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Review Article

Revised European core curriculum for RTs

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Abstract

Aim: To update the first version of the European core curriculum to reflect many developments in radiotherapy and educational philosophy that have taken place in the interim period.

Materials and methods: The first version of the European core curriculum was reviewed by the Steering Group together with current education programmes from the various member states and taking into account the developments and changes that have taken place in radiotherapy. From these initial meetings, a working document and provisional timetable were prepared. Given the diversity of the existing programmes, the language difficulties and lack of national curricula it was agreed that a representative from both the clinical and academic areas endorsed by their national professional body would be identified for each country. These participants were then invited to participate in two workshops and the working document and timetable were circulated. Two workshops were held and a final draft document was circulated to the professional bodies and other interested groups.

Results: The revised European Core Curriculum for RTTs was endorsed by the participants of the workshops representing academic and clinical areas of all the member states and was welcomed by the wider circulation. Compared to the first version the revised curriculum describes the background underpinning the practice of radiation therapy and the variation across the member states, issues of staffing, educational philosophy, certification level, legislation governing recognition of qualifications and a core syllabus.

Conclusion: The revised core curriculum is an important step in the progress of professional recognition for RTTs, towards harmonisation of education programmes in Europe and meeting the aim of best practice and equality of care for all patients receiving radiotherapy. Responsibility for developing education programmes from the curriculum will rest with the local and/or national education bodies and authorities.

Keywords: Radiotherapy; Radiation therapy; Curriculum; European harmonisation; Best practice; Title; Certification; Legislation

1. Introduction

In 1995, the European Radiation Technologists Education Development Group (ERTED) now called the Radiation Therapy Technologists Committee (RTT) of ESTRO published the first version of the European Core Curriculum for Radiation Therapy Technologists. This document was used by educationalists as part of their course development or restructuring.

Many changes have taken place in the intervening period that necessitated a revision of this core curriculum in order to reflect changing practice and professional status. These changes will be discussed in more detail in the following sections. One of the main issues is a professional title that would give international recognition to the profession. Given the difficulties associated with title change it was agreed that the letters **RT** would still be used as a generic descriptor and each country would continue to use the recognised national professional title until such time as unanimous change could be agreed at European level (Section 3).

A core curriculum is necessary to set standards which are recognisable across all member states. Graduates of a course designed from this core curriculum will be in a better position to influence RTs practice in their own departments and also in their own countries. A core curriculum will facilitate the development of local or national programmes based on identified essential topics. An accepted and implemented core curriculum will support the aspiration of freedom of movement within Europe.

The core, or universally required, component of any so-called core curriculum is intended to provide common

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learnings, or general education, for all students. That is, it constitutes the segment of the curriculum that teaches the common concepts, skills and attitudes needed by all individuals for effective functioning [1].

It is also important to consider the expansion of the European Community with the accession of 10 new member states, Estonia, Latvia, Lithuania, Poland, Czech Republic, Slovakia, Slovenia, Hungary, Cyprus and Malta, over the coming decade. This core curriculum will help these member states to ensure that their education level is equal to that of the existing members thus supporting the aspiration of freedom of movement for RTs from these new states also.

The Europe Against Cancer Programme provided funding in 2001 for this project and a steering committee was established and the membership was Mary Coffey Ireland (Project leader), Jan Degerfält, Sweden, Judocus van Hedel, The Netherlands, Andreas Osztavics, Austria and Guy Vandevelde, Belgium.

The workshop participants were drawn from all member states and from academic and clinical backgrounds which allowed for all perspectives and national practices to be considered (Appendix A).

2. Background

2.1. Cancer incidence

Cancer is the main cause of morbidity and mortality in the European Union after cardiovascular diseases. For a population of 322 million inhabitants, 750,000 die annually of the disease. J.P. Armand, in an advisory report to the Commission, predicted that by the year 2000, 2 million people would develop cancer [2]. It is accepted that the number of people developing cancer will continue to increase given the factors described below.

Cancer is recognised as predominantly a disease of the elderly and with the ageing population in Europe it is estimated that there will be a significant increase in the patient caseload and therefore the requirement for radiation therapy services. This will put an extra burden on education centres to increase the numbers of students recruited and the group has addressed this to a limited extent.

The increasing use of screening has led to earlier diagnosis of some cancers and, in particular, the increased diagnosis of early breast cancer will have a significant impact on referral rates to radiation therapy.

2.2. The role of radiation therapy in cancer management

The three main treatment modalities used in cancer management are surgery, radiation therapy and chemotherapy The World Health Organisation recognises that at least 50% of all patients with cancer require radiation therapy at some stage of their disease and up to 60% would benefit from radiation therapy. An estimated 40% of people with cancer can expect a normal life expectancy or cure following treatment and up to 18% of these cures can be attributed to radiation therapy [3].

To treat a person effectively, one, two or all three-treatment modalities may need to be combined at the same time or at different stages through the disease history. International best practice is agreed that optimal outcomes are achieved through co-ordination of radiation therapy and other surgical, medical and palliative oncology services. This is important from the perspective of RT education as they must be aware of the timing of and understand the synergistic effects of such combined treatment approaches.

Radiation therapy has a critical role in the spectrum of care, particularly in the management of many types of early stage cancer, with an additional major role in the optimal care of locally advanced malignancy, and metastatic disease.

The benefits of radiation therapy are not confined to malignancy, it is also used in the treatment of some benign diseases, for example radioiodine treatment offers rapid and effective therapy of certain common benign thyroid conditions. 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.

All of these aspects of radiation therapy application have been considered and addressed in the development of this core curriculum.

2.3. The radiation therapy process

Radiation therapy is a complex process involving many steps, personnel and equipment. The accuracy with which each step is carried out has a major impact on both tumor control and normal tissue complications/patient morbidity. In terms of outcome events, the existing literature suggests that changes in the radiation treatment dose of less than 5–10% are clinically detectable in patients. It is further recognised that changes in dose of the order of 5% may result in more dramatic reductions in the chance of tumor response and patient cure. These factors necessitate an exceptionally 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.

The International Commission on Radiological Protection in their report on the Prevention of Accidental Exposures to patients undergoing radiation therapy state

- "Radiation therapy involves many steps between prescription and dose delivery. Each step may involve a large number of parameters that must be selected, adjusted, recorded and communicated between different professionals. For example, the delivery of 30 fractions by external beam, each with four fields, requires around 15 parameters to be set for the first field and half this number changed for the other fields; in total, the requirement is to set about 1000 parameters for the entire treatment. The set-up for each patient is similar, but not identical. The number of parameters is much larger in conformal therapy using multi-leaved collimators and intensity modulated beams, although these are usually computer controlled.

- For treatment units without computerised 'record-and-verify- systems, the radiation technologist has to enter manually parameters in patients' treatment charts. This may be required for up to one hundred treatment beams daily. This is done in a repetitive way, but is different for each patient.
- Sophisticated technology, computer calculations, and data transfer, are combined with manual activities, e.g. preparation of organ shielding and immobilisation devices" [4].

Failure to carry out these procedures accurately can result in failure to control the disease and a reduced chance of cure, and a greater risk of the side effects associated with significant normal tissue damage. This has major implications for RT education programmes as the RT must be aware of the interaction between radiation and matter and the impact of a failure to comply with this level of accuracy. It also has implications for the standard of any education programme developed and the level of knowledge and understanding of the processes that are necessary to accurately deliver radiation therapy.

