ESTRO

European Higher Education Area
Level 6

Benchmarking document for Radiation TherapisTs

November 2014

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LIST OF ABBREVIATIONS

ALARA	**As Low As Reasonably Achievable**
CT	**Computed Tomography**
CTV	**Clinical Target Volume**
DS	**Diploma Supplement**
DVH	**Dose Volume Histogram**
ECTS	**European Credit Transfer and Accumulation System**
EHEA	**European Higher Education Area**
EQF	**European Qualifications Framework**
ESTRO	**European Society for Radiotherapy and Oncology**
IAEA	**International Atomic Energy Agency**
ICRP	**International Commission on Radiological Protection**
ICRU	**International Commission on Radiation Units and Measurements**
MRI	**Magnetic Resonance Imaging**
PET	**Positron Emission Tomography**
PTV	**Planning Target Volume**
QA	**Quality Assurance**
QC	**Quality Control**
QMS	**Quality Management System**
RTT	**Radiation TherapisT**
TAR	**Tissue Air Ratio**
TMR	**Tissue Maximum Ratio**

TPR	**Tissue Phantom Ratio**
UNESCO/CEPES	**The European Centre for Higher Education/Centre Européen pour l'Ensignment Supérieur**

1.0 PURPOSE OF THIS DOCUMENT

The ESTRO, through the Radiation TherapisT (RTT) Committee has sought, over a twenty -five year period, to address the educational and professional issues of the group of healthcare professionals responsible for the delivery of the radiotherapy prescription accurately and safely. This document defines the competences that RTTs should have on graduation from their basic education programme. It is recommended that the education programme should be at the European Qualifications Framework[1] level 6 which is Bachelor level education as defined within the European Higher Education Area (EHEA) framework[2]. This level reflects the complex technical and professional activities undertaken by RTTs as part of their routine duties and is consistent with the competence definition of the recommendations of the European Parliament and the Council (2008). It is also consistent with the requirement for life long learning enabling graduates to continue to levels 7 and 8. This document provides a set of core competences to assist in the process of curriculum design. It does not specify curriculum content but should assist education institutes in the development of undergraduate and postgraduate programmes. Detail on suggested curriculum content can be found in the 3rd Revision of the European SocieTy for Radiotherapy and Oncology (ESTRO) Core Curriculum for RTTs[3] and the International Atomic Energy Agency (IAEA) Handbook for the Education of Radiation therapists (RTTs).

2.0 BACKGROUND

[1] http://ec.europa.eu/eqf/home_en.htm

[2] Recommendations of the European Parliament and of the Council of 23rd April 2008 on the establishment of the European Qualifications Framework for lifelong learning. Official Journal of the European Journal. 6.5.2008

[3] http://www.estro.org/binaries/content/assets/estro/school/european-curricula/recommended_core_curriculum-radiationtherapists---3rd-edition-2011.pdf

2.1 Radiotherapy history and current status

Radiotherapy is the application of radiation in the treatment of patients., the majority of whom have been diagnosed with a malignant disease. It has a long history in the management of cancer and has been used to treat disease since the time of Roentgen's discovery of the beneficial effects of radiation in 1895. Treatment techniques in the initial period were primitive with patients suffering very severe side effects. The development of high-energy machines in the mid 20th century revolutionised treatment approaches but still relied on large volumes encompassing the tumour, potential areas of spread and surrounding normal tissues with side effects remaining significant and the dose-limiting factor. Technological development in radiotherapy over recent decades has been unprecedented in its history allowing for tailored treatment, delivering very high doses to the tumour whilst minimizing dose to the surrounding normal tissue and organs at risk.

Modern radiotherapy practice is labour intensive, due to the technological complexity and the associated challenge of maintaining accuracy and safety awareness. The diverse patient population presenting with a spectrum of tumour sites, stages and treatment intent and with various co-morbidities, psychological and social status adds further layers of complexity. The RTT is an integral member of the radiotherapy team and must be qualified to contribute to the care of the cancer patient as an autonomous professional within the team. This can be achieved through appropriate education programmes at the correct EQF level – in this instance level 6.

Radiotherapy today, is used either alone or, more commonly in combination with other treatment modalities. Up to 50% of newly diagnosed cancer patient should receive radiotherapy as part of the treatment of their disease with at least half this

number benefitting from further treatment during their lifetime[4]. This increases the complexity and further underlines the need for the inclusion of concepts from the wider perspective of oncology. This reinforces the need for specialized graduate level 6 education to ensure that graduates are familiar with the interaction of multiple treatment approaches and can support patients appropriately.

The associated capital investment now required for radiotherapy centres is high as are the recurring costs for the professionals involved in treatment preparation, delivery and follow up. These developments, coupled with the high capital costs, have necessitated a change in educational content for all the involved professionals to ensure accuracy and safety at all times, as reflected in the recommended ESTRO core curricula for RTTs, for Radiation Oncologists and Radiotherapy Medical Physicists.

2.2 Radiation TherapisTs (RTTs)

RTTs are the group of professionals with responsibility for the delivery of radiotherapy to cancer patients and, as part of the multidisciplinary team, for elements of treatment preparation and patient care. This encompasses the safe and accurate delivery of the radiation dose prescribed and the clinical care and support of the patient on a daily basis throughout the treatment preparation, treatment and immediate post treatment phases. The RTT is often the link person for the patient within the multidisciplinary team comprising essentially the radiation oncologist, radiotherapy medical physicist and the RTT. RTTs liaise also with all the other allied health professionals in ensuring the needs of the patient are met.

The ICRP, in report 48 of 2000[5], acknowledged this role when it stated “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

[4]http://www.inghaminstitute.org.au/sites/default/files/RTU_Review_Final_v3_02042013.pdf
[5] ICRP Report 48 the International Commission on Radiological Protection, Prevention of Accidental Exposures to Patients Undergoing Radiation Therapy (2000).

essential function in noticing any abnormal reaction of the patient or the machine and to report them". The evolution in radiotherapy requires absolute accuracy. The RTT needs to understand the complexity of treatment and the impact on the patient of treatment delivered incorrectly.

In Europe there is no single title defining this profession and the acronym RTT is used by the ESTRO and the IAEA to describe the professional group. The IAEA has adopted the title Radiation Therapist and it has been agreed by ESTRO that RTT can encompass the title Radiation TherapisT with the following conditions:

- The title RTT will be maintained by ESTRO but will now encompass "Radiation TherapisT" and this fits also with the previous denomination of "radiation technologist"
- ESTRO states that Radiation Therapist as a RTT title should be used only when it does not conflict with the title used for clinicians in said country

The list of titles used across Europe is given in Appendix 3.

2.3 Education of RTTs in Europe

As previously stated modern radiotherapy is extremely complex. However this was not always the case and the initial rapid technological development and application in diagnostic imaging was not mirrored in radiotherapy. As a result the first education programmes developed focused on diagnostic with a small subsection devoted to radiotherapy. As radiotherapy developed however this educational approach, from the perspective of the clinicians and physicians, was considered inadequate and dedicated education programmes for both of these professional groups were developed and are now both recognized as independent specialties within the discipline of radiation oncology. The education programmes for RTTs, however, failed to develop in the same way. There was a mistaken belief that if the prescription was correct and the equipment functioning within safe limits nothing could go wrong. This, coupled with the small numbers required as the discipline was developing, resulted in a failure in many countries to address the educational needs of the RTT with respect to delivery of safe and accurate treatment. The radiotherapy component of many education programmes was, and still remains, a very small component of mixed programmes in a range of loosely associated professional areas. Current education programmes for RTTs in Europe range from an apprentice –type 'learning on the job' training to a specialist four-year honours degree thereby leading to significant variation in the competences of the graduates and hence associated variation in the care of cancer patients.

