A CORE CURRICULUM
FOR FIRST LEVEL
EDUCATION PROGRAMMES
IN RADIOThERAPY TECHNOLOGY

First Edition

Prepared by

European Radiotherapy Technologist Education Development Group.

for

THE EUROPE AGAINST CANCER PROGRAMME,
COMMISSION OF THE EUROPEAN UNION
Foreword

(to be written by the Commission)
Acknowledgments

The contributions of those who attended the different workshops and of the participants in the consensus meeting are acknowledged with gratitude.

The financial support provided by the European Society for Therapeutic Radiology and Oncology (ESTRO) and the administrative assistance from the School of Therapeutic Radiography, St. Luke's Hospital, Ireland for the different workshops is recognised as is the funding of the workshops by the Commission of the European Unions' “Europe against cancer” programme.

Finally particular thanks are extended to Ms Mary Coffey for her work in editing this Core Curriculum.

Guy Vandevelde
Chairman of the European Radiotherapy Technologist Education Development Group.
1 INTRODUCTION

Throughout this core curriculum we will use the abbreviation R/T. This abbreviation covers all titles (Therapeutic Radiographer, Radiation Technologist, Radiotherapy Nurse, MTRA etc.) used in the various European countries to describe members of our profession.

1.1 THE PURPOSE OF A CORE CURRICULUM

This core curriculum has been designed to assist in the development of new national educational programmes in radiotherapy technology and, where appropriate, the improvement of existing national programmes. In this document we have used the word core to indicate the essence of an education programme for R/T's that is intended to ensure a safe standard of practice on entry into the profession.

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

The primary course developed by individual countries from this core curriculum will determine the standard for entry into clinical practice in each country. The expected outcome is an improvement in the international professional standard of technical, clinical and psychological care given to the patient to whom a course of radiation is administered. A core curriculum not only sets this standard, it also gives the opportunity to improve existing courses. In this way it serves the overall goal of educational programmes: to achieve the expertise to improve the treatment and care of the patient.

There is a need to establish a professional standard to ensure that the highest quality of treatment is given to patients throughout Europe. At the present time most European countries have an education programme for radiation therapists, but review carried out over the last decade show that there are wide variations in these programmes. The standard for entry into clinical practice is determined by each individual country.

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An adequate educational programme should be available and obligatory to ensure that the level of expertise necessary for the profession is achieved. The expertise, already developed in some European countries, should be made available to those with less well developed programmes, to facilitate an overall progression towards the desired goals expressed in this document.

In action 51 of their "Europe Against Cancer" programme (1987 - 1989) the Commission of the European Communities 'proposed recommendations for a plan of action relating to the training of health workers in cancer".

The International Commission on Radiological Protection (ICRP) 34 indicates that the Medical Radiological Technologist (D & T) is in a key position regarding the radiation protection of the patient which underlines the need for good education programmes within the profession.

The R/T works closely with the Radiotherapist and Medical Physicist in the preparation of the treatment plan, and is responsible for the final delivery of the radiation treatment as prescribed, and must ensure that the dose received by the patient is appropriate. Therefore radiation protection and radiobiology is an essential part of the education programme.

This responsibility for radiation protection is also indicated in Council Directive 84/466/Euratom Article 2 which states:

"Member States shall take appropriate measures to ensure that any ionizing radiation used in medical procedures is effected under the responsibility of doctors or dental practitioners or other practitioners who are entitled to perform such medical procedures in accordance with the national legislation and who, during their training, have acquired competence in radiation protection and received adequate training appropriate to the techniques used in medical and dental diagnostic radiology, in radiotherapy or in nuclear medicine."

1.2 BACKGROUND TO THE EUROPEAN RADIOTherapy TECHNOlogists EDUCATION DEVELOPMENT GROUP (ERTED)

Radiotherapy has made major technological advances over the past three decades and, as a single or combine modality, has a role in the management of over 50% of all cancer patients.
As the life expectancy of the population increases so also does the incidence of cancer and it is projected that the level of radiotherapy equipment in Europe will have to double over the next two decades in order to meet the demand.

The R/T is a vital member of the cancer management team, working in collaboration with the Medical Staff, Medical Physicists and other staff as applicable. A high standard of academic competence and clinical expertise is required to accurately plan, interpret and carry out a course of radiotherapy (radiation treatment). As a consequence of several historical factors and the small number of qualified practitioners our profession has not received the recognition it merits. This lack of recognition is reflected in the wide variation of educational programmes and level of professional status worldwide, and has, in some instances, led to recruitment problems and a subsequent shortage of qualified personnel.