2.4. Technological developments

Recent developments in computer technology and linear accelerator design, combined with refinements in imaging of tumors, have enabled the development and widespread clinical implementation of three-dimensional Conformal Radiation Therapy (3-DCRT). The latest development of this approach has been the early clinical use of Intensity-Modulated Radiation Therapy (IMRT). Both 3-DCRT and IMRT technologies have led to a reduction in short and long term morbidity and have improved the therapeutic ratio for many cancers. The use of Intra-operative radiotherapy (IORT) also has potential in this respect and this facility is being introduced into many departments. 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. There is now evidence that cancer relapse rates are reduced by the application of higher doses of radiation therapy made possible using 3-D and IMRT technologies.

There have also been significant developments in the clinical assessment of disease, particularly with the development of the sophisticated diagnostic imaging technologies of CT, MRI and PET and the preliminary use of image fusion technologies as part of the radiation therapy treatment planning process. Computerisation has led to a need for increased rather than decreased understanding of the underlying principles and an ability to be able to readily reflect and interact in every given situation. Again this has implications for education programmes that must ensure that graduates are competent in the application of these new techniques and can adapt to evolving technologies. The need for continuing professional development as an integral part of any education development is a key to ensuring a competent workforce in the future.

2.5. Clinical developments

In addition to the technical developments there have also been significant clinical developments that will have an impact on both patient and departmental management in the future There is a considerably expanded body of knowledge of the fundamental mechanisms that underpin both tumor and normal tissue response to radiation, and, as a consequence, there is now a greater ability to prospectively examine novel radiation therapy approaches. Results from more recent international fractionation studies, based on a greater understanding of radiobiology and molecular oncology, support the introduction of novel fractionation regimes for designated tumor sites. New treatment planning approaches allow for more accurate predictions of normal tissue complication probability and there is an increasing use of biological agents to enhance the therapeutic effect. These developments, when introduced into the workplace, will impact on professional and work practice and graduates must have an understanding of the scientific basis for these developments, their effect in practice and methods of monitoring outcomes.

2.6. The practice of radiation therapy

The future implications in terms of the increasing complexity of equipment and techniques and the increased awareness and expectations of the patient population must be considered Recent developments in radiation therapy technology and clinical practice highlight the trends towards increased sub-specialisation within the discipline. These trends also witness and support a need to develop comprehensive multi-disciplinary clinical teams that can address the many aspects of integrated care that cancer patients require. The future development of such teams will, to a considerable degree, depend on appropriate resource allocation and organisational structures that ensures the development of clinical teams with an appropriate critical mass of core health care professionals and treatment infrastructure. This is important for the professional development of the radiation therapy service in general and the RT in particular. The education programmes must support developments of this kind by providing the background knowledge and clinical skills to allow for sub specialisation within the profession. For example in several departments changing work practice is already being implemented with RTs taking direct responsibility for specific groups of patients, monitoring side effects, carrying out on treatment review clinics, and post treatment review for specific sites. The aim of any change in working practice should benefit the patient but should also be viewed in the context of retention and motivation of staff by offering potential career pathways.

It is our contention that these proposals will enhance the service offered, serve to minimise error or potential error, more effectively and efficiently utilise the specific skills of each professional group and will result in a more cohesive experience for the patients referred for radiation therapy as part of their treatment. An education programme for the RTs must ensure that the specific skills and expertise of the radiation therapist are appropriately developed to facilitate the introduction of new work practices and a move towards an evidence based quality rather than quantity driven service.

2.7. Staffing requirements and relationship to student recruitment

As radiation therapy is a professional qualification there is a direct relationship between the staffing levels in the radiation therapy departments and the recruitment levels into education programmes In most countries, at the time of writing this document, there is a significant shortage of qualified staff. This has implications for service delivery and also for the maintenance of an education standard. Individual countries are addressing these difficulties in many ways some of which impact directly on the level of the education programme offered or the subsequent professional role. In introducing a new or revised curriculum or in evaluating an existing programme it is important to ensure that recruitment levels are calculated in such a way as to take into account the time delay between recruitment and qualification and to ensure that sufficient students are enrolled to meet the service demand in the future. It is important for the academic and clinical community to liaise closely in this regard in order to maintain the educational standards while, at the same time, meeting the service requirement. Issues of recruitment and retention are therefore central to any wider discussion on education for the profession.

2.7.1. Staffing levels

There are a limited number of publications in existence that outline the recommended international norms for RT staffing There are, however, 'norms' which are accepted internationally. Methods for reporting the number of RTs required have historically been based on numbers per linear accelerator, simulator etc and this method has been consistent in terms of past working practices. Given the increasing complexity of radiation therapy, the need for a holistic approach to patient care and the impact of degree level education working practices are changing internationally and a revised model for reporting the number of RTs is likely to evolve.

Current international staffing recommendations are four RTs per linear accelerator, three per cobalt unit and two per simulator. Other areas will vary according to the level of activity. These recommendations are given in The College of Radiographers and The Royal College of Radiologists report 'Radiographer Staffing in Radiation Therapy Departments' published in 1979 and again in the 1999 report for the United Kingdom Department of Health 'A Survey of Radiation therapy Services in England (1999) which states that The Royal College of Radiologists and the College of Radiographers have also published documents recommending minimum staffing levels for therapy radiographers. These report recommended a minimum of four whole time equivalent radiographers 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.

In a report on The Provision and Replacement of Radiation therapy Equipment by the Board of Faculty of Clinical Oncology of The Royal College of Radiologists published in 2000 reference is made to work of the Society of Radiographers in 1999 to try to determine the number of therapy radiographers required nationally to meet the demands of the service. Their findings were 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. This report also cited the fact that there are currently insufficient radiographers in the United Kingdom to serve the current levels of equipment provision.

The report of the Royal College of Radiologists on 'Equipment, workload and staffing for Radiation Therapy in Scotland' published in 2000 also refers to the 1979 document as the only published standards for staffing levels for radiographers and goes on to state 'These guidelines almost certainly underestimate the need for staff on modern LinAcs and will need to be revised upwards; they have, however, been used as a standard against which current staffing levels can be judged (p. 8. 4.11.2). They also make two further comments in relation to staffing levels as per the findings of their survey:

- "A considerable variation was noted in the average workload per treatment radiographer. Very high and low levels were seen in all sizes of department. High pressure of work is undesirable because of the risk of error and the effect that this may have on the quality and safety of treatment" (p. 10 4.11.5)
- "LinAcs staffed by four or more radiographers generally achieved higher workload than LinAcs 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" (p. 10 4.11.6)

Extended roles, that more effectively utilise the knowledge and skills of the radiation therapist and enhance the service delivered, have been implemented in many departments in the United Kingdom. The lack of consistency on a national basis is currently being reviewed but this will also change the staffing requirements of departments.

In a report prepared by an advisory committee for the Ministry for Health in The Netherlands 'The National Health Council Report on the Future Needs of Radiation Therapy' the recommendation of four radiographers per linear accelerator that had been first made in the report of 1984 was re-iterated. (Ontwikkelingen in de radiotherapie: Een behoefteraming voor 1995–2010. Advies van een commissie van de Gezondheidsraad, 1993). In their most recent report there is an indication that this number may need to be increased given the complexity of current and future treatments. Centres in The Netherlands are now moving to a more patient centred approach to staffing levels and are revising the model used from unit based to a reflection of the patients treated in the department.

The Radiation Therapy Advisory Panel to the Australian Institute of Radiography has endorsed a recommendation of 1.06 radiation therapists per hour of linear accelerator operation. The RTAP staffing model excludes brachytherapy and other specialities that can be highly labour intensive in terms of radiation therapists' time. Furthermore it does not adjust for the number of radiation therapist hours spent on orthovoltage and superficial X-ray treatments that vary markedly between departments. For those departments undertaking significant amount of speciality work, the model needs to be adjusted to reflect their different practice [5].