2.4 ESTRO and educational development for RTTs

The European Society for Radiotherapy and Oncology (ESTRO) is a multidisciplinary society of individual radiation oncologists, medical/radiotherapy physicists, radiobiologists and RTTs. ESTRO has developed a remit for improving standards and practice, for providing radiotherapy specific education and for fostering research and development in radiotherapy both in Europe and internationally. It has taken the lead in developing and delivering guidance frameworks in education and quality assurance in radiotherapy and has produced consensus documents which have been endorsed by a wide range of national societies.

For a number of reasons including those outlined above, education specific to radiotherapy in undergraduate programmes has failed to reflect developments both in radiotherapy itself and the wider concepts of oncology. In the majority of professional National Societies, RTTs are a very small or non-existent subsection and given the small numbers of students, the content related to radiotherapy in the associated education programmes is also minimal or again, in some cases, non-existent. ESTRO is the first European association to provide a unique forum for RTTs in a radiotherapy environment and over a twenty-five year period has worked at a European level to address the educational shortfalls and to promote an equal standard of education, practice and career potential for RTTs.

ESTRO supported the development of the first core curriculum for RTTs in 1995, the second revision in 2004[6], and the third revision published in 2011[7]. The first

[6] Mary Coffey, Jan Degerfalt, Andreas Osztavics, Judocus van Hedel, Guy Vandevelde. Revised European Core Curriculum for RTs. Radiotherapy and Oncology 70 (2004) 137-158

[7] M.A. Coffey, L. Mullaney, A. Bojen, A.Vaandering G. Vandevelde Recommended ESTRO Core Curriculum for RTTs (Radiation TherapisTs) – 3rd edition .

curriculum focused on academic content and curriculum philosophy and the second revision contained detailed information on establishing education programmes, clinical and technological developments in radiotherapy and the evolving role of the RTT. Both curricula were used by educationalists as part of their course development de novo or restructuring of an existing programme. To ensure that the third review reflected current practice requirements an extensive questionnaire was prepared and circulated to all national societies representing RTTs [Appendix 2]. The questionnaire gathered data on all aspects of practice, education and professional standing and was completed and returned by 28 countries. The responses were then analysed and used to define the core competences expected of a graduate commencing work in a radiotherapy department. These competences were recognized as the minimum requirements for safe and accurate practice and formed the basis for the learning outcomes central to the third revision of the core curriculum for RTTs. The competences were used in the preparation of this document.

Given the complexity of modern radiotherapy and the associated potential for harm to the patient, education programmes must be about demonstrating mastery of the profession and enabling further development through continuing education and research. In addition, to enable mobility, consistent with the aspiration of the European Community, it is necessary to be able to describe the level of the qualification in a transparent way that allows direct comparison between institutions and countries. This is achieved by describing programmes in terms of learning outcomes and in terms of the European Qualifications Framework.

3.0 THE RECOMMENDATIONS OF THE EUROPEAN PARLIAMENT AND OF THE COUNCIL (2008)

These recommendations were published to support the transparency of qualifications 'necessary to adapt education and training systems in the Community to the demands of the knowledge society, the closer cooperation in the university sector and improvement of transparency and recognition methods in the area of vocational education and training'[8]. 'This recommendation is without prejudice to Directive 2005/36/EC on the recognition of professional qualifications which confers the rights and obligations of the relevant national authority and the migrant[9]. It does not replace or define national qualifications systems and/or qualifications and does not describe specific qualifications or an individual's competences'[10].

3.1 The European Higher Education Area (EHEA)

The European Higher Education Area (EHEA) was created as part of the Bologna Process and launched in 2010 when the Budapest-Vienna Declaration was adopted, with the main objective to ensure more comparable, compatible and coherent systems of higher education in Europe[11] . Through the provision of quality higher education underpinning mastery of the profession, the aims were to strengthen mobility to enhance education and graduate employability across Europe. The Bucharest Communique of 2012[12] reiterated the aspiration the need for graduates to be able to "combine transversal, multidisciplinary and innovation skills and

[8] Recommendations of the European Parliament and of the Council of 23 April, 2008 on the establishment of the European Qualifications Framework for lifelong learning (2)
[9]http://ec.europa.eu/internal_market/qualifications/policy_developments/legislation/index_en.htm
[10] Recommendations of the European Parliament and of the Council of 23 April, 2008 on the establishment of the European Qualifications Framework for lifelong learning (14)
[11] www.ehea.org
[12] EHEA Ministerial Conference, Bucharest 2012. Making the Most of Our Potential: Consolidating the European Higher Education Area, Bucharest Communique. FINAL VERSION) (http://www.ehea.info/Uploads/%281%29/Bucharest%20Communique%202012%281%29.pdf).

competences with up-to-date subject-specific knowledge so as to be able to contribute to the wider needs of society and the labour market".

In addition to high quality education and mobility the Bucharest Communique also stresses the need for higher education to ensure a stronger link between research, teaching and learning at all levels. Combined education programmes, which unilaterally have limited focus on radiotherapy, result in academic staff who frequently have little or no radiotherapy knowledge or background thus limiting the potential for research. This not only impedes graduates who wish to pursue further studies specifically in radiotherapy but also restricts research generated by RTTs within the clinical area.

3.2 European Credit Transfer and Accumulation System (ECTS) and the Diploma Supplement (DS) and the European Qualifications Framework (EQF)

The European Credit Transfer and Accumulation System together with The Diploma Supplement, the Education Qualification Framework and clearly defined learning outcomes are cornerstones of the Bologna Process in achieving transparency and comparability of education programmes.

3.2.1 European Credit Transfer and Accumulation System (ECTS)

To facilitate a more standardised and transparent approach to programme evaluation and qualification recognition it has been agreed that the ECTS should be used wherever possible[13].

The ECTS is considered one of the cornerstones of the European Higher Education Area and the Bologna Process[14]. ECTS are fundamental to the design of national and European Qualifications Framework. They can be applied to all programmes at all levels and should enable ease of comparison between programmes.

ECTS are student-centred and reflect the level of input that is expected of a typical student to achieve the learning outcomes and competences defined by the programme. They are based on the principle that 60 credits is a measure of the workload that a full time student would realistically be expected to carry out during one academic year. In most instances this ranges between 1200 – 1440hours or 20-25 hours per credit. ECTS include all student-related effort, incorporating both classroom contact hours, e-learning, independent preparation or study required for each specific component of the programme, as well as assessment. The basis of the

[13] http://ec.europa.eu/eqf/home_en.htm

[14] http://www.eua.be/eua-work-and-policy-area/building-the-european-higher-education-area/bologna-basics/Bologna-an-overview-of-the-main-elements.aspx

estimation of workload and the ECTS allocation is the learning outcomes and competences associated with the course. The definition of learning outcomes is therefore core as a reflection of what the learner will know, comprehend and be able to do at the end of a learning experience[15].

The ECTS is a tool that helps to design, describe, and deliver study programmes and award higher education qualifications. The use of ECTS, in conjunction with outcomes-based qualifications frameworks, make study programmes and qualifications more transparent and facilitate the recognition of qualifications throughout Europe[16].

3.2.2 The Diploma Supplement (DS)

The Diploma Supplement is a document attached to a higher education diploma, which aims to improve international transparency and facilitate academic and professional recognition of qualifications (diplomas, degrees, certificates, etc.). Developed by the European Commission, the Council of Europe and UNESCO/CEPES, the DS consists of eight sections describing the nature, level, context, content and status of the studies that were pursued and successfully completed. The DS provides additional information on the national higher education system concerned, so that the qualification is considered in relation to its own educational context[17].

3.2.3 The European Qualifications Framework (EQF)

The European Qualifications Framework for lifelong learning (EQF) provides a common reference framework which assists in comparing the national qualifications systems, frameworks and their levels. It serves as a translation device to make qualifications more readable and understandable across different countries and

[15] http://eacea.ec.europa.eu/tempus/tools/glossary_en.php
[16] http://eac.europa.eu/education/tools/ects_en.htm
[17] http://eacea.ec.europa.eu/tempus/tools/glossary_en.php

systems in Europe, and thus promote lifelong and life-wide learning, and the mobility of European citizens whether for studying or working abroad[18]. The EQF provides a common understanding of the levels of the qualification giving recognition for both academic and professional purposes.

