Benchmarking guideline

The European Society of Radiotherapy and Oncology (ESTRO) European Higher Education Area levels 7 and 8 postgraduate benchmarking document for Radiation TherapisTs (RTTs)

Mary Coffey *, Michelle Leech, on behalf of the ESTRO Radiation TherapisT Committee

Applied Radiation Therapy Trinity, Discipline of Radiation Therapy, Trinity College, Dublin 2, Ireland

A B S T R A C T

This guideline details the European Higher Education Area Levels 7 and 8 Postgraduate benchmarking document for Radiation TherapisTs (RTTs). The purpose of this benchmarking document is to assist higher education institutes in the development of radiation therapy-specific curricula for RTTs engaging in postgraduate education, with a view to working at an advanced level in radiation therapy departments.

The document specifies the knowledge, skills and competences that are required to work in specific areas of RTT practice, at levels 7 and 8. These include: advanced delineation and volume determination, advanced treatment planning, advanced imaging, quality and risk management, management and service development, patient care and support, brachytherapy and research.

© 2018 Published by Elsevier B.V. on behalf of European Society for Radiotherapy & Oncology. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

Executive summary

The European Society for Radiotherapy and Oncology (ESTRO), through the Radiation TherapisT (RTT) Committee has sought, over a twenty -five-year period, to address the professional and educational issues of RTTs who are responsible for the delivery of the radiotherapy prescription accurately and safely. The benchmarking document encompassing the descriptors for the first cycle in the Framework of the European Higher Education Area (level 6) has been published [1] and is available on the ESTRO website (http://www.estro.org/binaries/content/assets/estro/about/rtt/rtt-benchmarking.pdf) and defines the competences required of a graduate commencing work in a radiotherapy department. This document encompasses the descriptors for the second and third cycles of the Framework of the European Higher Education Area (levels 7 and 8) and defines the competences that RTTs should have for advanced or specialist practice [2]. In most instances there are two distinct options at level 7 and 8: role extension and advanced practice often with varying educational requirements. Level 7 indicates extended practice and is supported by postgraduate diploma education. Level 8 reflects advanced practice and is underpinned by Masters or Doctorate level education.

Level 7 is described in the Framework as "highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study, as the basis for original thinking and/or research, including a critical awareness of knowledge issues in a field and at the interface between different fields [2]. This description is very relevant for RTTs working at an extended level or in a specialised area underpinning best practice in technical treatment preparation and delivery, the provision of psychosocial care to patients and supporting the development of research for practice. Knowledge at this level underpins the skills and competences described in the Framework as "specialised problem-solving skills required in research and/or innovation in order to develop new knowledge and procedures and to integrate knowledge from different fields" and "manage and transform work or study contexts that are complex, unpredictable and require new strategic approaches; take responsibility for contributing to professional knowledge and practice and/or for reviewing the strategic performance of teams" [2]. These skills and competences enable RTTs to take responsibility for the introduction of change in their working environment, to work at an extended level and participate as an autonomous team member. Dreyfus et al describes individual progression through skills acquisition to explain the 'acquisition' of clinical skills over five levels: Novice, Advanced Beginner, Competent, Proficient and Expert [3] (Table 1). This model has also been used by Brenner in describing the stages of clinical competence in nursing [4].

* Corresponding author at: Discipline of Radiation Therapy, Trinity Centre for Health Sciences, St. James's Hospital Campus, Dublin 8, Ireland.
E-mail address: mcoffey@tcd.ie (M. Coffey).

Table 1

Stage	Descriptor	Definition
1	Novice	Rules based with an understanding of the context in which the rule is based
2	Advanced Beginner	The novice gains experience and begins to develop an understanding of the context. There is still a focus on following instructions
3	Competent	Uses rules and reasoning procedures to make decisions. Involves taking responsibility for one's actions. Ability to differentiate between elements of a situation that are important and those that can be ignored
4	Proficient	Sees goal and salient aspects and uses intuition in decision making and developing their own rules to formulate plans
5	Expert	Sees what needs to be done and, based on their experience in a variety of situations all seen from the same perspective but requiring different tactical decisions, allows immediate intuitive situational response characteristics

The ESTRO benchmarking document for EQF level 6 recommends degree level education with appropriate integration of clinical skills and assumes 'competent' as the starting point for a graduate RTT given the complexity of the RTT role and the safety implications of their duties. This benchmarking document for levels 7 and 8 reflects the proficient and expert stages of the model, respectively.

Level 8 is described in the Framework as "knowledge at the most advanced frontier of a field of work or study and at the interface between fields" providing the skills and competences of "the most advanced and specialised skills and techniques, including synthesis and evaluation, required to solve critical problems in research and/or innovation and to extend and redefine existing knowledge or professional practice" and "demonstrate substantial authority, innovation, autonomy, scholarly and professional integrity and sustained commitment to the development of new ideas or processes at the forefront of work or study contexts including research" [2]. Having knowledge, skills and competences at level 8 enables RTTs to become clinical specialists/advanced practitioners in their area at national and international levels and to drive professional change ultimately benefitting the patient as well as the profession. Basing education on the EQF Framework underpins the development of a career pathway for RTTs resulting in a more motivated workforce and a greater level of retention within the profession. In a case study on retention, carried out over three hospitals in three countries, CPD was an important factor in nurse retention in all three cases [5]. A study amongst Turkish nurses also confirmed opportunities and arrangements of on-the-job training were positive factors in retention [6].