2.7.2. Staff retention

It was agreed that, with the exception of Austria, there was a staffing problem in most countries at the time of this review. The group spent some time discussing issues relating to staff retention and the following views were amongst those expressed. There is a perceived lack of status for RTs and promotional opportunities are often not based on ability, knowledge or attitude but on years of service. The career structure is limited and there is lack of incentive for post-graduate education. The salary does not reflect the level of responsibility taken and there is a lack of opportunity to supplement salary levels in many countries. A more in depth review of the underlying reasons suggested the lack of a title which reflects our professional role and therefore a lack of understanding of what exactly our role is, the negative image which is still often associated with radiation therapy, the reluctance of RTs to present and publicise their work and the failure, in some countries, to implement continuing professional development as a requirement.

2.7.3. Student recruitment

Difficulty in student recruitment is not a universal experience Austria and Ireland do not have any difficulties in recruitment whereas other countries identified significant problems. Training programmes vary considerably between countries and the outcomes are very different. In some countries training only takes place when there is a service need or sufficient students can be recruited. The association with a negative image, a lack of awareness of radiation therapy and lack of willingness of young people to work in the healthcare system was cited. The lack of professional status for RTs was also identified.

2.7.4. Student retention

International figures show a 25% attrition rate from first year university courses It was agreed that this figure was reduced with mature student intake. In some countries the experience is that students are using radiation therapy as a 'stepping stone' into medical education. Finances were often a difficulty and resulted in students failing to complete the programme.

2.8. Current education situation

The current situation in relation to education programmes is very varied. Four countries currently offer radiation therapy specific education programmes, seven joint radiation therapy, diagnostic imaging and nuclear medicine programmes and three countries offer post graduate based programmes. Only The Netherlands still offers In Service Education (Table 1).

2.9. Conclusions/recommendations

Efforts must be made to raise the professional profile of RTs. As a starting point the identification of a single acceptable title and associated standard education programmes will facilitate a greater understanding and awareness of our role.

Table 1
Education programmes

Radiation therapy only	Joint courses	Postgraduate nursing based
UK	The Netherlands	Belgium
Ireland	Austria	Sweden
Portugal	Italy	Denmark
Spain	Finland	Postgraduate diagnostic based
Greece (secondary education)	France	Denmark
In service		
The Netherlands	Greece (University level—third level education)	Sweden
	Germany	

3. The profession of RT

RTs are the group of professionals with direct responsibility for the administration of radiation therapy to cancer patients. This encompasses the technical delivery of the radiation dose, the clinical care and the psychosocial care of the patient on a daily basis throughout the treatment preparation, treatment and immediate post treatment phases. The RT is a member of the multidisciplinary team comprising essentially the clinician, physicist and RT. As the RT sees the patient on a daily basis he/she is also often a link person for the patient within the wider multidisciplinary team. They liaise with all the other associated professionals in ensuring the needs of the patient are met.

The ICRP, in their most recent report of 2000, acknowledge this role: radiation therapy technologists have the responsibility for the set-up and delivery of the treatment, are involved in the simulation of the treatment, and have, therefore, an essential function in noticing any abnormal reaction of the patient or the machine and to report them. Thus radiation therapy technologists play an important role in preventing accidents [6].

3.1. Title

The lack of a single title creates difficulties in terms of identity and also in facilitating the free movement of personnel that is integral to the development of the European Community and a clearly identified aspiration. All recognised professions have an internationally accepted title that defines, within national limits, their role. This has not been the case for the professionals directly involved in the delivery of radiation therapy to patients. Currently, many different titles are used throughout Europe to describe the members of our profession (Table 2).

At the consensus conference for the first core curriculum in 1995, it was agreed that the professional descriptor Radiation Technologist would be used to encompass all the titles used across Europe to describe the discipline. This title was, in fact, unacceptable to the majority of the group and it was agreed, at that time, to use the letters RT as a compromise.

The current working group agreed that a single title was necessary to accurately reflect the profession and to give an international identity. The title Radiotherapy Technologist was still unacceptable to the majority of the participants.

Table 2
Titles used per country

Country	Title
Austria	Diplomierte/er radiologisch technische;/er Assistent/inDRTA or Dipl.RTA
Belgium	Verpleegkundige Radiotherapie-Verpleegkundige Infirmier en Radiothérapie
Denmark	Stråleterapisygepelejerske/Stråleterapiradiograf
Finland	Röntgenhoitaja
France	Manipulateur en électroradiologie Manipulateur en radiothérapie Technicien de radiothérapie Cadre médicotechnique Cadre manipulateur
Germany	MTRA
Greece	O Technologos Aktinologos = Medical Radiological Technologists (University level third level of education) O Radiotherapy machines' users (secondary education)
Ireland	Therapeutic Radiographer Therapy Radiographer Radiation Therapy Radiographer Radiation Therapist[a]
Italy	TSRM Tecnico Sanitario di Radiologia Medica
The Netherlands	Radiotherapeutisch Laborant Radiation therapy Technologist Therapeutic Radiographer
Portugal	Técnico de radioterapia
Spain	Técnico superior especialista en RT
Sweden	Onkologisjuksköterska
United Kingdom	Therapeutic Radiographer Therapy Radiographer Radiation Therapy Radiographer Radiographer Radiotherapist

[a] Following the publication of The Expert Report the title Radiation Therapist has been introduced nationally as the single title.

Discussion ultimately focussed on two options Radiotherapist or Radiation Therapist. The title Radiation Therapist is used in Australia and the United States and has recently been adopted in Ireland following the publication and recommendation by an Expert Review Group and the profession. There are difficulties with Radiotherapist as this is still used in many EU countries by the clinicians and it is also their title by European Charter. The title Radiation Therapist was the consensus view of the group. Given the difficulties associated with title change it was agreed that the letters RT would still be used as a generic descriptor and each country would continue to use the recognised national professional title until such time as unanimous change could be agreed at European level.

3.2. Autonomy

Given the level of responsibility undertaken by RTs in the performance of their role it is important that their education standard is such that it allows for a level of professional autonomy within the context of a multidisciplinary approach to patient management Autonomy, in this context, refers to taking personal responsibility for her/his role in the accurate preparation and administration of a course of radiation therapy and the subsequent monitoring of the patient while they are attending the treatment unit.

4. Education philosophy

In defining the content of any education programme it is necessary first to look to the local needs in terms of the departmental structure, the already defined roles, the current role of the RT and their own professional aspirations. The existing role varies significantly both between and within the member states.

Role development is a reality in many centres and will undoubtedly improve the service and give greater professional stimulation and motivation, however it frequently suffers from the lack of a co-ordinated approach and the backing of formal education programmes. Continuous Professional Development is being introduced in many countries and, in addition to maintaining a competent workforce, will drive and encourage role development. Greater co-operation within and across countries may create a more cohesive approach to evolving professional practice.

It is important to look from the international perspective at how the RT could contribute and impact at international level given the appropriate knowledge and skills background. The core elements of the role must be examined and the current education programme evaluated to determine whether these needs are met. However it is also essential to bear in mind the developments in the field and how graduates are equipped to meet future challenges. Elements of the education programme should afford graduates the opportunity to participate in, initiate or carry out research projects as part of a team or independently and they should have the necessary skills to prepare publications and make presentations. It is important that any education programme is the starting point of a lifetime of learning.

4.1. Course duration

It is recommended that any programme developed from this core curriculum should be of a minimum of 3 years duration Of this one year should be devoted to clinical practice and this should be on a continuum of change from theory to practice over the programme. The emphasis in the first year(s) should be on the academic content and establishing a strong scientific basis and in the latter years on the application of theory to clinical/reflective practice and the development of research skills.