Together the ECTS, DS and EQF facilitate transparency and lead to greater understanding of the level of individual qualifications across countries and therefore the level of performance that can realistically be expected from a graduate of a programme at that level.

[18] (http://ec.europa.eu/eqf/home_en.htm).

4.0 LEARNING OUTCOMES AND COMPETENCES

A priority for 2012-15 for the European Higher Education Authority was to ensure that European Qualification Frameworks, ECTS and Diploma Supplement implementation are based on learning outcomes.

Learning outcomes are clear statements on what the learner is expected to achieve and how he or she is expected to demonstrate that achievement. Learning outcomes are student-centred. They are less to do with the content of the course than with what a student knows or can do at the end of the course. They are constructivist rather than behavioural based. "learning outcomes means statements of what a learner knows, understands and is able to do on completion of a learning process, which are defined in terms of knowledge, skills and competence"[19]

Learning outcomes are very specific and are written in the context of the student's abilities and the level descriptor of the course. They can indicate the wider abilities, which a typical student could be expected to have developed at that level. These abilities could for instance, be the mastery of a practical skill and/or the key transferable skills such as communication, problem solving or self evaluation; all of which are critical for RTTs working as professionals in the clinical setting.

Learning outcomes are consistent with the principles of the Bologna Process, whose main outcome is the need to improve the traditional ways of describing qualifications and qualification structures and achieving standardisation of their description across the European Higher Education Area. They recommend the writing or rewriting of all modules or programmes offered in terms of learning outcomes and stress the crucial

[19] Recommendations of the European Parliament and of the Council of 23rd April, 2008 on the establishment of the European Qualifications Framework for lifelong learning. Official Journal of the European Council 6.5 (2008)

importance of "the development, understanding and practical use of learning outcomes to the success of ECTS".

Learning outcomes should not be confused with competences. A competency is a statement describing the knowledge, skills and behaviours expected from a new graduate. Competences define the application of the knowledge, skills and behaviour in the context of their daily practice at work. The term competency is commonly used in health related professions and form the basis of the third revision of the ESTRO core curriculum for RTTs. The Tuning Project defines competence as "a quality, ability, capacity or skill that is developed by and belongs to the student" and a Learning Outcome as "a measurable result of a learning experience which allows us to ascertain to which extent/level/standard a competence has been formed or enhanced." [20]

"Competence' means the proven ability to use knowledge, skills and personal, social and/or methodological abilities, in work or study situations and in professional and personal development. In the context of the European Qualifications Framework, competence is described in terms of responsibility and autonomy."[21].

5.0 THE CORE COMPETENCES EXPECTED OF A GRADUATE RTT

A competency shows a capability on the part of an RTT and demonstrates an ability to integrate knowledge, skills and attitudes to meet specific and often complex needs in a range of situations. All graduates seeking to pursue a career as an RTT should be able to think critically, examine practice, problem solve and make decisions based on scientific evidence. They should be able to reflect on their practice and consider ways

[20] (http://tuning.unideusto.org/tuningeu)

[21] F Recommendations of the European Parliament and of the Council of 23rd April, 2008 on the establishment of the European Qualifications Framework for lifelong learning. Official Journal of the European Council 6.5 (2008)

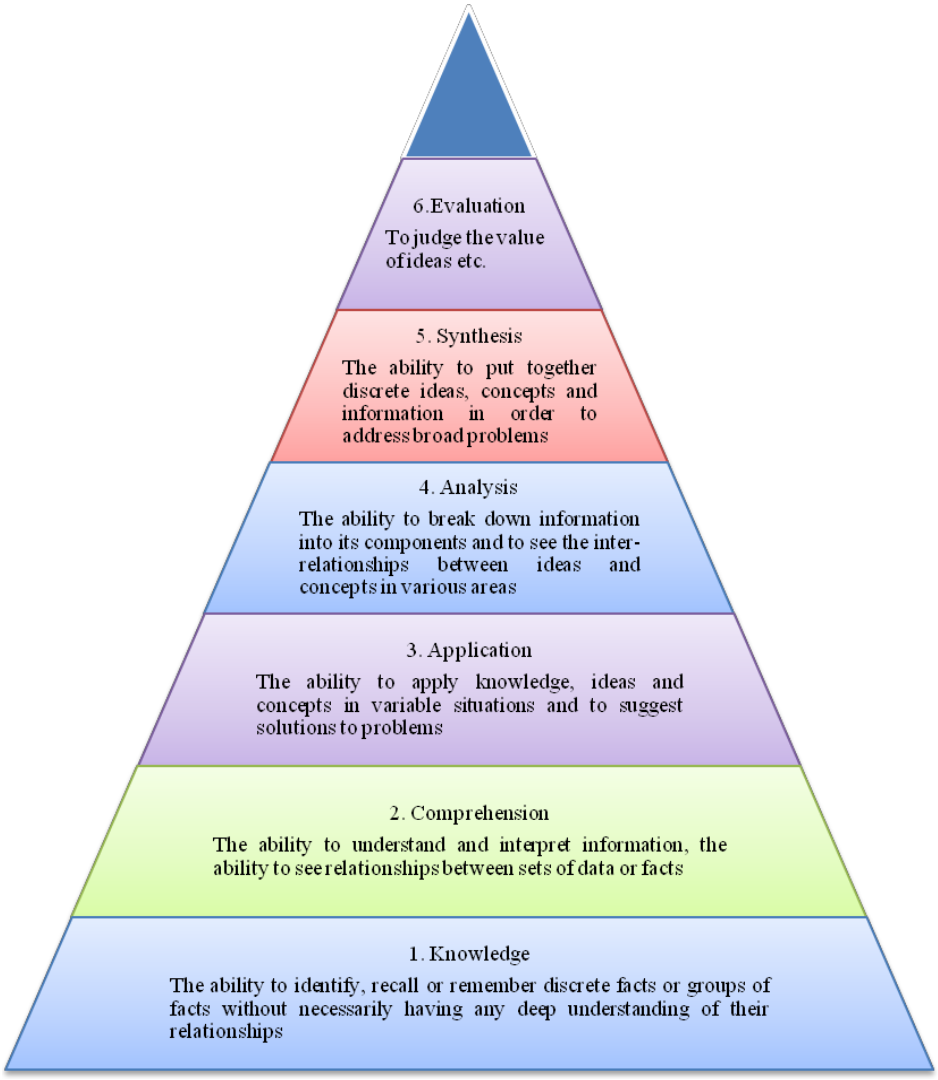
in which it can be improved. The core competences given in Appendix 2 were compiled following the results of the extensive questionnaire, circulated as part of the ESTRO third revision of the core curriculum, on education level and content, as well as roles and responsibilities expected of RTTs .

APPENDIX 1: Knowledge, Skills and Competences of a Graduate RT

The core competences required of a graduate RTT are detailed below using Bloom's taxonomy incorporating knowledge, skills, comprehension, application, analysis, synthesis and evaluation[22].