This document provides a set of core learning outcomes with associated knowledge, skills and competences, to assist in the process of curriculum design. It does not specify curriculum content but should assist educational institutes in the development of both taught and research-based postgraduate programmes. It is also sets a framework upon which the requirement for life-long learning can be developed. The European Qualifications for Lifelong Learning 'contributes to the wider objectives of promoting lifelong learning and increasing the employability, mobility and social integration of workers and learners. It should also contribute to . . . the interrelationship of education, training and employment and building bridges between formal, non-formal and informal learning [7].

At levels 7 and 8 there is the opportunity to tailor programmes to reflect the more diverse student population and learning outcomes. As part of a framework for lifelong learning and to reflect the career requirements and aspirations of RTTs, formal programmes are offered at postgraduate certificate, diploma, masters or doctorate levels and can be academic, vocational or professional. The level of the postgraduate qualification reflects the number of ECTs that are awarded. At levels 7 and 8, programmes are generally tailored to specific topics and may reflect new developments in an area or provide knowledge and skills to enable the graduate to take a greater level of responsibility within their workplace, carry out research, or take an active role in the education of RTTs for instance.

Introduction

Radiotherapy developments

Radiotherapy preparation and delivery is complex requiring absolute accuracy to ensure safe practice and the optimum outcome for all patients. Within this environment there have been wide ranging changes and developments that impact both on current and future practice. Technological developments enable more focused volume definition reducing the potential for long-term damage to normal tissues surrounding or in close proximity to the tumour. Chemotherapeutic regimes, including the dynamic field of molecular targeted therapies, impact on the management of patients and, coupled with a high awareness of the available treatment options amongst the patient population, require RTTs who can effectively contribute to the further development of both the discipline and the profession.

Radiation TherapisTs (RTTs)

RTTs are the group of professionals with responsibility for the administration 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, medical physicist and the RTT. RTTs liaise with all the other associated professionals in ensuring the needs of the patient are met.

In the modern radiotherapy environment RTTs are taking a greater level of responsibility for aspects of practice and new roles are being developed in many countries. It is essential that RTTs undertaking new, extended or advanced roles or a greater level of responsibility are suitably educated to ensure continued safe and accurate treatment for all patients.

Postgraduate education of RTTs in Europe

The radiotherapy component of many education programmes was, and still remains, a very small or often negligible component of mixed programmes in a range of healthcare disciplines. In some instances the education background of the RTT may have no healthcare component at all. The rate of development of radiotherapy has also varied significantly across Europe with several countries introducing high technology approaches in the last decade. This has created a need for increased numbers of RTTs but has not been matched by an increase in the number of students

in the education institutes nor an updating of education programmes to facilitate changing practice. Where level 6 education programmes are well established RTTs are progressing to MSc and PhD level but in many instances these are in non-radiotherapy related areas due to the lack of specialist programmes and expertise. This benchmarking document defining higher level practice can be used in conjunction with the level 6 benchmarking document to develop innovative approaches to appropriately defining the content of postgraduate education programmes. Both documents are based on the recommendations of the European Parliament and Council and the European Higher Education Area.

The Recommendations of the European Parliament and of the Council (2008)

These recommendations were published in 2008 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 [8].

The European Higher Education Area (EHEA)

The European Higher Education Area 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 (www.ehea.org). Through the provision of quality higher education the aims were to strengthen mobility to enhance education and graduate employability. The Bucharest Communique of 2012 reiterated the aspiration of the need for graduates to be able to "combine transversal, multidisciplinary and innovation skills and 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".

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 Learning Outcomes are cornerstones of the Bologna Process in achieving transparency and comparability of education programmes.

European Credit Transfer and Accumulation System
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.

The ECTS is considered one of the cornerstones of the European Higher Education Area and the Bologna Process [8]. Use of ECTS has a fundamental place in the design of national and European Qualifications Framework. ECTs can be applied to all programmes at all levels and should enable ease of comparison.

ECTs are student-centred and reflect the level of work that is required by a typical student to achieve the learning outcomes and competences defined by the programme. In most instances this ranges between 1500–1800 h or 20–30 h per credit. ECTs include all student related effort and incorporate both face-to-face contact and a reflection of the level of independent preparation or study required for each specific component of the programme. The basis of the estimation of workload and the ECT allocation is on 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, understand and be able to do at the end of a learning experience [10].

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 [11].

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 in a widely spoken European language 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.

The European Qualifications Framework (EQF). The European Qualifications Framework for lifelong learning (EQF) [12] provides a common reference framework, which assists in comparing national qualifications systems, frameworks and their levels. It serves as a translation device to make qualifications more readable and understandable across different countries and systems in Europe, and thus promotes lifelong and life-wide learning, as well as the mobility of European citizens studying or working abroad. The EQF provides a common understanding of the levels of the qualification giving recognition for both academic and professional purposes.

Learning outcomes

A priority for the period 2012–15 for the European Higher Education Authority was to ensure that qualification frameworks, ECTS and Diploma Supplement implementation were 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 output rather than input based.