The European School of Oncology Advisory Report to the Commission of the European Communities for the "Europe Against Cancer Programme" raises several points in its discussion on continuing medical education in oncology within the European Union which are also applicable to R/Ts:

"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. By the year 2000 2 million people will develop cancer...."

This report goes on to discuss among other things the wide heterogeneity in the various countries in the quality of cancer care for European cancer patients and states:

"It has been estimated that 20% of patients in Europe fail to be cured because of a delay in early diagnosis and/or erroneous treatment"

This report also states that

"Education was recognised by the Treaty of Rome as a major responsibility of the European Union"²

The Europe Against Cancer Programme in the section on training and the campaign against cancer states:

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² J. P. Armand et al  European School of Oncology Advisory Report to the Commission  European Journal of Cancer vol 30A  No. 8 1994, 1145-1148
The health professionals whether general practitioners, specialists or nurses, have a decisive part to play in the fight against cancer. Nevertheless the general opinion of European Oncologists is that the present situation in Europe should be improved. On the one hand there are severe shortages of specific health care workers (nurses or specialists) in the treatment field, on the other, training programmes for the health professionals are not always well adapted to current needs.3

Over the past decade there has been a move within the profession to heighten public awareness, increase the status of and establish the R/T as an autonomous professional.

In September 1990 Mary Coffey (Ireland) contacted Professor Jerzy Einhorn, chairman of the Education Branch of the European Organisation for Research and Treatment of Cancer (EORTC) and a member of the European Committee of Cancer Experts, with a proposal to set up a feasibility group who would evaluate the current position and prepare a workshop to develop a core curriculum for R/T's. An outline of the project was presented to the Education and Training Branch of the EORTC on the 7th November, 1990 and it was agreed that a submission for funding would be made to the European Commission (EC) under the auspices of the EORTC. This submission was accepted at the June 1991 meeting of the EC and funding was sanctioned for 1992. Contact was made with European nominees and a provisional group was established.

In September 1991 Mary Coffey met with Riet van der Heide (The Netherlands) and Guy Vandevelde (Belgium) for a preliminary discussion on the format for the workshops. As funding from the EC would not be available until the end of 1992 Guy Vandevelde approached the European Society for Therapeutic Radiology and Oncology (ESTRO) who agreed to fund a first meeting.

The major Radiotherapy centres in each EC and EFTA country were contacted and asked to send a representative to the first workshop in Leuven in February 1992. No replies were received from centres in Greece, Germany or Finland. Centres from France, Iceland and Sweden wrote that they were unable to send a representative to the first meeting but were keen to participate in the project. Representatives of centres in ten countries met in Leuven on 26th February 1992 for the first workshop. A first draft was drawn up during this meeting and subsequently printed, edited and circulated to the members of the working party for revision and comments which were then presented to a larger representative group at a second workshop in Malmo on the 4th September, 1992.

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3 Excerpt from the Official Journal of the European Communities 26/2/87 No. C50.39
Chapter 3: Training of the Health Professions
Further amendments, revisions, comments were integrated into the draft core curriculum.

The revised document was then circulated to a wider audience together with an explanatory letter outlining our work. The relevant government ministries and all national societies in the member states and other European countries were contacted and asked to send a representative to the consensus conference scheduled for Granada in September 1995. In addition other interested groups, ESTRO, EORTC, ISRRT, Radiographers Board of the CPSM, College of Radiographers, London and the chairman of the Europe Against Cancer Programme were invited to attend as observers. Comments or revisions were invited from all interested parties.

Twenty five participants representing 16 countries came together in Granada for the Consensus Conference. Two curriculum experts, Dhr. Gus de Haas of The Netherlands and Dr. Seamus McGuinness of Dublin, were invited in an advisory capacity. ESTRO sent a consultant Radiotherapist, Professor Jaques Mazeron and a Radiotherapy Physicist, Mr. Bob Schaeken as observer/participants. The secretary of the ISRRT, Mr. Terry West, attended with a view to discussing future relationships between the two groups. Simultaneous translation was available in Spanish and French to facilitate a greater level of participation. The comments, suggestions and amendments which had been received, were presented to the group and discussed in detail. Papers on curriculum development and assessment and evaluation were delivered by the two curriculum experts and addresses were made by Mr. West of the ISRRT and Professor Leer on behalf of ESTRO. The consensus conference extended over two days and concluded with consensus having been reached. A consensus agreement document was signed by all participants.