The following tables are consistent with the model suggested in the European Parliament and Council recommendations for level 6 qualifications

[22] (Bloom B. S (ed.) Taxonomy of Educational Objectives: the classification of educational goals. 1956.) and the Anderson and Krathwohl revision of classification (Anderson, L.W. and Krathwohl D. R. (Eds) A Taxonomy for Learning, Teaching and Assessing: A revision of Bloom's Taxonomy of Educational Objectives: Complete Edition, New York: Longman 2001)



APPENDIX 2: Core Competences

1. Professionalism
2. Inter and Intra professional communication
3. Positioning and Immobilisation
4. Image Acquisition and Virtual Simulation
5. Treatment Planning
6. On treatment Verification
7. External Beam Treatment Delivery
8. Quality Assurance
9. Brachytherapy
10. Research
11. Education

1. PROFESSIONALISM

The graduate must display a high standard of professionalism and integrity at all times. This includes professional appearance and manner, self-awareness and competency limitations, a high standard of ethical and moral behaviour, reliability and responsibility, respect for patients and autonomy and the ability to respond to and manage individual patient situations.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	**SKILLS** [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	**COMPETENCES** [Manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K1. Explain the legal and ethical guidelines related to the profession K2. Be aware of your own competency levels K3. Appreciate the importance of maintaining your knowledge and skills	S1. Apply professionalism in the context of a hospital setting S2. Practice in accordance with legislation, regulations and ethical guidelines S3. Promote collaborative practice S4. Critically evaluate and apply knowledge gained in solving problems S5. Evaluate your own role and the role of others involved in the patient pathway	C1. Take responsibility for ensuring that all aspects of your practice are optimum C2. Take responsibility for ensuring radiation protection is optimum in your area

K4. Identify the elements that reflect professional appearance and manner K5. Identify and describe the purpose of all areas within a radiotherapy department K6. Explain staging and grading of tumours and the system routinely used	S6. Evaluate the prescription relative to the stage and grade of disease S7. Evaluate the role of radiotherapy in the process	
K7. Recognise the importance of team interactions K8. Explain the principles of effective communication K9. Explain the components of good communication and psychosocial skills with patients and members of the multidisciplinary team K10. Outline cognitive and emotional development over the lifespan K11. Describe the main personality types K12 Be aware of the patients' gender, age, cultural background, educational level and social situation. K13. List physical and psychological co-morbidities	S8. Discuss the importance of team work in radiotherapy S.9 Evaluate how physical and psychological co-morbidities might impact on the patient's treatment S10. Analyse how the differences in personality influence approach S11. Demonstrate a professional attitude to patients and other staff S12. Demonstrate self awareness of own personality traits	C3. Discuss the patient pathway as an autonomous member of the multi-professional team C4. Carry out treatment preparation and delivery based on best practice at all times C5. Evaluate the patient's physical and psychosocial status prior to delivering treatment C6 Demonstrate a sensitive and caring attitude to patients

K14. Define the role of professional societies and their role nationally and internationally	S13. Evaluate and justify your practice regularly S14. Participate in continuing professional development	C7. Represent your profession at a national and international level
K15. Recognise the importance of accurate documentation K16. Know what should be included and to whom the documentation should be sent K17. Be aware of the legal issues relating to documentation	S15. Prepare the documentation S16. Inform all the involved areas/personnel S17. Ensure all legal requirements have been met	C8. Complete accurate and detailed documentation consistent with accurate and safe treatment delivery

2. INTER AND INTRA PROFESSIONAL COMMUNICATION

The graduate must be able to communicate effectively with his/her peers and with other members of the multidisciplinary team. This assumes an underlying understanding of the science underpinning radiotherapy practice and encompasses communication with the patients and members of the general public.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	**SKILLS** [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	**COMPETENCES** [Manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K18. Differentiate between cancer prevention and cancer screening K19. Outline the benefits and disadvantages of screening programmes K20. Explain the cancer risk associated with radiation exposure K21. Characterise the cancer patient pathway K22. Explain the need for absolute accuracy in the treatment of patients K23. Be familiar with current literature and evidence based best practice	S18. Promote cancer prevention and screening S19. Evaluate and contextualize the cancer risk associated with radiation S20. Apply the principles of cancer biology to the assessment of side effects and advice given S21. Evaluate the role of radiotherapy in the management of cancer at different sites S22. Review the treatment prescription and plan from the perspective of molecular and radiobiology with respect to dose, fractionation and anticipated side effects and respond appropriately	C9. Explain all aspects of radiotherapy as a treatment modality to patients and other members of the public

K24. Classify tumours according to their aetiology and epidemiology, signs and symptoms K25. Define the principles of cancer biology K26. Compare and contrast the main characteristics of normal and malignant tissue biology and structure K27. Explain the five basic radiobiological principles K28. Differentiate between the cancer types that present regularly in your department and those that either present less frequently or are not routinely treated with radiotherapy	S23. Apply the radiobiological principles to clinical situations S24. Discuss the precision, accuracy and attention to detail required in the radiotherapy process	

3. POSITIONING AND IMMOBILISATION

Patient positioning and immobilisation is one of the most important aspects of accurate and reproducible treatment delivery and isconsidered a core skill of the RTT. The student must understand the importance of correct positioning and how it can be achieved. This incorporates understanding the appropriate immobilisation methods and materials for each site, the referencing system, the physical and psychological conditions of the patient and the limitations of both imaging modalities and treatment delivery.

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K29 Discuss the general issues of reproducibility K30. Explain the principles of positioning K31. Be familiar with the immobilisation devices available K32. Explain how to use each device K343 Be familiar with the techniques and equipment used	S25. Evaluate the patient condition and the limitations that may result from any co-morbid conditions S26. Analyse the information and integrate to define the optimum patient position S27. Inform the patient about the procedure S28. Evaluate the optimal treatment position and immobilisation device for a given site	C10. Correctly position the patient consistent with implementation of the treatment prescription

K34. Be familiar with the protocols used in the department K35. Define the common co- morbid conditions that patients may suffer from K36. Describe the alternate treatment positions and positioning and immobilisation devices for each site		
K37. Recognise the associated health and safety issues	S29. Construct the most appropriate device for the individual patient within the context of the protocol S30. Apply the necessary precautions in production of positioning and immobilisation devices and other accessory equipment	C11. Prepare and / or produce immobilisation devices consistent with optimum treatment delivery
K38. Recognise the importance of regular quality checks on immobilisation device K39. Explain the quality checks that should be carried and the underlying reasons for the checks	S31. Implement correct storage and handling procedures for immobilisation devices S32. Carry out regular quality assurance checks on all immobilisation devices S33. Report / correct any deviations found S34. Evaluate new devices prior to implementation	C12. Carry out regular Quality Assurance of all accessory equipment

4. IMAGE ACQUISITION AND VIRTUAL SIMULATION

The RTT should be able to carry out the required procedures necessary for optimal image acquisition for treatment planning for all cancer sites while taking into account the patient's needs and limitations

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K40. Describe the purpose and process of simulation K41. Show a detailed knowledge of all major organs and systems of the body K42. Identify gross anatomy commonly referred to in the practice of radiotherapy on CT, MRI, PET and fused images K43. Describe the effect motion has on position within different anatomical sites K44. Describe the common routes of cancer spread and illustrate	S35. Compare the different imaging modalities and the rationale for their selection S36 Define volume for planning purposes	C13. Define the most appropriate imaging modality/modalities relevant to the site

anatomical relations, blood supply and lymphatic spread K45. Describe the various types of imaging modalities that can be used for treatment planning purposes K. 46 Identify relevant anatomy in relation to treatment sites covered		
K47. Describe how contrast agents and techniques are used in imaging to improve the identification of normal and pathological tissues K48. Explain the importance of imaging biomarkers K49. . Explain the importance of fiducial markers in the context of organ position and identification	S37. Assess the most appropriate image format and implement this in the context of virtual simulation S38. Educate and inform the patient concerning the different imaging modalities/procedures used S39. Inform and educate the patient on the process S40. Apply the various techniques to optimise image quality including the use of contrast agents where appropriate S41. Explain the principles of positioning and immobilisation to imaging department staff where necessary S42. Apply the ALARA (as low as reasonably achievable) principle	C14. Apply the appropriate scanning conditions / parameters

	during image acquisition and record the exposure dose S43. Acquire images based on known routes of cancer spread S44. Evaluate the extent of the scan volume for planning purpose	
K50. Describe the parameters affecting image quality for different imaging modalities K51. Describe the various image processing tools that can be used and appreciate their impact on image appearance K52. Define the target volume and organs at risk K.53 Describe the coordinate systems used K.54 Define and explain the different methods commonly used for referencing. K55. Identify the limitations of each treatment unit K56. Identify the influence of beam parameters	S45. Recognise the most appropriate method of imaging for treatment planning S46. Interpret and evaluate the images acquired to ensure accurate identification of the organs at risk S47. Carry out the simulation process with precision, accuracy and attention to detail. S48 Prepare and critically evaluate beam arrangements S49. Select the appropriate referencing method for the individual patient to ensure reproducibility throughout the treatment process	C15. Acquire the appropriate images for optimal for treatment planning C16. Interpret the acquired images and evaluate with respect to use for treatment planning C17. Perform virtual simulation procedures C18. Set the reference / isocentre points for the treatment verification and setup