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, self-evaluation all of which are critical skills for RTTs working as professionals in the clinical setting.

Learning outcomes are consistent with the principles of the Bologna Process where one of the main features or outcomes is the need to improve the traditional ways of describing qualifications and qualification structures and to achieve a standard way of describing these 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 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 graduate having completed an undergraduate or postgraduate course. 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 forms 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" [13].

Advanced competences

Currently RTTs are taking on a wide range of specialist, extended or advanced roles and responsibilities in many countries. These responsibilities reflect the changing face of radiotherapy and the profession and can form the basis of a career structure going forward. The extended and advanced competences defined in this benchmarking document reflect the responsibilities taken by RTTs across Europe and internationally and can be supplemented at any time to form the educational basis for new activities in the future.

Structure of the defined competency

Level 7 and 8 competences build on the knowledge, skills and competences previously defined at level 6. In the tables defining the knowledge, skills and competences at level 7 and 8 the foundation competences at level 6 are identified. Level 7 indicates extended practice and is supported by postgraduate diploma education. Level 8 reflects advanced practice and is underpinned by Masters or Doctorate level education.

The extended and advanced roles detailed below are common in current RTT practice. Several of the competences identified are transferable as practice evolves in the future and can be adapted to new and emerging roles. Unlike level 6, which defines the general core competences of any graduate RTT, level 7 & 8 reflect the specialist roles taken by appropriately educated RTTs. It is envisaged that the specialist roles are independent of each other and the RTT will not be required to be proficient in all areas defined in the accompanying tables. The accompanying tables refer to current practice but at level 7 & 8 RTTs should have the requisite transferable skills to adapt to future developments.

Advanced Delineation and Volume Determination

Level 7: Delineation of OARs and structures for advanced Treatment Planning
At level 7 the RTT can take responsibility for delineation of organs at risk for planning of routine treatment sites in the department e.g. Prostate, Breast, Head and Neck.

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	Level 7 KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	Level 7 SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	Level 7 COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K6, K42–K44, K.46, K52, K64, K65 S35, S36, S46, S51, S66, S67 C16	K1. Identify specific anatomical detail as it relates to each site on CT, MRI and PET K2. List the guidelines available for delineation of OARs K3. Be familiar with the recognised delineation atlases K4. Be familiar with automated delineation software K5. Define the correct naming conventions for OAR delineation K6. Describe the impact of motion on OAR position relative to the tumour and reference points	S1. Interpret anatomical information from CT, MRI and PET to define organs at risk for each site S2. Critically review the guidelines on OAR delineation S3. Explain the process of selection of images from the delineation atlases S4. Explain the limitations of using delineation atlases S5. Discuss the advantages and disadvantages of automated delineation S6. Apply the appropriate naming convention in delineation S7. Explain the impact of motion and how it can	C1. Evaluate the quality of the image fusion C2. Carry out delineation procedures for OARs for the range of sites routinely treated in the department C3. Critically evaluate the delineation of the OARs C4. Appraise current research and implement changes in delineation practice as appropriate C5. Participate in regular audit of delineation practices in the department

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	Level 7 KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	Level 7 SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	Level 7 COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
	K7. Define deformable imaging K8. Define windowing K9. Be aware of inter and intra observer variation K10. Be familiar with current research in the area of delineation	be managed S8. Explain how deformable images impact on image fusion S9. Explain how deformable images impact on delineation S10. Explain the impact of windowing on delineation S11. Select the correct windowing parameter for each OAR being delineated S12. Discuss the impact of inter and intra observer variation on delineation and how it can be minimised S13. Evaluate the current research and how it can be applied	

Advanced Delineation and Volume Determination
Level 8: Delineation of target volumes for routine sites, OARs for rare sites, delineation of lymph node regions, GTV/CTV definition and CTV to PTV margins

At level 8 the RTT should be competent to delineate target volumes for routine sites, OARs and lymph node regions for rarer sites and to 'grow' the margins within protocol. Level 8 builds on the knowledge, skills and competences of level 7 and these will not be repeated in the table below.

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES	Level 8 KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	Level 8 SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	Level 8 COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K1–10 S1–13 C1–5	K11. Demonstrate knowledge of the departmental protocols for tumours routinely treated in the department K12. Demonstrate knowledge of the lymphatic drainage of the tumour sites routinely treated in the department K13. Define the rationale for expanding the GTV to CTV and CTV to PTV based on the literature and evidence based practice K14. Be familiar with the current literature and evidence based practice for rare tumours K15. Be familiar with the protocols for treatment of rare tumours K16. Describe the steps involved in preparing an educational programme in delineation K17. Define the different approaches to teaching in a clinical setting	S14. Function as a member of the team involved in the delineation phase of f treatment planning S15. Interpret the pathological information from CT, MRI and PET to define the treatment volume for tumours treated routinely in the department S16. Explain the rationale for the selection of nodal groups for the site selected S17. Explain the rationale for margin selection S18. Interpret the anatomical information from CT, MRI and PET to define the OARs for the rare tumour sites S19. Evaluate the different methodologies in the context of their application to research projects in delineation	C6. Delineate the target volumes for standard treatments of tumour sites routinely treated in the department C7. Delineate nodal volumes relevant to the specific tumour type and stage C8. Critically evaluate the local protocols for margin expansion C9. Define the appropriate GTV/CTV and CTV/PTV margins and grow accordingly C10. Delineate OARs for planning of rare tumour sites C11. Participate in the critical evaluation of the delineation protocols in the department C12. Participate in the peer review of delineated volumes