This group has no official remit. It is composed of interested committed R/Ts working in both the clinical and academic areas, who are prepared to give their time and energy to the development of professional standards for education programmes for their profession. This work on the core curriculum has been supported by the Europe Against Cancer Programme of the European Union. The final revisions have now been made and this document, under the auspices of the EU, is ready for circulation.
2. PHILOSOPHY

Cancer is one of the major health problems of our decade and the incidence, with ageing populations, is increasing. A large percentage of cancer patients will undergo radiotherapy at some stage during the course of their disease. The projection is that the radiotherapy equipment in Europe will need to double over the next decade to accommodate this increasing number of patients. Radiotherapy plays a role in both curative and palliative aspects of patient management and any course must reflect the differing skills emphasis that is required in these situations. Earlier detection of cancer is occurring in the context of greater availability of information and screening programmes. In these instances radiotherapy is used with curative intent and involves high technology precision techniques which require significant skills and expertise. In palliative radiotherapy high precision may be less critical but a greater degree of nursing and psychosocial care will be required. It is important that any core curriculum reflects both of these aspects of cancer care.

The ever increasing complexity and computerisation of the technology necessitates a corresponding increase in the level of expertise of the practitioners. Increasing public awareness and expectations of care further underline the need for specialised RTs, confident in their psychosocial skills.
Educational programmes developed from this core curriculum should ensure the following:

1. The cancer patient receives the highest level of technological expertise administered in an atmosphere of care and consideration for his/her physical and psychosocial needs.

2. R/Ts by the effective and efficient use of the equipment ensure that the maximum number of patients can benefit from radiotherapy and, as such, are professionally accountable for their actions.

3. That research is conducted to give a basis for improving patient care, the further development of treatment protocols and quality assurance programmes.

4. The recognition of the need to initiate and support research within the profession.

5. Heightened public awareness and promotion of a more positive attitude towards radiotherapy and its role in cancer management.

The curriculum would form a basis on which continuing education can be founded, an essential factor in maintaining competence to practice. The curriculum will need revision at regular intervals to ensure it continues to meet the educational requirements of the profession.

2.1 PHILOSOPHY OF EDUCATION

On entry to a course drawn from this core curriculum students will have reached third/higher level studies or, in some countries, already have a professional qualification.

With new information on cancer constantly emerging, rapid technological developments in radiotherapy and a greater awareness of the psychosocial needs of patients, it is important that education programmes in this area prepare the student to be able to adapt to clinical developments and accommodate change.
throughout his/her professional life. A course should provide a basis on which to build and thus ensure professional growth.

There is now a vast amount of information available to us and it is not possible to learn everything. 'Facts' can change rapidly. What is important, therefore, is that the student understands the concepts and principles, develops the ability to analyse information, is able to assess the relevance and/or reliability of scientific research and can apply the knowledge gained in the professional setting both clinical or academic.

The student should be equipped with the knowledge, skills and attitudes to enable him/her to make independent professional judgements and to be accountable for his/her professional practice. It should also stimulate the student to recognise his/her obligations to contribute to the continued development of the profession.

This philosophy has implications for the teaching methods used in the delivery of an education programme. There is a general move away from the traditional reliance on 'lectures' towards a more interactive approach. A lecture is, in general, a passive non-interactive process which does not always stimulate the development of an enquiring mind. By using more interactive teaching methods the curriculum should provide a tool which enables the student to take responsibility for his/her own learning. It should develop a capacity for self education so that he/she can continue to extend his/her knowledge and skills throughout professional life.

2.2 THE EDUCATIONAL SETTING:

The settings in which education is given varies in accordance with the health and educational structures of the country or region in which the education and training takes place. It is not practical, therefore, to attempt to provide a blueprint for an ideal learning environment. What is possible in one country/area may be unattainable in another. However theoretical education should take place in an educational institution within a clearly defined structure.

Technical/Clinical education can be carried out to advantage in different settings. The clinical course should be structured to facilitate student placement on as wide a range of equipment and relevant clinical settings as possible to
enable him/her to integrate into a variety of departments on qualification. In clinically based programmes, therefore, it is important that clinical staff have the skills and attitudes necessary to facilitate the learning process and that a supportive team structure exists; care must be taken to ensure that the student is exposed only to the highest standard of practice. However, in participating in clinical education, the quality of care of the patient and the efficient running of the department should not be compromised.