Three years has been agreed as the minimum duration in order to ensure:

- The acquisition of sufficient knowledge and understanding of the scientific basis underpinning the practice of radiation oncology. This includes the technical application and psychosocial care of the patients
- Sufficient time to develop professional attitudes to practice and to continuing professional development
- Sufficient time to acquire the basic competencies necessary for the accurate preparation and application of radiation therapy

Based on these criteria outlined below are the aims and objectives defined for the core curriculum. These reflect the overall role of the RT both now and in the future.

4.2. Curriculum content—introduction

Students should have exposure to a wide range of practices but must gain experience in the core elements essential to radiation therapy delivery.

Exposure and experience need not necessarily be distinct and will vary across countries. This core curriculum is designed to allow for individual differences to be facilitated but to ensure that all RTs have achieved a common set of transferable skills. The working group have discussed these skills at length and have agreed that experience is essential in the following areas. The detailed syllabus content that is considered necessary in order to meet these aims and objectives is given in Section 7.

4.3. Aims

- To produce a reflective radiation therapy practitioner
- To achieve technical, clinical and psychosocial competence

- To enable the establishment of a research base for the profession led by the RTs
- To establish guidelines for RT research
- To move towards evidence based practice
- To achieve a uniform standard across the European Community
- To support free movement of RTs within Europe

4.4. Overall objectives

- To develop an understanding of the technical and clinical basis of radiation therapy
- To be able to give psychosocial support to the patient
- To develop problem solving skills
- To develop transferable skills
- To develop team skills
- To develop research skills

4.4.1. Pre-treatment objectives

In the pre-treatment area the student must learn to

- recognise the end point of the process ie. delineation of the treatment volume and the patient position necessary to ensure that this volume can be treated accurately every day.
- define the steps which should be followed to achieve this.
- identify the appropriate imaging method for each patient in order to produce the information required subsequently for planning and treatment with regard to efficient use of the available resources.
- carry out these procedures.

The student must have gained experience in CT and simulation and should have exposure to MRI, PET and US. These parameters may change as technology and practice evolves.

4.4.2. Planning objectives

A significant percentage of the planning experience can be gained in skills laboratories within the academic setting However, the group recommend that some time should be spent in the planning department to enable students to become familiar with planning in practice. In the planning area the student must learn to:

- Understand the requirements of an acceptable treatment plan
- Identify the factors which must be considered in preparing a treatment plan
- Follow the steps required to achieve an optimal treatment plan

4.4.3. Treatment delivery objectives

Basic skills can be introduced in the academic setting but it is essential that students spend significant time in the clinical environment Students should develop competency in:

- Interpretation and evaluation of the treatment plan, prescription sheet and clinical status of the patient
- safe handling of equipment which includes accuracy and precision of daily set up and verification
- patient care which includes managing of side effects, immediate post treatment review, giving of information and psychosocial support
- multi-professional team work which includes instruction of students and communication

5. Education methodology

5.1. Academic environment

The importance of providing an adequate learning environment for the students must be prioritised Both physical infrastructure and teaching staff must be adequate for the delivery of an optimum programme. Guidelines for minimum standards are indicated below and should be compulsory for the development of any new programme developed from this core curriculum. Existing institutions should attain the recommended levels over a designated period if they are not already in place.

5.1.1. Physical infrastructure

- Teaching areas that meet the health and safety standards for the methods used These will vary depending on whether the main methodology is didactic lecture, small group teaching or problem based learning.
- Adequate computer facilities for the student numbers. This includes both hardware and software capacity and intranet and internet access. If 'e' learning or distance learning are an integral part of the programme the number of available computers must reflect this.
- Student common room facilities
- Library access with sufficient variety of relevant textbooks, reference books and current journals available for student use. The appropriate computerised databases should also be available.

5.1.2. Academic staff

In each institution there should be a course/programme director. Depending on the structure of the educational institution this post should have the appropriate level of authority or autonomy to allow decisions that directly affect the day to day running and development of the programme. The director is responsible for the overall management of the programme that includes ensuring that the criteria for the programme are implemented and outcomes achieved, national or professional requirements are met and ongoing development is ensured.

The dedicated academic staff numbers should meet national or institutional student/staff ratios as a minimum.

Given the high clinical input it may be necessary to increase this ratio. The dedicated staff should maintain their own knowledge of the changes taking place in oncology generally and radiation therapy specifically and on current thinking on education philosophy and developments. Academic staff should reflect the content of the programme and lecturers from the various professional disciplines should be invited to participate where necessary. Regular staff meetings should be held to review the aims and objectives of the course, its effectiveness, educational validity and future developments.

It is desirable that academic staff participate actively in national and international professional organisations. It is essential that they maintain close contact with clinical staff. To maintain their knowledge and expertise in a rapidly developing profession academic staff must attend profession specific courses or conferences at both a national and international level.

5.2. Clinical environment

5.2.1. Clinical infrastructure

It is essential that students are exposed to the widest possible clinical experience It is a requirement that the School assess all clinical sites where students are going to be placed prior to their inclusion in the clinical education programme There should be periodic review of all associated centres and audit of outcomes to ensure standards are maintained or improved. The clinical programme must be regularly updated in conjunction with the staff of the clinical departments to ensure all developments are integrated into both the academic and clinical components.

Placements must include dedicated time spent on multi energy, dual modality linear accelerators, orthovoltage/ superficial units, simulators and CT scanners. Students must spend time in a computerised treatment planning department, mould room and brachytherapy facility. Students should also have exposure to the diagnostic modalities commonly used in conjunction with radiation therapy. It is also desirable that students have exposure to other general aspects of patient care such as can be gained on radiation therapy wards or in radiation therapy related clinics.

Where a single department cannot offer this range of experience arrangements must be made to facilitate this experience in the school setting or in an alternative radiation therapy department. Where specialist procedures are carried out in designated centres it is important that arrangements are made for students to attend these centres for an agreed period of time.

The clinical departments should be encouraged to take some responsibility for the education of students to ensure stability for future programmes. This is already the case in several departments but it is not universal even within countries and is often dependent more on goodwill than policy. The academic body is ultimately responsible for setting the standard but the clinical staff are more familiar with current equipment and techniques and should take an active part, therefore, in clinical education.

5.2.2. Clinical educators

The objectives of the clinical programme are to ensure that the student:

- Develops skills in the technical aspects of radiation therapy
- Develops problem solving skills
- Is a reflective practitioner,
- Can provide psychosocial support to patients
- Is able to transfer knowledge and skills to new situations
- Develops team skills

Clinical RTs should, therefore, play an active role in the training programme. The group acknowledges the difficulties encountered in achieving this and particularly noted are lack of time to devote to the students, lack of formal training programmes for clinical staff to enable them to train students and no financial reward or other motivation. It is important that time and support are given to the clinical trainers, that they are actively involved in designing the clinical education programme and that they receive training in both clinical teaching and assessment. Their input should be acknowledged within the academic and clinical institutes. The possibility of student education outside of normal clinical hours should be considered in particular for clinics with a heavy patient load during the working day.

It is recommended that clinical co-ordinators are appointed who will take responsibility for assigning students to named clinical RTs and who will ensure equity of learning experience for all students.

Clinical tutors and clinical assessors will identify members of the clinical team to whom the students will be assigned. This person is not necessarily a tutor or an assessor and may not carry out assessment but can act as a mentor or support person for the students. It is preferable that at least two people from any clinical department act in this role while students are on placement. The clinical tutors and assessors in conjunction with the academic staff should carry out continuous assessment.

In addition it is expected that feedback will be received from all staff on the overall performance of individual students and that there is also formal self evaluation by the student on their learning outcomes and whether their learning objectives were met during each clinical placement. In this way, the responsibility for the success of the clinical placement becomes the joint responsibility of the student and the clinical staff. In respect of the academic staff their role in clinical education is one of facilitator and mediator.