K18. Define the steps involved in the development and initiation of novel delineation research projects			C13. Participate in the development of delineation processes and procedures C14. Participate in the development and delivery of education in delineation C15. Initiate novel research on delineation based on existing research findings and evidence based practice

Advanced Treatment Planning

Level 7: Treatment Planning – e.g. IMRT, VMAT, adaptive planning and TBI

This builds on the competences defined in level 6. Level 7 applies only to RTTs who are already involved in treatment planning and are competent to plan standard treatments. Level 7 applies to the treatment planning process and therefore builds on the knowledge, skills and competences necessary for treatment planning and these will not be repeated in the table below. For RTTs starting to work in treatment planning level 6 is necessary.

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	Level 7 KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	Level 7 SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	Level 7 COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K57, K59, K65, K69, K72–K80 S52, S54–S56, S58–S60, S63–S65, S68, S69, S72 C19–C21	K19. Define inverse planning K20. Have knowledge of the algorithms used in inverse optimisation K21. Describe the definition of target volumes as per ICRU 83 K22. Describe recommended dose prescription methods as per ICRU 83 K23. Have detailed knowledge of the Level 2 dosimetric endpoints reportable as per ICRU 83 K24. Have knowledge of the Level 3 dosimetric endpoints given in ICRU 83 K25. Identify the reasons for the use of tuning volumes, rinds, coolers and dummy structures in the inverse optimisation process K26. Be familiar with the concept of volumetric normalisation K27. Be familiar with dose calculation algorithms K28. Define beam fluence K29. Define gamma index K30. Have knowledge of the relevance of the inverse square law in TBI treatment planning	S20. Compare and contrast forward and inverse treatment planning S21. Discuss the advantages and disadvantages of optimisation strategies for modulated techniques S22. Interpret the treatment prescription S23. Select the optimal beam arrangement or class solution for individual cases S24. Demonstrate an ability to work as a team member in collaboration with the radiation oncologist and medical physicist in treatment plan preparation and evaluation S25. Critically review the patient immobilisation practices used to acquire the planning data S26. Evaluate planning protocols for modulated techniques, and TBI in light of emerging evidence S27. Critically evaluate auto delineation algorithms and their application in various cancer sites S28. Appraise the emergence of automated and probabilistic planning for IMRT and VMAT and their impact on departmental workflow	C16. Utilise ring tuning volumes, rinds, coolers and other dummy structures appropriately in the inverse optimisation process C17. Evaluate the planning process and intervene appropriately during the iteration process C18. Be competent in the evaluation of beam fluences C19. Explain the dose verification process for modulated techniques C20. Utilise appropriate dose volume constraints for the treatment technique in question and in line with the published evidence and departmental protocols C21. Produce a clinically acceptable plan consistent with the prescription aims, treatment unit limitations and patient physical condition, while remaining cognisant of the need for plan robustness C22. Create libraries of plans for sites where adaptive planning is clinically indicated C23. Participate in quality assurance and audit procedures pertaining to the treatment planning process C24. Initiate novel research on treatment planning based on existing research findings and evidence based practice

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	Level 7 KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	Level 7 SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	Level 7 COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
	K31. Have a detailed knowledge of IMRT delivery methods K32. Be familiar with the evaluation metrics required for plan improvement K33. Describe the link between dosimetric endpoints and likely clinical outcome K34. Describe the optimal method of plan verification for the given technique K35. Be familiar with published and departmental dose volume constraints for modulated techniques and TBI K36. Explain the concept of adaptive planning K37. Describe the process of auto planning		

Advanced Treatment Planning Level 8: Complex Treatment Planning:

This builds on the competences defined in Level 7. Level 8 applies only to RTTs who are already competent in routine treatment planning. Level 8 applies to the treatment planning process for specialist approaches, for example brachytherapy and stereotactic treatments. Level 8 will also apply where new and complex techniques are implemented. **{|CL6|}**

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K19–37 S20–28 C16–24	K38. Explain the principles of a treatment planning system K39. Recognise benefits and disadvantages of plans K40. Explain the dose parameters of treatment planning in brachytherapy and stereotactic treatments K41. Explain the volume terms (CTV, PTV) in relation to brachytherapy and stereotactic treatments K42. Be familiar with the appearance of brachytherapy applicator structures on CT and MRI slices K43. Explain and interpret different loading	**NB. Skills related to stereotactic treatment planning follow those of level 7** S29. Reconstruct needles and tubes as part of the verification process S30. Evaluate and critique the treatment plan S31. Optimise reconstructed views for an ideal applicator appearance S32. Input the applicator specific parameters in brachytherapy (needle length, offset)	C25. Evaluate the planning process C26. Utilise appropriate dose volume constraints for the treatment technique in question and in line with the published evidence C27. Produce a clinically acceptable plan consistent with the prescription aims, treatment unit limitations and patient physical condition, while remaining cognisant of the need for plan robustness C28. Participate in quality assurance and audit procedures pertaining to the treatment planning process C29. Apply radiation and health and safety regulations C30. Analyse 4D imaging, gating and breath-hold techniques and apply as appropriate C31. Evaluate immobilisation practices for stereotactic treatments C32. Integrate radiobiology of hypofractionated regimes C33. Initiate novel research on treatment planning based on existing

patterns in brachytherapy (influence of changing loadings)
K44. Be familiar with different fractionation schemes in brachytherapy (HDR, PDR, LDR) and their influence of prescribed doses
K45. Interpret meaningful applicator key figures like run out length or offset