There are several important general principles which must be met:

1. The setting, both educational and clinical-based, should be appropriate to the nature of the education and training to be provided and should enable the objectives to be met.

2. Adequate resources must be available to achieve this. If these resources are not available locally or nationally then they should be shared by those European colleagues who do have them.

(NB References from the post basic course in cancer nursing relate to general points on educational settings and do not imply a common course content)

3. It is desirable that courses designed from this curriculum also have external validation of examinations in order to try to achieve and maintain equivalent standards between the various countries

NOTE
Following a course designed from this curriculum does not at the moment guarantee registration in another country and it may be necessary to apply individually to the national registration board for a licence to practice.

3. PROFESSIONAL PROFILE

The treatment of a cancer patient is a collaborative management process and as part of the multidisciplinary team the R/T must be competent to critically appraise, interpret, plan and implement a prescribed course of radiotherapy and should, as a professional, be accountable.

The R/T plays a central role in linking eight areas of key importance in the radiotherapy department. No other member of the health care team fulfils this function. The eight areas are:

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4 A core curriculum for a post basic course in cancer nursing. Prepared by the European Oncology Nursing Society for the Europe Against Cancer Programme, Commission of the European Communities.
3.1 **Administration of Therapeutic Doses of Radiation**

The R/T will apply understanding of a range of techniques which will ensure:

a) Optimisation of beam arrangements during the planning stage

b) Accurate interpretation of a prescription

c) Delivery of the proposed radiation doses

3.2 **Patient Welfare**

The R/T has both a direct and supervisory role with regard to the welfare of the patient in his or her care.

This is a prime responsibility of the R/T

The welfare of the patient will depend on:

a) recognition by the R/T of the relevant physical and psychological factors which may affect the patient, together with an understanding of the patient's social and cultural needs; and reporting these when necessary

b) the R/T taking care of and making appropriate arrangements for the patient's general safety and comfort

c) the R/T ensuring that all required information is present and correct and that correct identification procedures are carried through

3.3 **Clinical Responsibility**

The R/T's prime expertise and responsibility is to undertake the whole range of techniques in radiotherapy and to subsequently assess the quality of their own work. He/she is thus one of the key members of the health care team.
3.4 Organisational Aspects (Management)

Depending upon the level in the organisation to which an R/T is appointed he/she has responsibility for the proper and efficient organisation of their work, use of resources, management of staff and the application of departmental policies for the area for which he/she is responsible.

3.5 Radiation Protection

ICRP states that the R/T is in a key position regarding radiation protection of the patient, and will by their "skill and care, determine within wide limits the amount of radiation administered". Therefore the R/T must:

a) be able to interpret and apply all relevant laws, rules, regulations and recommendations relating to the application of ionising radiation to patients and staff

b) understand both the somatic and the genetic hazards which are consequent upon the medical and research use of ionising radiations, and to be able to explain these in appropriate terms when appropriate

c) by attitude, authority and maintenance of current knowledge, help in the control of the use of radiation for medical purposes.

3.6 Quality Assurance

All areas of the R/T's responsibility require quality assurance procedures. In all specialisations, the R/T MUST be a full member of the team that develops, maintains and monitors the quality standards of the department. If no programme is in place, then the R/T has the responsibility to initiate one, and to ensure its implementation in collaboration with the Medical Physics department.

In radiotherapy QUALITY CONTROL is carried out TO ACHIEVE A CONSTANTLY HIGH QUALITY OF PATIENT TREATMENT in an efficient and cost effective manner.
3.7 Education and Training

The R/T working in the clinical field must be involved with the practical education of the R/T student. The R/T's qualifications, abilities and role enable him or her to advise, instruct and supervise other staff in appropriate circumstances. In addition they may be required to participate in the theoretical training of the students, other professionals and the general public.

3.8 Technology

The R/T is specialised in the branch of radiation medicine technology, radiotherapy. He/she is involved in the treatment of patients using ionising radiations5

This implies:

a) Integration of planning/mould room equipment, simulator and treatment units and computerised management systems

b) Evaluation of all such technologies

c) Involvement in developing and commissioning new equipment

In order to act in a professional way there is a need for the integration of the cognitive, technical and interpersonal processes central to the profession of radiation therapy.