	S50. Evaluate the site for imaging and if appropriate discuss how motion will be managed S51. Evaluate the target volume with respect to the organs at risk	

5. TREATMENT PLANNING

All RTTs should be able to interpret and evaluate a treatment plan and compare it to the treatment prescription. In addition RTTs directly involved in the treatment planning process should be able to participate in the preliminary discussion on the issues relating to the optimum treatment plan for an individual patient and be able produce a treatment plan that fulfills the criteria.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	**SKILLS** [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	**COMPETENCES** [manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K57. Explain the principles of a treatment planning system K58. Explain the importance of absolute accuracy in treatment planning K59. State the relevant definitions in treatment planning K60. List the main organs of the body and their anatomical relationships K61. Describe the lymphatic drainage, blood and nerve supply of the main	S52. Acknowledge the limitations of the treatment equipment and accessory devices when constructing a plan S53. Evaluate the accuracy of the plan from an anatomical perspective S54. Critically evaluate the dose distribution and the DVHs S55. Transfer the patient data and images to the TPS and to the record and verify system and verify the plan	C19. Interpret and evaluate a treatment plan and compare it to the treatment prescription taking any patient physical condition into consideration C20. Appraise and discuss the treatment plan options available for the patient

organs K.62 Relate the functional interrelationships that normally exist between the organs and system during daily life K63. Explain the mechanisms by which the different organ systems are controlled physiologically K64. Label a range of cross sectional anatomical diagrams K65. Define the target and organs at risk using the ICRU terminology K66. Explain CTV-PTV expansion and rationale K67. Define the radiation types and energies routinely used in radiotherapy and how they are produced K68. Differentiate between the structure and interactions of electrons and photons K69. Explain the factors that affect the percentage depth dose, TMR, TAR, TPR in patients K70. Explain the functionality of the equipment used in treatment delivery K71. Explain the benefits and disadvantages of each treatment modality used in radiotherapy K72. Describe how radiation beams can be modified	S56. Appraise the treatment prescription in terms of the technique, dose and fractionation schedule and treatment modality S57. When necessary perform manual calculations for both isocentric and no-isocentric units S58. Review each plan taking radiobiological effects into consideration S59. Evaluate each plan with respect to dose to the target volumes and dose to the Organs at Risk S60. Explain the selection of the dose and fractionation schedule	

K73. Define the dose and fractionation schedules used routinely K74. Describe the architecture of normal tissue in relation to function K75. Define the radiation sensitivity of tumours and normal tissue K76. List the dose restrictions for the organs at risk K77. Describe how DVHs are created and used to evaluate plans. K78. Relate the influence of changing planning parameters on DVHs K79. Explain concepts relevant in treatment planning		
K.80 Explain the parameters available within the Treatment Planning System to produce an optimal treatment plan K81. Outline the principles of image fusion and the issues that need to be considered when fusing images acquired from different modalities K82. Explain image fusion K83. Relate the functional interrelationships that normally exist between the organs systems during daily life	S61. Evaluate the role of image fusion S62. Apply anatomical knowledge in the preparation of a treatment plan S63. Apply knowledge of molecular oncology and radiobiology to the preparation of a treatment plan S64. Evaluate the treatment modalities available and select the most appropriate one S65. Select the optimum beam type and energy S66. Appraise fused images S67. Contour skin surface and organs at risk. S68. Evaluate the requirement for beam modification S69. Optimise and evaluate the plan options	C21. Produce an appropriate treatment plan that meets the requirements of the treatment prescription and is consistent with the treatment unit capabilities and the patient physical condition

	S70. Carry out manual calculations S71. Double check computer and manual calculations S72. Evaluate any beam modification required and select the most appropriate	

6. ON TREATMENT VERIFICATION

Competence

Before delivery of the first treatment the RTT must be able to check for consistency between the data in the record and verify system and the treatment prescription, the immobilisation and the setup and the beams with the treatment plan. The RTT must be able to carry out the patient position verification and record the reference data. S/he must be able to carry out verification checks and implement adjustments in accordance with departmental protocol. The RTT should be able to perform and evaluate images that are acquired during treatment to establish the accuracy of patient setup and to make adjustments in accordance with departmental protocol. This section refers to the acquisition and verification of the image on the first day and throughout the treatment. It also includes the use of in-vivo dosimetry where this is practiced.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	**SKILLS** [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	**COMPETENCES** [manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K84. Be familiar with the treatment plan K865 Explain the different modalities / methods used to generate verification images K86. Identify the imaging protocol	S73. Check all preparatory procedures have been completed S74. Inform and educate the patient as to the treatment procedures S75. Assess the physical and psychological status of the patient	C22. Set the patient and equipment requirements according to verification C23. Carry out the necessary data transfer checks

K87. Explain the position verification protocols commonly used		
K88. Define the imaging parameters routinely used K89. Recognise the critical structures on the verification images K90. Explain the principles of treatment verification K91. Identify the correction protocols and their importance in treatment delivery and outcomes K92. Recognise the difference between online and offline protocols and their rationale	S76. Check all parameters are set correctly S77. Check all immobilisation and beam modification devices are correct and correctly positioned S78. Check reference or isocentre settings are correct S79. Select the correct settings to acquire an appropriate image S80. Make corrections in accordance with the departmental protocol	C24. Position the patient for treatment following the treatment planning and simulation criteria ensuring comfort as far as possible C25. Interpret and critically evaluate the verification images C26. Be able to carry out corrective actions C27. Carry out on on-treatment verification and make adjustments as necessary and in accordance with protocol
K93. Identify the daily entrance and exit dose and the dose level of critical organs	S81. Identify the daily entrance and exit dose and the dose level of the critical organs S82. Carry out in vivo dosimetry S83. Evaluate the results and take corrective action as per protocol S84. Report any inconsistency S85. Acquire the initial verification images S86. Compare and contrast bony anatomy and soft tissue matching S87. Evaluate the images	C28. Check the dose delivered is as prescribed C29. Carry out in-vivo dosimetry

	S88. Evaluate inaccuracies in relation to the CTV-PTV expansion and compare and contrast the different methods by which these can be assessed or accounted for S89. Make corrections in accordance with protocol S90. Record any corrections	

7. EXTERNAL BEAM TREATMENT DELIVERY

The RTT is responsible for the accurate daily delivery of the prescribed treatment. This incorporates daily evaluation of the patient's physical condition to note, account for and seek advice for any significant change that may directly affect the delivery of the treatment as prescribed, checks for consistency of the positioning aids, image verification and all quality assurance procedures in accordance with department protocols.

The RTT must be able to receive, process and provide information to staff, patients and their families and members of the public as appropriate and be able to differentiate and fulfil the informational requirement of each group. As the main contact point for the patient on a daily basis they must ensure that they inform the patient of the procedures at every stage and they must continuously monitor the physical and psychosocial status of the patient prior to any procedures taking place. They must make referrals to the relevant health professionals and ensure that all pertinent information is transferred accurately and concisely and in a timely manner.