S33. Identify preliminary setting of dwell points
S34. Document treated volumes in physics documentation protocol and patient record

research findings and evidence based practice
C34. Evaluate the rationale underpinning the different methods of brachytherapy application

Advanced Imaging

Level 7 & 8: IGRT and ART

Level 7 & 8 for IGRT and ART have not been separated, as the initiation of ART in a radiotherapy department is highly dependent upon the available technology and workflow practices of the department. It is implicit that the RTT must have all the IGRT knowledge, skills and competences before proceeding to the implementation of ART.

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES [the specific knowledge, skills and competences to underpin extended role]	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
Level 6: K40–44 Level 6: S35, 36 Level 6 C13	K46. Be familiar with imaging techniques that are frequently applied in the workflow of IGRT and ART K47. Evaluate how each aspect of the radiotherapy chain can influence the IGRT and adaptive processes K48. Identify how IGRT can assist in negating potential sources of errors in target definition K49. Describe optimal organ motion management strategies required for IGRT and ART K50. Describe the use of different acquisition modes K51. Identify the correct match anatomy to use for each site K52. Distinguish between systematic and random errors K53. Describe the QA procedures necessary on imaging systems K54. Evaluate IGRT correction strategies and protocols	S35. Apply appropriate imaging techniques in the practice of IGRT S36. Acquire high quality images correctly and safely S37. Capture and document error data from acquired images S38. Create anatomical templates from a reference image S39. Prepare match parameters for image registration as per site protocol S40. Perform a correct registration to yield the isocentre displacement coordinates S41. Analyse images, remaining cognisant of rotations S42. Check for changes in patient anatomy that can modify target coverage (e.g. contour changes, organ filling or emptying for pelvic treatments or atelectasis for lung treatments) S43. Evaluate correction, ensuring target coverage S44. Identify reasons for displacements (e.g. positioning and immobilisation) and modify accordingly S45. Apply isocentre correction methods as per clinical protocol S46. Correctly identify the most suitable plan from plan libraries on a daily basis S47. Develop recommendations for establishing an image-guided/Adaptive workflow	C35. To implement IGRT and ART in the clinical setting C36. Identify when re-planning is required C37. To decide on the appropriate plan for each fraction of treatment C38. To work within the interdisciplinary team to deliver the departmental ART framework and apply research findings as appropriate

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES [the specific knowledge, skills and competences to underpin extended role]	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
	K55. Discuss the concept of ART K56. Describe methods of ART delivery K57. Compare and contrast ART delivery methods to define their clinical applicability K58. Describe the deformable registration process K59. Discuss the merits and drawbacks of deformable registration	S48. Develop recommendations for a QA programme for IGRT systems.	

Quality and Risk Management

Level 7 & 8 build on the knowledge and skills defined at level 6. Quality and risk management are essential components of high quality accurate and safe practice. The core knowledge and skills are the same for level 7 & 8 but at level 8 it would be anticipated that the RTT would take the lead role in developing and establishing quality management structures

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K1, K3–K5, K7–K9, K11, K14, K23, K28, K97–K99,–K120, K136, K151 S1–S4, S8, S10, S12, S14, S91, S104, S105, S109, S110, S138, S139 C3, C7, C9, C30, C37–C40, C53,	K60. Review current legislation that is applicable to service delivery K61. Define Quality Assurance (QA) and Quality Control (QC) K62. Define concepts such as LEAN, Six Sigma in the management context K63. Define the principles of clinical audit K64. Outline the steps necessary for effective clinical audit K65. Define the principles of an incident learning system K66. Define human factors in the context of risk management	S49. Recognise the legislative framework governing radiation, health and safety and ethical practice S50. Recognise the role of each profession in QA and QC S51. Discuss the use of LEAN, Six Sigma and other quality tools in improving efficiency and quality S52. Prepare the documentation for an internal clinical audit S53. Establish the team for internal clinical audit S54. Maintain incident databases	C39. Ensure workplace compliance with current legislation C40. Participate in the department Health and Safety Committee C41. Establish a QM system and a QM committee C42. Draw up the RTT QA and QC roles and responsibilities C43. Critically evaluate and apply as appropriate the principles of LEAN, Six Sigma and other quality tools C44. Ensure compliance with quality and safety requirement including infection control

| | K67. Summarise the tools used in retrospective and prospective risk management
68. Define quality indicators | S55. Establish the quality indicators that are relevant to the service
S56. Establish an incident reporting system in the department to inform learning
S57. Evaluate the risks associated with human factors
S58. Determine the most appropriate risk management methods | C45. Implement and carry out internal clinical audits
C46. Review the findings of the audit and act accordingly
C47. Participate in the review and analyse incident reports including retrospective and prospective analysis
C48. Establish feedback sessions on incident analysis findings
C49. Introduce practice changes to reduce potential for repeat incidents
C50. Formulate a strategy to minimise risks associated with human factors
C51. Establish teams to carry out risk evaluation
C52. Analyse statistics on incidents and prepare reports for dissemination
C53. Review quality indicators and the extent to which they are met |