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5 International Society of Radiographers and Radiological Technicians The Role of the Radiographer in Europe 1992, 8.
4. CORE CURRICULUM

4.1 A MODEL FOR CURRICULUM DEVELOPMENT:

The development of a core curriculum needs a structured foundation. In order to do this it is first necessary to assemble a group of experts reflecting the academic and clinical aspects of the profession. These experts, drawing from their own programmes or experiences, exchange ideas and put forward suggestions. However, in order to gain the consensus required to draw up a core curriculum from the individual contributions, it is necessary to structure it within a specific context. To put an order on the ideas and plans this group decided to work with the well established model of curriculum building illustrated below:
The starting point of the discussion was the assessment of the learning needs of the profession. These needs must reflect the role of the R/T in clinical practice and are based therefore on the role included in appendix 1 set out in detail at the beginning of this document. This profile was drawn up by experts from the profession and is summarised as:

*The R/T must be competent to critically appraise, interpret, plan and implement a prescribed course of radiotherapy and should, as a professional, be accountable.*

This profile delineates professional attitude as an integration of knowledge and skills and defines an ideal professional in terms of his level of knowledge and clinical competence.

4.2 **THE IMPLEMENTATION OF A CORE CURRICULUM**

To achieve the final goal - an improvement in the general level of professional behaviour throughout Europe based on improved education programmes - implementation of the core curriculum is essential.

The overall aim is to deliver the highest standard of care to the patient receiving radiotherapy and education is one of the best means of achieving this aim.

A working definition of implementation could be *- the process, based upon a strategy, to spread an idea with the intention of improving a situation.* This definition assumes:

The idea - in this instance the core curriculum - is worth spreading. There are situations which can be improved and there is a willingness to share/exchange ideas or information and an idea of a route for publication.

This core curriculum has been drawn up by representatives of the profession across Europe and reflects a consensus of views. There is a wide variation in the level of education programmes within Europe and a core curriculum, in a European context, is a tool to assist educators in devising national curricula, in developing education programmes and in improving existing courses.

Implementation of the core curriculum requires a strategic plan, a willingness to share expertise, and provides an instrument to adapt new knowledge or developments in radiotherapy in the whole of Europe.

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6 From the text of a speech delivered by Mr. Gus de Haas at the Malmo conference September 1992
The steps to implementation are first the development of a national curriculum based on the European core curriculum, and from this the drawing up of local education programmes.

An education programme belongs to the profession and is a tool for use by them. A professional organisation must have an education branch but they should retain the responsibility for the content of the programmes.

A core curriculum should be revised regularly in order to ensure its continued relevance to the profession.

4.3 A COURSE BASED ON THIS CORE CURRICULUM

4.3.1. RELATIONSHIP BETWEEN THEORY AND PRACTICE;

The theoretical content of the course should serve as the academic base on which the clinical skills are built. It should serve to give the students a comprehensive, in depth, understanding of the functioning of the human body, the disease process, radiotherapy and its equipment, the psychosocial status of the patient and the interaction between all these aspects. The theoretical course should ensure that the clinical skills are knowledge based.

Regardless of the length of the course, there should be a balance between theory and clinical practice; indeed the two should be directly related. Every student should have an individual course profile which will include a minimum requirement for clinical experience, with the emphasis on the quality of that experience rather than on time and repetition.

There needs to be a clear understanding and agreement that individuals undertaking an educational course should receive every support and opportunity to pursue their studies.

4.3.2 ENTRY REQUIREMENTS

The universal concept known as "secondary school education" implies a level catering to a much greater degree than the primary school with a view to preparing the students to take their place in adult society. It is recommended, therefore, that the student should have completed the recognised secondary school studies which would prepare him/her for higher education and that he/she should be capable of completing advanced study. This selection should not be
based on academic qualifications alone. Maturity and emotional stability, satisfactory attitudes towards social responsibilities and the ability to communicate are equally important. The health of the prospective student, both physical and mental, should be considered.\[7\]

Credit may be given to students who have already completed higher/further education in a related discipline and this will be at the discretion of the individual institutes.

It is recommended that students have studied one or more of the science subjects at the higher education level.

### 4.3.3 SUGGESTED DURATION OF THE COURSE

It is anticipated that three academic years is the minimum duration in which any programme developed from this core curriculum could effectively be completed. An additional advantage of a three year programme is that it will allow for ease of mobility within the European Union (EU).