KNOWLEDGE	SKILLS	COMPETENCES
[Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	[Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	[manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]

K94. Review the individual patient requirements	S91. Participate in the organization of the daily work schedule to maximize efficiency	C30. Ensure that the daily organization of the treatment unit is optimum
K95. Define the factors that need to be considered when checking the treatment plan and prescription prior to the first treatment K96. Recognise the importance of treatment QA throughout all the treatment delivery processes K97. Recognise the need for different treatment time slots according to technique prescribed	S92. Explain in detail the proposed treatment, how it will be carried out, potential side effects and how they can be managed S93. Inform the patient of the possible side effects	C31. Inform the patient of all aspects of the treatment prior to first fraction. C32. Prepare the patient for their first treatment
K98. Outline the key points in the treatment protocols routinely used in the department K99. Explain the principles defined by these protocols K100. Be familiar with the treatment plans for all patients on the treatment unit K101. Discuss the importance of patient identification and how it should be carried out K102. Identify the co- morbidities that will impact on patient	S94. Interpret the treatment plan and prepare the equipment accordingly S95. Identify the patient in accordance with recognised procedures and consistent with the department protocol S96 Evaluate the patient general condition prior to commencing positioning S97. Select and accurately apply the optimum position and	C33. Accurately position and immobilize the patient consistent with the aims of the treatment prescription and taking the patient's physical and psychological aspects into consideration C34. Carry out treatment delivery in an accurate and safe environment

position K103. Describe the biological processes that occur within the radiotherapy field K104. Identify the typical normal values for the physiological variables commonly monitored as part of radiotherapy practice K105. Recognise the signs and symptoms associated with treatment in different sites K106. Define the effects of concomitant treatment K107. Identify the side effects associated with the individual treatment	immobilisation method for each patient S98. Evaluate treatment protocols to check consistency with current literature S99. Evaluate the treatment parameters prior to treatment delivery and make adjustments as appropriate S100. Integrate the physical principles underlying the radiotherapy process into understanding the specific treatment technique used	
K108. Record all side effects and any intervention recommended K109. List support groups that might benefit patients K110. Be familiar with the follow up procedures	S101. Assess the daily physical and psychological status of the patient prior to treatment delivery and discuss the management of routine problems with the patient S102. Evaluate the patient test results prior to treatment delivery S103. Advise the patient on management of side effects in accordance with departmental protocol	C35. Monitor, manage and record the patient's side effects throughout the course of treatment referring to the clinician or other health professional as necessary C36. Advise patient on immediate post treatment care and inform of the follow up procedures

8. QUALITY ASSURANCE

The RTT is responsible for ensuring the quality of all procedures in which they are involved and should be familiar with and participate in the routine quality assurance and quality control procedures carried out in the department.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	SKILLS [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	COMPETENCES [manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K111. Explain QMS, QA and QC differentiating between them K112. Define the roles and responsibilities of the individual disciplines with respect to QA and QC	S104. Evaluate the role of the QMS in a department S105. Appraise quality and how it is applied in daily practice S106. Perform the daily QC procedures as appropriate to work area S107. Analyse and record the results and report any deviations S108. Participate in the wider QA programme within the department	C37. Ensure that all Quality Control checks have been completed and that all parameters are correct for treatment preparation or delivery
K113. Distinguish between systematic and random errors K114. Define dosimetric and geometric errors	S109. Report incidents and near incidents to the Quality and Safety Committee or its equivalent S110. Examine any incidents or near incidents and how they can be prevented in the future	C 38. Participate in the analysis and feedback on incident and near incident reports

K115. Be familiar with the reporting systems and reporting protocols K116. Discuss why incident and near incident reporting is necessary		
K117 Describe radiation hazards and how they are managed K118. Explain the legislation related to radiation protection K119. Describe in detail current radiation protection legislation	S111. Routinely inspect the area to ensure that radiation protection measures are in place and functional	C39. Ensure radiation protection legislation is adhered to at all times throughout the area
K120. Describe the health and safety hazards that might be encountered and how they are managed	S112. Routinely inspect the area to identify any health and safety hazards and report where necessary	C40. Ensure that general health and safety procedures are adhered to at all times
K121. Explain the importance of accurate and complete documentation in reducing incidents K122. List all the methodologies used routinely for treatment documentation	S113. Evaluate the problems that result from incomplete or inaccurate documentation S114. Discuss the merits and disadvantages of the different methodologies used in documentation of all aspects of treatment preparation, delivery and follow up	C41. Accurately and comprehensively complete all documentation to enable future review and analysis if required

9. BRACHYTHERAPY

The RTT must fully appreciate the fundamental principles involved in the delivery of brachytherapy. The RTT must be competent to participate in procedures including plan evaluation, treatment planning and carrying out QA and safety checks prior to treatment commencement as appropriate to practice in the department. These procedures should be carried out in accordance with departmental protocols.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	**SKILLS** [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	**COMPETENCES** [manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K123. Explain the principles and application of brachytherapy K124. Identify the roles and responsibilities of the members of the team K125. Identify the technique to be used K126. Evaluate the treatment plan K127. Identify the patient in advance and be familiar with their general condition	S115. Arrange the treatment room and ensure all equipment is available S116. Assemble all the documents required S117. Inform the patient of the procedure S118. If appropriate participate in planning the treatment S119. Evaluate the rationale underpinning the different methods of brachytherapy application	C42. Prepare the area for the procedure correctly ensuring hygiene and sterilization procedures are adhered to C43. Manage the aspects of the procedures that are the responsibility of the RTT

	S120. Participate as a member of the multidisciplinary radiotherapy team in the procedure	
K128. Identify the routine QA and safety procedures that should be carried out prior to treatment K129. Recognise the specific radiation hazards associated with brachytherapy K130. Calculate radioactive decay rates, attenuation rates and inverse square law corrections	S121. Check all radiation protection requirements have been met S122. Carry out the routine QA and safety procedures prior to treatment	C44. Ensure radiation protection rules are adhered to at all times

10. RESEARCH

The RTT should be able to evaluate and apply the results of research in their daily practice. They should be able to participate in research projects within their sphere of activity and identify areas within their own practice that would benefit from research.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	SKILLS [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	COMPETENCES [manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K131. Describe the principles of evidence based medicine K132. Describe the scientific method as a fundamental mechanism for critical analysis and problem solving K133. Review clinical trial documentation K134. Be familiar with the individual trial requirements	S123. Set up the trial documents and introduce to the staff S124. Confirm that all trial parameters are met	C45. Participate in the implementation and monitoring of national or international clinical trials into the department C46. Participate as an active member of the research team
K135. Identify the correct search terms for a literature review K136. Recognise an aspect of practice that would benefit from research K137. List all the items to be included in the proposal K138. Identify the ethical requirements	S125. Evaluate the research proposal in the context of the methodology chosen and comment/make suggestions as appropriate S126. Critically appraise the studies selected and carry out a comprehensive literature search S127. Collect all the information necessary to refine the research idea and plan the project S128. Organise the elements necessary to write the proposal	C47. Initiate and develop a research idea C48. Write up a research proposal

K. 139 Identify the correct search terms for a literature review		
K140. Introduce the research study to the staff K141. Identify the patients who are suitable for recruitment onto the trial K145. Recruit appropriate patients , adhering to informed consent procedures. K146. Recognise when multidisciplinary input is necessary K147. Define the data analysis methods commonly use	S129. Inform and educate the patients with respect to the requirement of the study S130. Work within the defined time schedule S131. Analyse the results S132. Write up the research for submissions to a scientific publication S132. Monitor if adaptation of the protocol is necessary S133. Work closely with the multidisciplinary team in implementing the research finding/s	C49. Implement and manage an independent research project C50. Analyse the data C51. Participate in the implementation of the research findings
K 148. Prepare results of research in a scientific format	S134. Synthesise and evaluate the findings of the research S135. Prepare and evaluate a poster based on the research finding S136. Prepare, deliver and evaluate an oral presentation S137. Prepare, analyse and present information in a scientific and professional manner	C52. Present and defend research findings

11. EDUCATION

The RTT should be prepared to teach / support / supervise new colleagues of all disciplines in their department. He/she should participate in education programmes for student RTs and other health related disciplines. He/she should participate in public information sessions and patient information and education programmes.