Management

Level 7: Service delivery

Management of the day to day delivery of the radiotherapy service. Level 6 gives a basic understanding of the structure and function of radiotherapy departments and the professionals in the team. At level 6 the responsibility of the RTT is to integrate into the team and to manage his/her role in the team. At level 7 the RTT would be expected to take responsibility for the administrative aspects of service delivery

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K1, K3–K5, K7–K9, K11, K14, K23, K28, K97–K99, –K120, K136, K151 S1–S4, S8, S10, S12, S14, S91, S104, S105, S109, S110, S138, S139 C3, C7, C9, C30, C37–C40, C53,	K69. Be familiar with the equipment used in radiotherapy and its functionality K70. Define the key quality indicators for monitoring service performance K71. Summarise the role of the professional bodies and trade unions that relate to RTT activity K72. Define the principles of a Performance Management Development Scheme (PMDS) K73. Define the statistical methodology necessary for effective service delivery K74. Explain the reasoning underpinning statistic collection	S56. Match patients appropriately to treatment units S57. Manage accessory equipment and material purchase S58. Measure the departmental performance in terms of the key performance indicators S59. Examine how the professional bodies and trade unions might influence RTT practice S60. Explain how the PMDS system can be introduced into the department S61. Calculate the statistics relating to patient data and prepare reports for submission to the cancer registry and hospital management	C54. Make best use of resources to optimise patient outcome C55. Participate in the decision making process for the acquisition of new equipment or the implementation of new techniques C56. Participate at the design stage of a new build or the expansion of existing services C57. Prepare the criteria for equipment / accessory equipment selection C58. Collate all necessary departmental data and analyse to inform practice C59. Prepare annual patient data statistics C60. Analyse statistics and apply findings to evaluate future trends and needs C61. Review and redefine the key performance

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
			indicators C62. Prioritise workflow for improved outcomes C63. Manage resources for efficiency and effectiveness C64. Establish links with the professional bodies and trade unions C65. Carry out regular PMDS with staff and advise staff appropriately C66. Analyse the future staffing requirements and potential models

Level 8: Management and service development

Level 8 relates to leadership within the department, development of the services consistent with current and future practice and ensuring that resources required to deliver high quality radiotherapy are recognised at a local and national level

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K69–74 S56–61 C54–66	K75. Describe the different theoretical approaches to leadership K76. Describe the different approaches to management theory K77. Describe the factors involved in team management K78. Identify external key stakeholders K79. Define the data sets which are necessary for good management K80. Describe key performance indicators and how they are used in the radiotherapy environment K81. Explain the roles and responsibilities of the professionals working in radiotherapy K82. Define the extended and advanced practice roles that are in place or can be developed K83. Define the principle components of a business plan	S62. Discuss the application of different leadership approaches in the clinical setting S63. Discuss how team management is applied in a clinical setting S64. Discuss the role and potential impact of external key stakeholders on service delivery and development S65. Explain the most applicable key performance indicators in terms of the objectives of the department S66. Evaluate the effectiveness of current practice S67. Evaluate the potential for advanced practice roles S68. Analyse the resources required for effective service delivery S69. Draw up agreements with service departments as required S70. Develop relationships with other centres	C67. Critically evaluate the management systems in place and modify as appropriate C68. Critically evaluate manpower resources and implement efficiencies in practice C69. Implement a system of staff rotation to ensure service continuity C70. Recognise and support staff specialisation and career development C71. Critically evaluate the existing management structure and delegate appropriately C72. Implement an effective CPD programme C73. Establish performance reviews for all senior staff C74. Implement conflict management protocols and practices C75. Apply the appropriate management theory to the introduction of new service development C76. Appraise the interdepartmental relationships and address any issues identified C77. Appraise the relationships with other service providers

K84. Explain new management theories	to share knowledge and expertise	to ensure consistency and continuity of service
K85. Describe conflict theories	S71. Review current practice and how new approaches can be implemented	C78. Liaise as appropriate with external stakeholders
K86. Define the principles of staffing models	S72. Explain how conflict theories are applied in practice	C79. Monitor the allocation of patients within the department to ensure optimum treatment options for patients are met
	S73. Apply the principles of staffing models to the local situation	C80. Compile and implement planning to ensure continuity of service
		C81. Draw up a business plan for the service
		C82. Promote and support RTTs in the development of advanced roles for the improved efficiency of the department and enhanced patient care
		C83. Evaluate staffing levels in the context of new thinking and approaches

Patient care and support

Level 7: Patient information and support

The two roles described under patient care and support can be integrated given appropriate education and training. Providing information and support can be achieved with level 7 education and training.

