number of protons but a different number of neutrons, is referred to as a nuclide.

Simulation – Meaning to pretend; in radiation therapy, the precise mock-up of a patient treatment with radiographic documentation of the treatment portals.

Stereotactic Radiation Therapy – A method using three-dimensional target localisation, which enables precise irradiation of small intracranial lesions.

Superficial X-rays – Minimally penetrating X-rays of low peak energy, generated by voltages in the range of 85-140 kV; used to treat lesions on the body surface.

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