KNOWLEDGE [Advanced knowledge of a field of work or study, involving a critical understanding of theories and principles]	**SKILLS** [Advanced skills, demonstrating mastery and innovation, required to solve complex and unpredictable problems in a specialized field of work or study]	**COMPETENCES** [manage complex technical or professional activities or projects, taking responsibility for decision making in unpredictable work or study contexts, take responsibility for managing professional development of individuals and groups]
K149. Explain the basic procedures carried out K150. Describe the preparation pathway and treatment procedures to others K151. Discuss the educational methods most appropriate to clinical education	S138. Prepare information for the patient and public education sessions S139. Evaluate the optimal method to impart information to other RTTs and health professionals S140. Inform and educate student RTTs on all aspects of clinical practice	C53. Actively participate in the dissemination of information on radiotherapy and its application to students, other health professionals, patients and the public. C54. Take responsibility for the clinical skills acquisition of student RTTs through effective teaching in the clinical setting.

APPENDIX 3: Questionnaire for the 3rd Revision of the ESTRO Core Curriculum for RTTs

REVISION OF THE EUROPEAN CORE CURRICULUM FOR RTTs

Explanatory information for the questionnaire

The RTT (Radiation Therapist)

The RTTs are the group of professionals with direct responsibility for the final administration of a prescribed course of radiation therapy to cancer patients and who is an integral member of the multidisciplinary team involved in the total process. 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 RTT is a member of the multidisciplinary team comprising essentially the clinician, physicist and RTT. As the RTT 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 other associated professionals in ensuring the needs of the patients are met.

Aims of the current revision

- To assess the relevance of the content of the existing core curriculum in the context of changing technology and practice across the whole of Europe.

- To reflect the education level and curriculum content necessary to achieve core competencies of RTTs on completion of their initial education programme.

- The curriculum content will be defined based on the core competencies. The core competencies will be identified by surveying the national societies in each country to ascertain the basic practice of RTTs. We have identified the probable core competencies based on the patient pathway through the radiotherapy department.

- To define the scope of practice and level of responsibility taken by RTTs in the member states in the context of recognition of qualifications and free movement of personnel.

- This revision will also describe the additional roles that have been developed across a range of countries based on further education.

CORE COMPETENCIES ON GRADUATION (On completion of the basic education programme)

We are not expecting you to answer all of these questions yourself but to liaise with a group of colleagues covering a range of departments and to try to provide as comprehensive an indication as possible of the practice of RTTs in your country.

For the purposes of analysis we will use the term RTT throughout this document to encompass all the titles used across Europe. RTT was used in the two previous Core Curricula and is the term used by ESTRO and the IAEA.

In defining the core competencies please explain when and how a new RTT would be expected to have achieved these, i.e. immediately on graduation, following an intern period, following on site training in a clinical department or other. Please give details and duration of additional clinical training if required.

The Title RTT

The lack of a single title is one of the aspects that creates difficulties in terms of international identity and also in facilitating the free movement of personnel that is integral to the development of the European Community and is a clearly identified aspiration. All recognised professions have an internationally recognised and accepted title that defines, within national limits, their role. This is not the case for the professionals directly involved with the delivery of radiation therapy to patients. Currently many different titles are used throughout Europe to describe the members of our profession and it has been agreed that the abbreviation RTT is adopted in the interim until an internationally agreed title has been defined. Table 1 gives the titles currently in use in Europe.

Questionnaire

PART 1.

Table 1: Titles used per country in Europe

Country	Title
Austria	Diplomierte/er radiologisch technische / er Assitant / in DRTA or Dipl RTA
Albania	
Belgium	Verpleegkundige Radiotherapie – Verpleegkundige Infirmier en Radiothérapie
Bielorussia	
Bosnia - Herzegovina	
Bulgaria	
Croatia	
Cyprus	
Czech Republic	
Denmark	Stråleterapisygepelejerske/Stråleterapiradiograf
Estonia	
Finland	Röntgenhoitaja
France	Manipulateur en électroradiologie Manipulateur en radiothérapie Technicien de radiothérapie Cadre médicotechnique Cadre manipulateur
Georgia	
Germany	MTRA
Greece	• Technologos Aktinologos = Medical Radiological Technologists (University level education) • Radiotherapy machine users (secondary level education)
Hungary	
Iceland	
Ireland	Radiation Therapist
Italy	Tecnico Sanitario Radiologia Medica
Kazakhstan	
Kyrgystan	
Latvia	
Lithuania	
Luxembourg	
Macedonia	
Malta	
Moldova	

Monaco	
Montenegro	
The Netherlands	Radiotherapeutisch Laborant Radiation Therapy Technologist Therapeutic Radiographer
Norway	
Poland	
Portugal	Técnico de Radioterapia
Romania	
Russia	
Serbia	
Slovakia	
Slovenia	
Spain	Técnico superior especialista en RT
Sweden	Onkologisjuksköterska
Switzerland	
Turkey	
Ukraine	
United Kingdom	Therapeutic Radiographer Therapy Radiographer Radiographer Radiotherapist
Uzbekistan	

The countries listed above are those known to have radiotherapy.

What is the legally recognised title of the RTT in your country? (please give the official title where several are used in practice)

_____
_____
_____

What is the title of the qualification awarded at the end of the education programme?

-

_____
_____
_____

What is the nationally recognised qualification required to work in radiotherapy as an RTT in your country?

_____
_____
_____

What is the duration of the education programme?

_____
_____
_____

Is further clinical training required after graduation? If so please give details

_____
_____
_____

Is RTT a statutory / state registered/ regulated profession in your country?

_____
_____
_____

Who is responsible for maintaining the register / legal list / roll of RTTs?

_____
_____
_____

If this is not maintained by the appropriate Government Department then how has this responsibility been delegated?

_____
_____
_____

Is Continuing Professional Development (CPD)/ Continuing Medical Education (CME) a requirement for maintaining registration?

_____
_____
_____

What is the system for recognition of professional qualifications in your country?

_____
_____
_____
_____
_____

Is there a nationally defined career structure / pathway / progression for RTTs in your country?
If yes please give details

_____
_____
_____
_____
_____

Is a further qualification required for progression? Yes / No (Please circle)
If yes please give details

_____
_____
_____
_____
_____

ACADEMIC EDUCATION

What is the level of the institution where the academic programme is delivered?

_____
_____
_____

Are RTTs directly involved with the delivery of the academic programme? Yes / No (Please circle)

If YES what subjects do they teach?

_____
_____
_____

Are they formally part of the Institution staff? Yes / No (Please circle)

_____
_____
_____

If NO who teaches the RTT specific subjects and how is this organised?

_____
_____
_____
_____
_____
_____

Who is responsible for the overall management of the RTT course?

_____
_____
_____

CLINICAL EDUCATION

Are there specific departments affiliated to the academic institution? Yes / No (Please circle)

Are there teaching agreements in place between the academic institution and the clinical centre? Yes/No (Please circle)

_____
_____
_____

Do you have clinical teachers / tutors? Yes / No (Please circle)

If YES are they RTTs? Yes / No (Please circle)

If NO what professional group carry out this role?

_____
_____
_____

Are the clinical teachers / tutors employed by:

The academic centre	
The clinical department	
Both	
Neither	

Is any part of the clinical teaching carried out in the academic department? If yes please give details (e.g. treatment planning, making immobilisation devices, simulation etc.)