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K1–K13, K21, K23–K28 S1–S14, S20–S23 C4, C6, C9	K87. Define the anticipated site -specific side effects for the tumour sites routinely treated in the department K88. Link treatment doses to anticipated side effects K89. Describe the theories of communication K90. Explain the impact of cultural variations on communication K91. Identify all cancer societies and support groups	S74. Interpret the treatment prescription S75. Describe the anticipated side effects for the routine sites treated in the department and how they can be managed S76. Prepare advice material for patients working with medical interpreters as necessary S77. Maintain a database of cancer societies and support groups S78. Liaise with relevant cancer societies and support groups	C84. Provide a clear and accurate description of the individual patient's preparation, treatment and potential side effects based on their specific situation C85. Establish information sessions for new patients C86. Facilitate information sessions for new patients C87. Establish and facilitate support groups for patients C88. Introduce patient advice material into the department C89. Be culturally competent in communication C90. Provide information on support services C91. Prepares education sessions for radiotherapy staff C92. Deliver education sessions on radiotherapy to non RTT professionals C93. Create information material for dissemination to community groups

Patient care and support

Level 8: Patient assessment and review clinics

The RTT carries out regular routine assessment and review of defined site-specific patient groups on treatment and in the immediate post treatment phase and manages individual patients assigned to him/her appropriately. This includes referral to clinicians and other health care professionals.

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K 87–91 S74–78 C84–93	K92. Describe the commonly anticipated side effects of radiotherapy and combined therapy K93. Define the management of anticipated side effects K94. Define medications used routinely in side effect management K95. Describe the pharmacology of the medications commonly used and any known side effects and contraindications K96. Describe the associated support services (such as transport) K97. Define development of patient assessment and review clinics in other departments and settings and by other professional groups	S79. Participate in the preparation and drafting of protocols S80. Identify suitable facilities and times for patient meetings S81. Compile data on support facilities and the criteria for accessing services S82. Evaluate how progress made in other areas can be applied locally	C94. Establish site specific patient on treatment review clinics C95. Prepare individual patients for treatment C96. Evaluate individual patient requirements and advise appropriately C97. Carry out on site specific weekly on-treatment review for individual patients C98. Prescribe medication within protocol C99. Liaise with treatment RTTs, clinicians and other healthcare professionals as appropriate C100. Prepare patient reports C101. Support patients in the immediate follow up period after end of treatment C102. Refer patients to support services in their area C103. Carry out regular review of the service offered, suggest and implement improvements

Brachytherapy

Level 7 and 8: Brachytherapy

At level 6 the RTT must fully appreciate the fundamental principles involved in the delivery of brachytherapy. At level 7 & 8 the RTT will take part as an autonomous member of the team in all aspects of the procedures: patient preparation, pre-treatment imaging, treatment delivery, aftercare and all associated health and safety procedures. At level 8 the RTT would also be expected to take a more active role in the management of the brachytherapy service.

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES [the specific knowledge, skills and competences to underpin extended role]	KNOWLEDGE [Knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K123–K130 S115–S122 C42–C44	K97. Compare and contrast the principles of brachytherapy and EBRT dose distribution K98. Compare LDR and HDR brachytherapy (permanent vs. afterloading) K99. Identify clinical indications for brachytherapy treatment (i.e. patient populations) K100. Identify and explain brachytherapy treatment techniques by disease site K101. Describe the specifications of insertion types (intracavitary, interstitial, intraluminal, plaque, surface) K102. Explain and identify the specifications of different brachytherapy applicators, needles and related equipment K103. Explain the afterloading device and procedures K104. Identify afterloading related accessories (transfer tubes, connectors) K106. Identify the most commonly used brachytherapy sources K107. State the physical parameters (half-life, type of radiation, range) for the most commonly used sources K108. Explain physical dose and activity units (Gray, Sievert, Curie, Units) K110. Interpret the parameters of delivered LDR seeds K111. Explain the coherence between dwell-time, source position and dose delivery K112. Interpret the influence of Total Reference Air Kerma (TRAK) on treated volume K113. Explain the terms of ICRU 58 and 89 K115. Explain optimal applicator and/or needle placement to achieve treatment planning objectives by technique and disease site K117. Explain the threshold dose of organs at risk in case of brachytherapy	S83. Compare activity at the calibration date with the actual activity S84. Compare the supplied certificates with the internal results S85. Perform optical checks regarding condition of all devices and sterile packaging (after-loader, accessories, applicators, measurement chambers, LDR sources for implant S86. Ensure informed consent has been obtained S87. Inform patient of the planned intervention and any necessary preparation S88. Inform the patient and relatives of behaviour and care during and after radiation (e.g. radiation protection aspects) S89. Prepare the intervention room and sterile workspace for the procedure S90. Prepare the radiation device, applicators, accessories, and equipment for the procedure correctly, ensuring adherence to quality and functional standards S91. Ensure secure positioning and immobilisation of patients and applicators and/or needles for imaging and treatment S92. Prepare the patient for imaging (bladder-filling, contrast, rectal tube, cannulation) S93. Prepare applicators and/or needles for imaging (X-ray, CT, MRI markers) S94. Acquire and interpret images for applicator placement, verification and treatment planning (Ultrasound, X-Ray, CT and/or MRI) S95. Carry out necessary measurements on images for clinical comparison S96. Fuse treatment planning images with verification images and recognise organ changes S97. Perform treatment planning and optimisation (pre-procedure, intra-operative) adhering to target dose objectives and OAR dose limits S98. Compare the channel details at the afterloader with plan parameters S99. Compare calculated activity and treatment	C104. Review of the correct patient data and informed consent procedures have been carried out prior to the beginning of each intervention (see the ESTRO Code of Conduct) C105. Ensure all QA procedures have been completed prior to treatment C106. Modify standard imaging procedures for individual patients C107. Ensure accurate delivery of the prescribed dose C108. Ensure radiation protection and safety procedures are in place and adhered to at all times