5.2.3. Integration of academic and clinical

A high level of co-operation between the academic and clinical education facilitators is essential and should be encouraged and supported. It must be acknowledged that patient management is the priority of the clinical staff where student education is the priority of the academic staff and it is therefore important that there is close liaison between the clinical and academic staff to ensure that the clinical experience for the student is free of avoidable conflict. Students must be clear as to their position within the clinical department. Where practicable the clinical staff should be encouraged to participate in the academic programme in order that they may gain a clearer understanding of the processes within the School. If the clinical tutor is education based then it is also recommended that he/she spend time actively working in the department. If a full time clinical tutor is employed in the radiation therapy department he/she should be facilitated to spend time in the academic setting, to participate in drawing up timetables and should participate in the academic programme.

To reflect the importance of linking theory with practice there should be a continuum of change from theory to practice over the duration of the programme. The emphasis in the first year(s) should be on the academic content and establishing a strong scientific basis and in the latter years on the application of theory to clinical/reflective practice and the development of research skills.

5.3. Learning and teaching

Learning may be defined as changes in knowledge, understanding, skills and attitudes brought about by experience and reflection upon that experience. At the basic level learning indicates an increase in the quantity of information that a student acquires and retains; the acquisition of new facts or skills. At a higher level learning involves the processing of the information acquired to make sense of it, abstract meaning and identify ways in which it can be related in other situations; it becomes an active, interpretive process which requires higher level skills. This higher level of learning is necessary for radiation therapists who will be working in a dynamic and interactive discipline.

There are many routes that lead to learning. What is important is that as wide a range of learning experiences are offered which facilitate the spectrum of student learning styles. Experience has shown that learning is more likely to take place when the teaching staff adopt an advisory attitude rather than a prescriptive attitude. It is important that active learning takes place and that the passive content is not the main focus. It is, therefore, good to combine different methods, and to link academic content with clinical practice.

Teaching is a process that supports learning. In radiation therapy, it is about creating and sustaining an environment that promotes higher level learning while supporting students and encouraging personal growth and development. Teaching methodologies chosen should reflect the range of learning styles and an education programme should be designed to include as wide a range as possible. Facilities must be appropriate for the teaching that is to take place. Teaching methodologies and facilities will be dictated to a large extent by local preference and availability but students should be encouraged to be responsible for themselves and their own learning. The use of new technologies such as video conferencing and the internet should be encouraged but students do need direction and advice when starting to use these methods.

As stated a wide range of teaching methodologies are accepted in international practice and all have a proven role in the wider field of education. What is important in designing a programme from this core curriculum is to choose the methods most appropriate to the specific situation but which will still meet the stated aims and objectives. Each method chosen will have a different outcome. Some will result in increased individual knowledge whilst others, for instance, will develop team skills and co-operation but as a whole will ensure the aims and objectives of the programme are met. It is not the intention of this core curriculum to give an exhaustive overview of the methodologies available but rather to indicate the most commonly currently used in the education of RTs.

- Lecture
- Tutorial
- Problem based learning
  PBL is resource intensive and requires a lot more assessment and tasks. It must be more structured and must be learnt.
- Small group teaching and learning
  10–15 maximum and preferably six to nine
- Continuous interactive learning
- Case-based
- Journal club based
- Project based
  Four to five is the preferred size for a group project
  For small group research projects it is important that measures are in place to ensure active participation by all group members
- Research project
  May be carried out by a single student or in small groups with a maximum of two to three
  For small group research projects it is important that measures are in place to ensure active participation by all group members
  Research was considered by the group to be very important in order to keep pace with other professions and to generate a research background for our own profession. Research is essential if we are to move to evidence based practice
- Seminars
- Clinical conferences
- Distance learning
- E-learning
- Skills laboratory

5.4. Assessment

Assessment can be defined as any procedure used to estimate student learning for whatever purpose. As with learning and teaching methodology there are a very wide variety of assessment methods that assess different aspects of learning processes and outcomes. Assessment can be used to test student recall, depth of knowledge or application of learning in specific outcomes. It can be used to pass or fail a student, to confer a grade, to rank students and in the case of any professional course to confer a licence to practice. Assessment can also be used to provide feedback to lecturers, to evaluate and improve teaching and the validity of the curriculum. Assessment can be formative as in the case of continuous assessment or summative as in the case of end of year examinations. The trend in the past two decades has been to move away from summative assessment to formative assessment. Commonly used assessment methods include:

Written examinations
Multiple Choice Questions (MCQ)
Short answer questions
Long written questions
Problems
Laboratory based experiments
Reports on practicals
Oral examination
OSCE (objective structured clinical examination)
Case studies
Essays
Project based
Poster production and presentation
Oral presentation
Group project
Single student research project
Reflective practice assignment
Peer group assessment
Portfolio

In some countries, a national standard assessment is used and it is important in these instances that discussion takes place between the educators and the assessors to ensure that there is consistency between what is learnt/taught and what is assessed.

Ideally, assessment should take place regularly during the programme and also at the end. It should be progressive and provide continuous feedback to the student on their learning. Assessment should be at all levels and not test purely recall or superficial knowledge.

In the case of clinical assessment, the assessors should have both initial and ongoing training and should liaise closely with the academic staff. The final award of a grade will rest with the academic department. For clinical assessment, it is recommended that a portfolio based approach is adopted rather than a logbook which records only numbers of treatments observed or participated in. The clinical assessment should contribute to the final degree classification if it is to have real value within the programme.

5.5. Certification level

Certification level varies currently across Europe. The findings of the survey carried out by the Radiation Therapy Technologists Committee demonstrated this variation both between and within countries. The responses received indicated that a degree was offered by 28% of centres, a diploma by 46% and a certificate by 18%. The qualification awarded was not specified by 8% of the responders [7].

In their report ICRP 86, the recommendation is that 'radiation therapy technologists, dosimetrists, and nurses, should have a degree, granted by a university or medical school, in academic studies and clinical training for a period of three or four years' [7]. The Bologna accord, when implemented, will also have an impact on the education programmes offered in the future [8].

6. Legislation

The dilemma of how to resolve the inherent conflict between national education systems, the diversity of which testifies to, and preserves, national identity and the right conferred upon every European citizen to exercise his or her profession throughout the Union had remained a challenge since the Treaty of Rome.

Directive 89/48/EEC came about as a result of discussion at the European Council meeting of 25th and 26th June, 1984 held in Fountainebleau, France. In accordance with the aspirations for free movement of personnel within the Community it was necessary to introduce a 'general system for ensuring the equivalence of University diplomas in order to bring about the effective freedom of establishment within the Community' This Directive was replaced by Directive 92/51/EEC and new legislation is currently under consideration.

The general system is founded on a simple concept: 'the presumption that if one is qualified in one member State to exercise a given profession, one should be entitled to exercise that same profession throughout the Union'.

This requires individual Member States to display mutual trust in the education and training provided by other Member States. The Commission stated that the traditional approach to the recognition of diplomas provided for the introduction of harmonised conditions, in particular with regard to qualifications, for the purpose of access to and exercise of specific activities. The system was based on the principle of mutual confidence and comparability of training levels. The system also allowed for situations where major structure differences existed and where fundamental differences between education and training after detailed

Country	Degree undergraduate	Diploma undergraduate	Certificate undergraduate	Post graduate
Austria		Yes		
Belgium				Yes (post nursing)
Denmark				Yes (post nursing)
Finland	Yes	Yes (pre 1992)		
France		Yes		
Germany		Yes	Yes	
Greece	Yes (university level)	Yes (secondary education)		
Ireland	Yes			
Italy	Yes	Yes		
Netherlands		Yes		
Portugal	Yes			
Spain	Yes			
Sweden				Yes
UK	Yes			

Details on the legislative process for recognition of qualifications is given in Appendix B.

examination could be demonstrated. In these instances the host Member State would be entitled to require the migrant to undertake some form of compensatory action to address the differences.