_____
_____
_____
_____
_____
_____

Are there set criteria for the level of equipment necessary for a department to have students? Yes / No (please circle)

If YES please give details

_____
_____
_____

Is there a formal clinical assessment / examination? Please give details

_____
___

PART 2

SCOPE OF PRACTICE of and RESPONSIBILITY TAKEN by the RTT

Newly qualified RTT			
Activity	**Yes**	**No**	**Comment**
Are new RTTs expected to work independently immediately?			
If no for what period would they require mentoring prior to working independently?			
Is there a system of mentorship for new RTTs?			
What areas would a new RTT be first expected to work?			
The RTT in the radiotherapy department			
Are RTTs expected to work in all areas within the department?			

For the following sections what is required is for you to give details of the role and responsibility of RTTs in the defined areas. Please indicate if this role is taken by an RTT. (yes or no)

If yes:

- Does it depend on their experience?
- whether they do this alone or as part of the team
- if as part of the team who else is involved?

If no please indicate who is responsible for this task

Patient Information and support (ongoing throughout the process)	**Yes**	**Experience or additional qualification dependent**	**Alone or as part of a team**	**No**	**Who is responsible?**	**N/ A**
At diagnosis						
At referral for RT						
At first visit to department						
At time of treatment preparation – mould room or simulation						
At the time of first treatment						
During treatment						
As part of the follow up procedure						

Treatment Preparation Mould room	Yes	Experience or additional qualification dependent	Alone or as part of a team	No	Who is responsible?	N/ A
Preparation of immobilisation devices						
Preparation of customised shielding						
Preparation of electron cut outs						
Preparation of bolus material						

Treatment Preparation Simulation	Conventional Simulation		CT Simulation		Other imaging modalities		Comment
	Yes	No	Yes	No	Yes	No	
Can the RTT carry out the preparatory procedures without a clinician present?							
Can the RTT carry out the full procedures including acquiring the							

images, without a clinician present?							
Must a clinician verify all simulation images prior to transfer to treatment planning?							
Must a clinician be present during the procedures?							
Must a physicist be present during the procedures?							
Must a diagnostic radiographer be present during the procedures?							

TREATMENT PLANNING / DOSIMETRY					
Can all RTTs work in treatment planning / dosimetry or is a special education programme required? Y / N					
When an RTT works in the treatment planning / dosimetry department which procedures can they carry out?					
Procedure	**No**	**Yes**	**Yes for certain sites (please indicate)**	**With clinician**	**With physicist**
Treatment planning					
Image fusion					
Contouring					

• Outline					
• Tumour volume					
• Organs at risk					
2D Planning					
3D Planning					
4D Planning					
IMRT					
Stereotactic					
TBI					
Electrons					
Protons					
Dose calculation					
Preparation of treatment prescription sheet					
Data transfer					
Other dosimetry related tasks					
In vivo dosimetry					
Dose verification					

TREATMENT								
	Always	**Single Field**	**2D**	**3D**	**4D**	**IMRT**	**TBI**	**Stereotactic**
Are all first set ups checked by a clinician?								
Does the clinician have to approve all set ups?								
Does the physicist have to be present?								

Are the treatment charts completed and signed daily by the RTT?								
Can the RTT check the on line set up verification images?								
Can the RTT approve the on line set up verification images?								
Can the RTT check the off line set up verification images?								
Can the RTT approve the off line set up verification images?								
Can the RTT carry out the placement of the in vivo dosimetry devices?								
Can the RTT carry out the in vivo dosimetry analysis?								

PATIENT PSYCHOSOCIAL AND CARE PROCEDURES			
	Yes	**No**	**Comment**
Does the RTT monitor the daily side effects experienced by the patient?			
Can the RTT discuss the patient's side effects with them?			
Can the RTT manage the patient's side effects?			
Does the RTT document the side effects using a recognised scoring system?			
Can the RTT prescribe medication for the patient during treatment?			
Can the RTT discuss the patient's psychological status with them?			

Quality Assurance	Yes	No	N/A	Experience or additional qualification dependent	Alone or as part of a team	Who is responsible?
Are RTTs involved in clinical audit in your country?						
Are RTTs involved in radiation protection committees at the local, regional or national level						
Can RTTs carry out the daily quality control checks on the Linear Accelerator, Cobalt, Orthovoltage Unit or other						
Can RTTs carry out the daily control checks on the Simulator, CT etc.						
Are RTTs involved in image matching for verification purposes of EPID or other verification images?						
Is there a defined quality assurance post for RTTs in your country?						

Brachytherapy	Yes	Experience or additional qualification dependent	Alone or as part of a team	No	Who is responsible?	N/ A
Are RTTs involved in the room preparation for Brachytherapy?						

Are RTTs involved in patient preparation including information and patient support?						
Do RTTs assist with the Brachytherapy procedure?						
Are RTTs involved with Simulation for brachytherapy?						
Are RTTs involved with Treatment planning for brachytherapy?						
Are RTTs involved with Dose calculation for brachytherapy?						
Are RTTs involved with Monitoring the dose to critical organs in brachytherapy?						
Are RTTs involved with Source preparation for brachytherapy?						
Are RTTs involved with Source introduction for brachytherapy?						

Are RTTs involved with Source removal for brachytherapy?						
Are RTTs involved with maintenance of source activity register for brachytherapy?						

Research	Yes	Experience or additional qualification dependent	Alone or as part of a team	No	Who is responsible?	N/ A
Are RTTs involved in research?						
Do the RTTs generate their own research ideas?						
Can the RTTs initiate and conduct research in the department?						
Do the RTTs publish the result of their research?						
Is research or research and development a recognised post in any of the departments in your country?						

Do RTTs require further education in order to carry out research?						

Management	Yes	Experience or additional qualification dependent	No	Comment
Do RTTs require further education to take a position as a manager in the department?				
Is there a defined management career structure for RTTs in your country?				

Continuing Professional Development (CPD) Continuing Medical Education (CME)	Yes	No	Comment / Give details
Is there CPD/CME available for RTTs in your country?			
Is CPD / CME funded? If yes by whom?			
Is CPD / CME compulsory?			
Who is CPD / CME organised by? • **Local group** • **National Society**			

• **The University / Education Centre** • **Other (please specify)**			
Are RTTs supported to attend international conferences? If yes by whom? (please specify)			

APPENDIX 4: Titles

Country	Title
Austria	Radiologietechnologe (from 2005)
Belgium	Verpleegkundige Radiotherapie – Verpleegkundige Infirmier en Radiothérapie Nurse specialized in oncology from 18th February 2009 (Recognised by a Ministerial Order)
Bulgaria	X-ray technician
Croatia	Baccalaureus of Radiation Technology / Medical Radiology Engineer
Cyprus	Therapeutic Radiographer
Denmark	Stråleterapeut
Estonia	Radioloogiatehnik Radioloogiaõde
Finland	Röntgenhoitaja
France	Manipulateur (trice) d'électro-radiologie médicale en radiothérapie
Hungary	Röntgenasszisztens Radiografus
Ireland	Radiation Therapist
Italy	Tecnico Sanitario di Radiologia Medica
Lithuania	Radiologijos technologas-radiology technologist
Macedonia	Radiation Technologist
Malta	Therapy Radiographer
The Netherlands	Medisch Beeldvormings-en Bestralingsdeskundige (MBB'er) Radiotherapeutisch Laborant Radiation Therapist
Norway	Stråleterapeut in Norwegian i.e. Radiation Therapist
Poland	Technik radioterapii
Portugal	Técnico de Radioterapia
Serbia	Strukovni medicinski radiolog – Medical Radiologist of Applied Sciences
Slovenia	Diplomirani inženir radiološke tehnologije
Spain	Radioterapia
Sweden	Onkologisjuksköterska med specialistutbildning radioterapi Sjuksköterska med specialistutbildning radioterapi
Switzerland	Technicien en radiologie médicale
Turkey	Radiotherapist / Radiotherapy technologist
United Kingdom	Therapeutic radiographer / Radiographer
Russia	
Slovakia	

Spain	Técnico superior especialista en RT
United Kingdom	Therapeutic Radiographer Therapy Radiographer Radiographer Radiotherapist