### 4.3.4. AIM OF THE COURSE

To provide the learning environment for the individual student to acquire the necessary skills and attitudes to practice as a R/T.

### 4.3.5 GENERAL OBJECTIVES OF THE COURSE

In drawing up these objectives three elements underlying the professional responsibility of the R/T have been identified. These relate to:

- The role of the R/T in the direct care of the patient and his/her family
- The role of the R/T in the multidisciplinary team
- The role of the R/T in the development of the profession at national and international level

### 4.3.6. SPECIFIC OBJECTIVES

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\[7\] International Society of Radiographers and Radiological Technologists Professional standards for the education of medical radiation technologist First Draft September 1993
The specific objectives of a course drawn from the core curriculum will ensure that the general objectives listed above are achieved.

A. DIRECT PATIENT CARE

Theoretical Objectives

On completion of his/her educational programme the R/T will have knowledge and understanding of the:

1. Physical, technical and biological aspects of radiation medicine and the sciences relating to the human body
2. Physical effects of cancer and its treatment on the patient and his/her family
3. Psychosocial effects of cancer and its treatment on the patient and his/her family
4. Principles and practice of radiation protection and quality assurance methods and legislation
5. Principles and practice of radiotherapy planning and techniques for accurate and reproducible treatment
6. Other treatment modalities for the patient with cancer
7. Moral, ethical and legal aspects of caring for patients with cancer
8. Methods of research and the implementation of basic educational skills
Technical/clinical objectives
Quality Control

On completion of his/her educational programme the R/T will be competent to:

1. co-ordinate, interpret and carry out an accurate and reproducible plan for each patient

2. operate manual and computer aided technology and accessory radiotherapy equipment within safe systems of work

3. carry out procedures for monitoring and recording the performance of radiotherapy equipment and verifying data relevant to achieving the radiotherapy prescription

4. carry out continuous evaluation and investigation of all aspects of professional practice

5. assess and record the physical condition of the patient throughout the course of radiotherapy and implement care procedures or referral as required

6. assess and record the psychosocial condition of the patient throughout the course of radiotherapy and implement care procedures or referral as required

7. educate, support and advise the patients and their families before, during and after the course of radiotherapy

8. instruct R/T students in the practice of the profession

9. play a role in heightening public awareness of the safe use of radiation

10. to maintain and improve this level of competence and to keep up to date with development in their field
B. MULTIDISCIPLINARY TEAM

The newly qualified R/T will:

1. show empathy with colleagues at both intra and multidisciplinary levels

2. act as a responsible member of staff by contributing to the efficient management of the department

3. support and contribute towards a learning environment by a willingness to share knowledge, skills and ideas

4. appreciate and support the role and value of research and development within the profession

C. PROFESSIONAL AWARENESS

The R/T will heighten public awareness and raise the professional status by being:

1. an active member of the (inter) national organisations

2. aware of the need to promote the profession at all times and to highlight the need for skilled R/T's

3. involved in public education programmes on:
   a) cancer - its management and prevention
   b) the positive benefit of the safe use of radiation

4. involved in professional education and taking advantage of learning opportunities

5. SYLLABUS
5.1. RADIATION PHYSICS

5.1.1. Basics

Atomic structure and radioactivity
Natural and artificial sources of radiation
Characteristics of radiation
Interaction of ionising radiation with matter
Photons and matter
Electrons and matter
Units and applied mathematics

5.1.2 Detection of radiation

Basics
Environmental detection
Radiation detection in the clinical set-up

5.1.3 Clinical dosimetry for photon and electron beams

Dose distribution along beam axis
Dose distribution off axis
Variation of doserate with distance and collimator settings
Manual calculation of treatment times
Beam modifiers (bolus, wedge, compensators)
Computer dose calculations
Definition of volumes and their significance
Single, parallel and multifield technique
Effect of change of energy, beam direction, beam collimation, irradiation geometry
Calculated and applied doses and beams against professional knowledge
Clinical dosimetry form brachytherapy

5.2 RADIOBIOLOGICAL EFFECTS

At cellular level
On human tissues
On the human body
On malignant cells and tissues
Produced by fractionation regimes
Of biological modifiers on the radiation response
5.3. ANATOMY