Member States still remain responsible for determining whether or not a professional activity should be regulated, i.e. made subject by law, regulation or administrative provision to the possession of a professional qualification and, if so, what the level, structure and content of the education programme should be.

The Community makes reference to; the uniformity of terms after a successful completion of education and training received in the Community and recognised by a competent authority in that Member State, the host Member State, a regulated profession, regulated professional activity, professional experience adaptation periods and an aptitude test. All of these factors have to be considered in the process of evaluation of the equivalence of a migrant's qualification [9]. Four main areas for action have been identified the aim of which is to achieve co-ordination between the different types of recognition of qualifications. These are information, academic and professional networks, jointly agreed adaptation of training and the assessment of training quality.

7. Syllabus

1 Basic sciences
- 1.1 Biology
- 1.2 Chemistry
- 1.3 Physics
- 1.4 Psychology
- 1.5 Biochemistry
- 1.6 Anatomy
  - 1.6.1 Topographical
  - 1.6.2 Radiographic
- 1.7 Physiology
- 1.8 Pathology
- 1.9 Oncology
- 1.10 Management
- 1.11 Information Technology
- 1.12 Medical English

2 Patient Related
- 2.1 Patient care
- 2.2 First Aid to include Cardio Pulmonary Resuscitation
- 2.3 Professionalism
- 2.4 Patient impact factors
  - 2.4.1 Human
  - 2.4.1.1 Ethical issues
  - 2.4.1.2 Legal issues
  - 2.4.1.2.1 Data Protection
  - 2.4.1.2.2 Health and Safety
  - 2.4.1.3 Cultural issues
  - 2.4.1.4 Gender
  - 2.4.1.5 Religious issues
  - 2.4.1.6 Informed consent
  - 2.4.2 Age related
  - 2.4.2.1 Pediatric
  - 2.4.2.1.1 Impact of family illness on children
  - 2.4.2.2 Adults
  - 2.4.2.3 Elderly

3 Cancer prevention
- 3.1 Aetiology and epidemiology
- 3.2 Carcinogenesis
- 3.3 Genetics
- 3.4 Information
  - 3.4.1 To the general public
- 3.5 How to impart information effectively
- 3.6 Promoting a healthy lifestyle

4 Early detection
4.1 Signs and symptoms
4.2 Public awareness on early signs and symptoms
4.3 High risk groups—genetics
4.4 Screening programmes
4.4.1 Breast
4.4.2 Prostate
4.4.3 Colorectal
4.4.4 Skin
4.4.5 Cervix

5 Diagnosis
5.1 Information
5.2 Clinical investigation
5.2.1 Tumor and lymph node status
5.2.1.1 Paraneoplastic syndromes
5.2.2 Patient performance status
5.2.2.1 Karnofsky index
5.2.2.2 Lung function
5.2.2.3 Cardiac function
5.2.2.4 Nutritional status
5.3 Laboratory investigations
5.3.1 Blood analysis
5.3.2 Body fluid analysis
5.3.3 Cytology
5.4 Diagnostic imaging
5.4.1 CT
5.4.2 MRI
5.4.3 Nuclear Medicine
5.4.4 PET
5.4.5 Conventional radiography
5.4.5.1 Use of contrast media
5.4.6 Ultrasound
5.4.7 Angiography
5.5 Exploratory surgery
5.5.1 Biopsies
5.5.1.1 Needle
5.5.1.2 Excision
5.5.1.3 CT/Stereotactic guided
5.5.1.4 Ultrasound guided
5.5.1.5 Endoscopic
5.5.1.6 MR guided
5.5.2 Laparoscopy
5.5.3 Mediastinoscopy
5.5.4 Endoscopy
5.5.5 Sentinel node evaluation

6 Pre treatment evaluation
6.1 Staging and Grading
6.2 Treatment intent
6.2.1 Radical
6.2.2 Palliative
6.2.3 Prophylactic
6.2.4 Benign conditions
6.3 Treatment protocol determination by the multi disciplinary team
6.4 Treatment scheduling

7 Treatment modalities
7.1 Surgery
7.1.1 Principles of oncological surgery
7.1.2 Indications for and against
7.1.3 Routine procedures
7.1.4 Management of nodes
7.1.5 Prosthetic surgery
7.1.6 Quality of Life
7.1.6.1 Morbidity
7.1.6.2 Cosmetics
7.2 Chemotherapy
7.2.1 Classification of cytotoxic agents
7.2.2 Drug regimes/schedules
7.2.3 Modes of administration
7.2.4 Safe handling procedures
7.2.5 Side effects and management
7.2.6 Synergistic effects with Radiation therapy
7.2.7 Patient support
7.3 Immunotherapy
7.4 Hormonal therapy
7.4.1 Principles of hormonal therapy
7.4.2 Classification of hormones
7.4.3 Treatment intent
7.4.4 Modes of administration
7.4.5 Modes of action
7.4.6 Side effects and management
7.5 Radionuclide therapies
7.6 Gene manipulation
7.7 Photodynamic
7.8 Complementary therapies
7.8.1 Aromatherapy
7.8.2 Relaxation
7.8.3 Visualization
7.8.4 Therapeutic massage
7.8.5 Art therapy
7.8.6 Journaling
7.8.7 Others
7.9 Radiation therapy
7.9.1 External beam
7.9.1.1 Physics
7.9.1.1.1 Radioactivity
7.9.1.1.2 Interaction with matter
7.9.1.1.3 Generation of photon, electron and particle beams
7.9.1.1.4 Radiation detection
7.9.1.1.5 Radiation protection
7.9.1.1.5.1 Basic Safety Standards Directive
7.9.1.1.5.2 97/43/EURATOM
7.9.1.1.6 ICRU
7.9.1.1.7 ICRP 86
7.9.1.2 External beam equipment
7.9.1.2.1 Beam source: Linear Accelerator, Cobalt, Particle Beams, Orthovoltage, Superficial
7.9.1.2.1.1 Generating mechanisms
7.9.1.2.1.2 Physics and beam characteristics
7.9.1.2.2 Design features* To include room design

7.9.1.2.3 Equipment for simulating and planning
7.9.1.2.4 Laser/ positioning system
7.9.1.2.5 Treatment couch
7.9.1.2.6 Accessory equipment
7.9.1.3 Molecular oncology/radio biology
7.9.1.3.1 Cell kinetics
7.9.1.3.2 Cell cycle control mechanisms
7.9.1.3.3 Tumor biology
7.9.1.3.4 Metastases
7.9.1.3.5 Five R's of Radio biology
7.9.1.3.6 Tissue structure and radiation effect
7.9.1.3.7 Q/Alpha Beta concepts
7.9.1.3.8 TCP/NTCP
7.9.1.3.9 Acute and late side effects
7.9.1.3.10 Sensitizers/Protectors/side effect reduction
7.9.1.3.11 Fractionation
7.9.1.3.12 Treatment combinations
7.9.1.4 Pre treatment review
7.9.1.4.1 Documentation
7.9.1.4.2 Briefing initial doctors
7.9.1.4.3 Physical and Psychologic issues
7.9.1.4.4 Medical support
7.9.1.5 Radiation therapy preparatory phase
7.9.1.5.1 Patient's file
7.9.1.5.1.1 Anamnesis (taking information directly from the clinicians medical history notes)
7.9.1.5.1.2 Medical aspects
7.9.1.5.1.3 Information
7.9.1.5.1.4 Informed consent
7.9.1.5.1.5 Additional investigations
7.9.1.5.1.6 Treatment proposal
7.9.1.5.2 Localization
7.9.1.5.2.1 Information and communication
7.9.1.5.2.2 Dimensions
7.9.1.5.2.3 Patient positioning, immobilisation and reproduction
7.9.1.5.2.4 Localization data
7.9.1.5.2.5 Contours
7.9.1.5.2.6 Documentation
7.9.1.5.2.7 Lasers/Markings
7.9.1.5.3 Mouldroom
7.9.1.5.3.1 Information and communication
7.9.1.5.3.2 Materials in RT
7.9.1.5.3.3 Moulds
7.9.1.5.3.4 Ind. shielding
7.9.1.5.3.5 Management of pollution and hazards
7.9.1.5.4 Planning and Dose Calculation
7.9.1.5.4.1 Dimensions — 1D
7.9.1.5.4.1.1 PDD, TAR, OAR, TMR, TPR
7.9.1.5.4.1.2 Influence of shielding and FSD on the dose distribution
7.9.1.5.4.1.3 2D
7.9.1.5.4.1.4 3D
7.9.1.5.4.1.5 Beam shaping and modification
7.9.1.5.4.2 TPS-algorithm
7.9.1.5.4.3 Calculations
7.9.1.5.4.4 ICRU
7.9.1.5.4.5 Dose limits
7.9.1.5.4.6 Target volume and Critical organ delineation
7.9.1.5.4.7 Image fusion
7.9.1.5.4.8 Treatment plan analysis and evaluation
7.9.1.5.4.9 Documentation
7.9.1.5.5 Simulation
7.9.1.5.5.1 Isocenter
7.9.1.5.5.2 Planning data
7.9.1.5.5.3 Documentation
7.9.1.5.5.4 Generation of DRRs
7.9.1.5.6 Verification
7.9.1.5.7 Film processing
7.9.1.5.8 Patients delivery chart
7.9.1.6 Support group facilitation
7.9.1.6.1 Staff support
7.9.1.6.2 Patient Support or self help groups
7.9.1.6.3 Lifestyle information
7.9.1.6.4 Psychologic issues
7.9.1.6.5 Side effects
7.9.1.6.5.1 Disease
7.9.1.6.5.2 Treatment
7.9.1.6.6 Lymphodema Care
7.9.1.6.7 Stoma Care
7.9.1.7 Treatment
7.9.1.7.1 Information
7.9.1.7.2 Set-up
7.9.1.7.2.1 Manual
7.9.1.7.2.2 Computer assisted
7.9.1.7.3 Data verification, registration or recording
7.9.1.7.4 Dose monitoring
7.9.1.7.5 Dosimetry
7.9.1.7.5.1 In vitro
7.9.1.7.5.2 In vivo (TLD, Diodes etc)
7.9.1.7.5.2.1 Protocol and decision making
7.9.1.7.6 Verification
7.9.1.7.6.1 Epid and Portal imaging
7.9.1.7.6.2 EPID protocol and decision
7.9.1.7.7 Geometric Uncertainties
7.9.1.7.8 Documentation
7.9.1.8 Patient management on treatment
7.9.1.8.1 Side effect related to radiation and dose
7.9.1.8.1.1 Acute
7.9.1.8.1.2 Late
7.9.1.8.1.3 Monitoring side effects
7.9.1.8.1.4 Management of side-effects
7.9.1.8.2 Information and communication
7.9.1.8.2.1 To include evaluation of impact of the disease and treatment on the family and family support
7.9.1.8.3 Monitoring patients health
7.9.1.8.4 Schedules of monitoring
7.9.1.8.5 Infection control
7.9.1.8.6 Documentation
7.9.1.8.7 Treatment of Palliative patients

7.9.1.9 Post treatment review
7.9.1.9.1 Long term post treatment
7.9.1.9.1.1 Late side effect
7.9.1.9.1.2 Second malignancies
7.9.1.9.2 Immediate post treatment
7.9.1.9.3 Development of protocols for
7.9.1.9.3.1 Investigations
7.9.1.9.3.2 For referal
7.9.1.9.3.3 Clinical management
7.9.1.9.3.4 Advising side effect management
7.9.1.9.3.5 Acute side effect evaluation
7.9.1.9.3.6 Psycosocial evaluation
7.9.1.9.4 Treatment evaluation
7.9.1.9.5 Follow-up schedules
7.9.1.9.5.1 Evidence of disease
7.9.1.9.5.2 Risk alert
7.9.1.9.5.3 Monitoring survival rates
7.9.1.10 Special Techniques
7.9.1.10.1 Total Body Irradiation
7.9.1.10.2 Hemi body
7.9.1.10.3 Stereotactic
7.9.1.10.4 Total Skin Irradiation
7.9.1.10.5 Intra-operative
7.9.1.10.6 IMRT
7.9.1.10.6.1 Inverse planning
7.9.1.10.6.2 Techniques
7.9.1.11 Quality Assurance/Control
7.9.1.11.1 Equipment
7.9.1.11.2 Procedures (Evidence based)
7.9.1.11.3 Protocols (Evidence based)
7.9.1.11.4 Audit
7.9.1.11.5 Incident registration
7.9.1.11.6 Health and Safety
7.9.1.11.6.1 Manual Handling
7.9.1.11.6.2 Occupational injury
7.9.1.11.6.3 Fire etc
7.9.1.11.6.4 Infection control
7.9.1.11.7 Communication and Support
7.9.1.11.7.1 Multidisciplinary team
7.9.1.11.7.1.1 Inter and Intra professional co-operation
7.9.1.11.7.2 Patient and Family
7.9.1.11.7.3 Counseling Skills
7.9.1.11.7.4 Group facilitation
7.9.2 Brachytherapy
7.9.2.1 Design features
7.9.2.2 Radiation sources
7.9.2.3 Radiobiology
7.9.2.4 Technique
7.9.2.4.1 HDR
7.9.2.4.2 LDR
7.9.2.4.3 PDR
7.9.2.5 Planning and Dosimetry
7.9.2.6 Radiation protection
7.9.3 Systemic
7.9.3.1 Radio nuclide therapies

8 Post treatment
- 8.1 The cured patient
  - 8.1.1 Late side effect
  - 8.1.2 Psychosocial issues
  - 8.1.3 Second malignancies
  - 8.1.4 Rehabilitation
- 8.2 Relapsed
  - 8.2.1 Local recurrence
  - 8.2.2 Metastatic disease
  - 8.2.3 Quality of Life

8. Conclusion

This review and revision of the core curriculum has been carried out in the context of the major technological developments which have taken place in radiation therapy over the last decade, changes and developments in education and the need to reflect these changes within the academic content of future education programmes.

The working party represented education and clinical areas in all the EU countries and we have tried to take an inclusive approach to construction of this document. This core curriculum can be used by educators to review the content of their existing programmes or to develop new ones. However we are aware that wide differences exist with regard the education philosophy and we would encourage all readers to view this document as interactive and to continue to send comments, suggestions, recommendations and proposals that will improve the content of the document in the future. It is our intention to carry out a review within one year to assess the impact of the revised core curriculum.

It is important to remember that a primary professional education programme is not an end in itself. Developments in radiotherapy are ongoing and a well structure programme of postgraduate education is necessary to enhance clinical experience and widen professional knowledge for full and part time staff. Continuing professional development or continuing medical education is becoming compulsory in many countries and is seen as an integral part of professional life. Experience gained in professional practice can provide part of this ongoing education but must be recorded and supported by participation in academic courses.

A core curriculum should be dynamic and therefore constant review and updating will be necessary. The working party hope that this review will continue to raise the discussion about the quality of education and contribute to a high standard of education and professional practice across Europe.

Appendix A. List of participants

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Appendix B. Legislations

See Table B1.