- Topography
- Cytology
- Histology
- Systems of the body

5.4 PHYSIOLOGY

- Maintenance of homeostasis
- Pathophysiology
- Biochemistry

5.5 GENERAL PATHOLOGY

- Common diseases for all sites
- Intercurrent disease
- The ageing process

5.6 PATHOLOGY OF MALIGNANT DISEASE

- Epidemiology
- Aetiology
- Carcinogenesis
- Characteristic of neoplasia
- Histological classification of neoplasia
- Spread of neoplasia
- Staging and grading systems
- Investigation and diagnosis

5.7 PREVENTION

- Prevention and early detection
- Screening programmes
- Public education programmes

5.8 MANAGEMENT OF THE ONCOLOGY PATIENT

- Development of neoplasia within the patient
- Clinical signs and symptoms of neoplasia
- Available treatment modalities and their role in
the management of patients with cancer
Physical effects on the body of neoplasia
Physical effects on the body of radiotherapy, chemotherapy, surgery and other treatments, in combination and alone
Prevention and treatment of the acute side effects of radiotherapy and associated treatments
Nutritional advice and support for patients and their family
Prognosis and prognostic factors
Complications associated with cancer and its treatment
Causes of death

5.9 PSYCHOSOCIAL MANAGEMENT

Procedures for adaptation and rehabilitation of the person with cancer and their family to the disease process and its treatments
Support of patients with life threatening illnesses and terminal disease, and of their families
Counselling skills
Role of effective communication
Complementary therapies
Stress and stress management

5.10 LOCALISATION AND SIMULATION

Principles of accuracy in patient set up procedures
Principles and functioning of simulators
Patient positioning, knowledge of fixation techniques
Knowledge of simulation techniques for a broad range of indications and use of contrast media
Contour taking techniques and reference marking
Use of CT and MR images
Data recording and transfer

5.11 EXTERNAL BEAM THERAPY

5.11.1 Radiation equipment

Principles and functioning of low energy x-rays
Principles and functioning of telecobalt machines
Principles and functioning of linear accelerators

5.11.2 Dose delivery to the patient
Principles of planning and dose delivery to ensure treatment accuracy
Immobilisation of patient
Interpretation of the treatment prescription and plan
Setting up of the prescribed beam parameters and check against reference marks
Preparation, fixation and care of in vivo dosimeters
Registration of the delivered beam parameters on a daily basis
Documentation of portal verification and results of in vivo dosimetry
Surveying the patient during the treatment procedure

5.11.3 Main clinical applications

Basis of oncology - epidemiology, diagnosis, work-up, TNM classification, treatment principles

Skin cancer
Head and neck tumours
Brain tumours
GI tract tumours (oesophagus, rectum, anus)
Lung cancer
Lymphomas
Breast cancer
Gynaecological cancers
Prostate cancer
Bladder cancer
Seminoma

5.11.4 Radical and palliative treatment

5.11.5 Special techniques

Total body irradiation
Hemi body irradiation
Stereotactic radiotherapy
Intraoperative radiotherapy

5.11.6 Paediatric oncology

Epidemiology
Survival rates and complications
Site specific management
New developments
Psychosocial aspects

5.12 BRACHYTHERAPY

Knowledge of use of radionuclides and afterloading equipment (low, medium, high and pulsed doserate)
Preparation of the source holders (applicators, catheters)
Preparation of the patient including radiographs for dosimetry and preparation of the moulds
Monitoring of the patient before, during and after treatment
Accurate and complete recording of documentation of all the parameters relevant to the treatment
Aftercare of the used radioactive sources with emphasis on safety

5.13 OTHER TREATMENT MODALITIES
Emphasis should be placed on the multidisciplinary approach to the management of the patient

Surgery
Cytotoxic drugs
Hormone therapy
Immunotherapy
Gene therapy
Photodynamic therapy
Unsealed radioactive nuclides
Radiation enhancers - hyperthermia, radiosensitisers

5.14 MEDICAL, LEGAL AND ETHICAL ASPECTS

Getting the consent of the patient
Confidentiality
Data handling and information control
Clinical trials and implications of research
Efficient use of available resources
Non discriminatory practice
The professional role of the R/T
Organisational legislation for health care
Litigation
5.15 RADIATION PROTECTION

Risks of ionising radiation
  Stochastic and non stochastic effects
  The ALARA Principle

Procedures for radioprotection
  Design of treatment units and rooms
  Control of radioactive sources
  Personal and environmental monitoring

5.16 HEALTH AND SAFETY

Emergency Procedures
  Cardiopulmonary resuscitation procedures (CPR)

Legislation
  National and international
  Data protection legislation

Implementation of safety guidelines at department level
  Health and safety at work
  Infection control
  Processor chemical control
  Emergency procedures for all
  Treatment modalities

5.16 MOULD ROOM TECHNIQUES

Immobilisation techniques for patients
  Beam shaping devices (block, compensators etc.)
  Bolus material and preparation
  Moulds for brachytherapy

5.17 QUALITY ASSURANCE - METHODS FOR

  Equipment and auxiliary materials (to include care of)
  Treatment procedures - accuracy, reproducibility
  and verification
  Data handling
  Monitoring and evaluation of QA procedures
  Establishing a chain for quality assurance in practice

5.18 QUALITATIVE AND QUANTITATIVE METHODS OF RESEARCH AND CASE STUDIES
6. ASSESSMENT AND EVALUATION

6.1 ASSESSMENT

There needs to be assessment of student performance in relation to both the theoretical and clinical components of the course and these must be clearly stated.

The course lends itself to the use of a wide range of assessment techniques. Multiple choice (objective) tests may be appropriate for some of the assessment of the knowledge and comprehension of the theoretical components of the course. These can be administered at various stages throughout the course, such as at completion of a particular section or module, and generally take one hour. At other times, particularly in relation to the assessment of higher order skills, extended essays may be more appropriate. These may be administered as formally timed terminal tests, or as open ended exercises to be submitted on a pre-specified date, or as more extended pieces of research in the form of projects. The latter may be more appropriate where research skills are being developed.

Practical assessments may take the form of group tests where the students' demonstrate their knowledge and understanding of equipment and its correct use, and their ability to select the most appropriate equipment for a particular task, observe and to take accurate readings or measurements, implement appropriate safety standards, may be assessed.

Over and above these assessment in the theoretical and practical / clinical areas, there may be a need to assess certain areas related to the development of
interpersonal skills, quality assurance, legal issues and research.\textsuperscript{8} Methods of assessment will vary across Europe.

Assessment may be carried out by the teachers, clinical staff, peer group and the learners themselves. In addition to individual assignments, progressive assessment of knowledge, understanding and skills of the students should be made throughout the length of the course. Formative and summative evaluation of the course may be achieved by involvement of all those concerned in its design, development and implementation including the participants themselves.

6.2 EVALUATION

Evaluation is designed to monitor the progress of a course and, in particular the degree to which the objectives it is intended to meet are being implemented. Evaluation takes two forms. Formative evaluation is conducted throughout the development of a course and is essentially directed towards monitoring the various stages of the development process. The outcome of the evaluation is then fed back to the course developers who, in the light of the information supplied, may make certain alterations to the course before a final outline is confirmed.

Summative evaluation takes place after the course has been finally determined and is concerned with finding out how well the course as designed is being implemented in a particular setting.\textsuperscript{8}

Clearly identifiable objectives need to be set for evaluation during course planning. These may relate to the theoretical content of the course, the practical or clinical setting, the personnel and the available resources. All aspects of course design and planning may vary depending upon the setting in each European country but each will need to be considered as part of the course planning team's remit.

The course planning team will be involved in monitoring the quality of the course and its outcome for making revisions as necessary.

7. CONCLUSION

\textsuperscript{8} From a text by Dr. S. McGuinness of the Department of Higher Education and Research, University of Dublin, Trinity College, Dublin.

\textsuperscript{9} Dr. S. McGuinness
The construction of this core curriculum is the first attempt to formulate an educational programme for R/T’s throughout Europe. The working party are very well aware that it is not perfect and will be grateful to all contributors who send remarks and proposals to improve the content of the document.

As soon as consensus is arrived at from all the countries in Europe it can be offered as a tool for the development of educational programmes in radiation therapy. Meanwhile it can be used by educators to compare with their own programmes, and as a tool to develop new ones.

It is important to remember that a formal education programme is not an end in itself. Experiences gained in professional practice provide ongoing education. Developments in radiotherapy are ongoing and a well structured programme of postgraduate education is necessary to supplement clinical experience and widen professional knowledge for full and part time staff.

Radiation therapy belongs to those fields where "education permanente" is necessary.

The implication of this is that this core curriculum is only valuable for a short period of time. Even after consensus is achieved constant review and updating will be necessary. The working party hope that it will raise the discussion about the quality of education and contribute to a high standard of education and professional practice in Europe.
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