Table B1
Legislation

Country	Accepted qualification	Course duration	Competent authority	Advisory body	Fee charged	Process title	Documentation required	Adaptation or examination process provided	Governing legislation
Austria	Diploma					Nostrification		Examinations in subjects not taught as part of the applicants original qualification. Supplementary clinical practice period	
Denmark	1. Nurse and diagnostic radiographer for the treatment 2. For the treatment preparation: Diagnostic Radiographers	1. 1 year after completion of Nursing or Radiography study (3 years) 2. Local training and 10 week course together with the education to the radiotherapy nurse and radiographers	The Danish National Health Service Leader: Peter Groen, Statens Institut for Stralehygiejne—SIS, Knapholm 7. Herlev 2730, Denmark	Peter Groen, Statens Institut for Stralehygiejne—SIS Knapholm 7, Herlev 2730, Denmark		1. Accreditation from the Danish Board of Health as Radiotherapy nurse or radiographer 2. Some departments have started a local examination, but there is not an accreditiation, especially for the radiotherapy	1. The certificate will be issued at the autumn 2002	Obligatory post graduate programme	The Danish Health Institute, Announcement no. 48 from Januarry 25, 1999 (Announcement about electron accelerators to patient treatment with energies from 1MeV to 50 MeV) and the Danish Health Institute Guidance no. 139 from July 25, 2001 (Guidance about education of persons in radiation therapy departments—radiation therapy nurses and radiation therapy radiographers)
France	-DTS -DE Radiodiagnostic and Radiotherapy	Three years	-Minister for Education -Minister for Health		No	Registration			Décret 84-710 (17/07/84)

(*continued on next page*)

Table B1 (*continued*)

Country	Accepted qualification	Course duration	Competent authority	Advisory body	Fee charged	Process title	Documentation required	Adaptation or examination process provided	Governing legislation
Finland	Radiographer, diploma or degree level	If shorter than three years the authority will check the deviation from the Finnish programme	National Authority for Medicolegal Affairs, Terveydenhuollon Oikeustur-vakeskus, Lintulahdenkatu 10, 00500 Hlesinki, Finland, P > O > Box 265, FIN-00531, Helsinki, Finland	Society of Radiographers, Röntgen-hoitajaliitto ry, PO. Box 140, FIN-00060 THEY, Finland	262 Euros	Registration	Translated certificates, Certified photocopy of registration in applicants own country, beginning and finishing dates of the education programme, subjects studied and the curriculum content	The education has to be completed in the Polytechnics	EU Directives 89/48/EEC and 92/51/EEC Finnish law number 559.94 and statutes 564/94
Germany			Ministry of Health						Law for technical assistants in medicine (MTA-Law-MTAG) from August 02.1993. Education and examination law for technical assitants in medicine (MTA-APrV) from April 25, 1994
Greece	(a) Medical Radiation Technologists (third level education) (b) Radiotherapy machines' users (secondary)	(a) 4 years for third level education (b) Three years for secondary education—is dependent on other parameters also ie. Programm of studies	(a) Institute of Technological Education (RTE for third level education) (b) Organisation of Vocational Training (OEEK) for secondary education		(a) ITE stamps (b) OEEK 8.8 Euro	Accreditation	Application form. Official form to be claimed that all the submitted certificates are legitimate: no other application has been made to another authority for this title, and the Institute and place of studies.	In the case that the qualification is not accepted, ITE may refer the applicant to attend semesters/ modules/to give exams/or carry out a dissertation at the Technological Educational Institute	National law 1404/83 decree 567/84

Table B1 (*continued*)

Country	Accepted qualification	Course duration	Competent authority	Advisory body	Fee charged	Process title	Documentation required	Adaptation or examination process provided	Governing legislation
							Certificate of secondary education. The degree of studies. Certificate of all attended modules and the grades. Certification from the Institute that ‘all his/her studies were carried out at the place of campus of the University & at no other campus’ This certification has to be sent to the authority directly by the Institute of studies. All certificates have to be officially translated. Moreover, licence of residence in the country or any other proof that he/she legally stays in the country		

(*continued on next page*)

Table B1 (*continued*)

Country	Accepted qualification	Course duration	Competent authority	Advisory body	Fee charged	Process title	Documentation required	Adaptation or examination process provided	Governing legislation
Ireland	Honours degree	Minimum 3 years	Minister for Health and Children. Department of Health and Children, Hawkins House, Dublin 2, Ireland	Irish Institute of Radiography	100 Euro	Accreditation	Completed forms A and B which can be downloaded from the IIR website, birth certificate, degree certificate, marriage certificate if applicable		EU Directives 89/48/EEC and 92/51/EEC
Italy	Degree or equivalent	Three years at University	Minister for Health Minister for Education	Federazione Nazionale Collegi Professionali Trsm, Via Veio 20, 00183 Roma, Italy					Law 25 (31/01/1983), D.lg 502 (30/12/199), D. lg 517 (07/12/1993), D.lg 746 (26/09/1994), D.lg 230 (17/03/1995) aw 42 (26/02/1999), D.lg (18/06/1999), DL 187 (26/05/2000) Law 251 (10/08/2000) D.M. (02/04/2001) (From the Minister of Education, the Degree law) Law 1 (08/01/2002) Deontological Code of 1994 Law 233 (13/09/1946) DPR 221 (05/04/1950) Law 1103 (1995)
Portugal			Any Portuguese School running a degree programme						
Spain		Two years only Rt	Minister Education			Accreditation			

Table B1 (*continued*)

Country	Accepted qualification	Course duration	Competent authority	Advisory body	Fee charged	Process title	Documentation required	Adaptation or examination process provided	Governing legislation
Sweden									
The Netherlands			Dutch Government						Individual Health Care Professions Act (BIG Act)
United Kingdom	DCR (T), BSc (Hons) Therapeutic Radiography or equivalent	Three years—England and Wales, $years in Scotland, N. Ireland	Health Professions Council previously the Council for Professionals Supplementary to Medicine (CPSM)	Society of Radiographers, 207 Providence Square, Mill Street, London SE1 2EW			Details of courses and references. Application forms can be downloaded from www.cpsm.og.uk or www.hpcuk.org.uk. Equiries also to NARIC—National Academic Records Information Centre at www.naric.org.uk	If qualification is unacceptable The Colllege of Radiographers may refer the applicant to a University. Courses can be tailored to help the applicant reach the required standard	
Norway									
Malta	D.C.R.T B.Sc (Hons) in Radiotherapy		Board for the Professions Supplementary to Medicine	Sub-committee for Radiotherapy and the Equivalence Centre at the University of Malta					

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[4] International Commission on Radiological Protection, Prevention of accidental exposures to patients undergoing radiation therapy, Pergamon Press; 2000. October, p. 17–8.

[5] National Strategic Plan for Radiation Oncology (Australia), The Royal Australian and New Zealand College of Radiologists, Faculty of Radiation Oncology, Australian Institute of Radiography and the Australian College of Physical Scientists and Engineers in Medicine, August; 2001.

[6] International Commission on Radiological Protection, Prevention of accidental exposures to patients undergoing radiation therapy, Pergamon Press; 2000. October, p. 48.

[7] ESTRO/ERTED Network project. The Development of a European Network of Radiotherapy Technologists prepared for the European Commission and submitted 01/03/01. Summary available on the ESTRO website.

[8] The European Higher Education Area: Joint declaration of the European Ministers of Education. Convened in Bologna on 19th June, 1999 www.cruunige.ch/cre/activites/bologna

[9] XV/E/8537/95—EN Report to the European Parliament and the council on the state of application of the general system for the recognition of higher education diplomas. Made in accordance with art. 13 Directive 89/45/EEC.