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES [the specific knowledge, skills and competences to underpin extended role]	KNOWLEDGE [Knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
	K118. Identify organ motions and brachytherapy specific anatomical changes K119. Explain the principlels of patient positioning in brachytherapy K120. Identify secure positioning types for patient transport where applicable K121. Explain quality checks which are related to positioning during brachytherapy K123. Explain optical and functional checks of the brachytherapy applicators, accessories and related equipment K124. Explain and identify the measurement chamber used in brachytherapy departments K125. Explain the emergency procedures as applied to brachytherapy K126. Recognize the specific radiation hazards associated with brachytherapy K127. Explain brachytherapy related radiation protection for staff, patients and relatives K128. Explain principles of imaging types used in brachytherapy K129. State standard verification imaging protocols and routinely used parameters K130. Describe the purpose and procedure of imaging for applicator placement, verification and treatment planning (Ultrasound, X-Ray, CT and/or MRI) K131. Describe the use of all contrast enhancing agents	time with the plan parameters S100. Calculate Total Reference Air Kerma (TRAK) and treatment time and estimate their validity for the treatment S101. Ensure applicators are accurately and securely attached to transfer tubes for afterloading procedure S102. Monitor patient condition, afterloading procedure and in-vivo dosimetry. S103. Document the intervention (applicator, set-up of applicator, number, length and position of needles, depth of needles, patient preparations)	

Research

Level 7: Research – clinical trial management

The RTT should be able to facilitate the management of local, national and international clinical trials in the department. This includes introducing the trial into the department, recruiting patients, collating and recording data and presenting findings

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K131, K132, K135–K148 S123–S137 C47–C52	K132. Define the principles of research protocol evaluation K133. Define the practical aspects of participating in national or international clinical trials K134. List clinical trials organisations and their portfolios K135. List available trial support material such as Quality of Life questionnaires and toxicity scoring systems K136. Define the QA/QC procedures required by the trial K137. Identify all legal requirements K138. Identify the ethical requirements related to conducting clinical trials	S104. Analyse current journal articles and research findings S105. Review current clinical trials for appropriateness S106. Evaluate clinical trial proposals in terms of available resources and feasibility S107. Estimate the workload associated with implementing, recruiting and monitoring the trial S108. Estimate patient numbers and realistic appraisal of recruitment potential S109. Prepare all trial documentation and trial packs for staff and patients S110. Establish trial files and databases S111. Prepare QA/QC protocols S112. Determine that all legal and ethical requirements can be met	C109. Carry out initial evaluation of the suitability of the department to participate in clinical trials C110. Apply the results of clinical research where appropriate C111. Participate in the trial team discussions C112. Prepare an overview of required resources for evaluation C113. Liaise with external services to secure agreement C114. Introduce national or international clinical trials into practice C115. Carry out all preliminary QA/QC dry run/dummy run procedures C116. Educate all participating staff to ensure compliance with trial protocol C117. Evaluate dry run/dummy run feedback and adjust as necessary C118. Recruit patients onto appropriate trials C119. Monitor trial process and patient status C120. Participate in the presentation of trial status updates and results C121. Participate in national and international trial groups

Level 8: Research – initiation, development and management of trials

At level 8 the RTT should initiate, develop and manage independent clinical trials on an area of practice that could be improved. This applies to all level 8 RTTs working in any of the previously described roles

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K132–138 S104–112 C109–121	K139. Be familiar with the major clinical trials organisations K40. Define the criteria for participating in local, national and international trials K141. Define how to draw up a trial protocol	S113. Explain the value of research to colleagues at a local level S114. Discuss potential trial protocols with RTTs, clinicians and other health professionals S115. Carry out a preliminary evaluation of the	C122. Raise awareness of research potential C123. Collaborate and participate with international trial groups C124. Design a new trial C125. Apply for research grants

K142. Describe the common methodologies used for a range of trial types
K143. Discuss the basic criteria of budgeting from a clinical trial perspective

trial resource requirements and recruitment potential
S116. Develop the trial protocols
S117. Prepare presentations for the healthcare professionals who will be involved in the trial
S118. Invite suggestions from staff on potential local trials
S119. Support staff in preparing trial documentation and submission
S120. Demonstrate ability to manage the trial budget

C126. Implement a new trial
C127. Mentor the staff involved in the trial
C128. Manage the trial budget and resources
C129. Carry out the statistical evaluation of the trial results
C130. Manage a research group
C131. Present the findings of trials
C132. Publish the results

Education
Level 7: CPD and advocacy

In level 6, the RTT takes part in the teaching and supervision of students and junior colleagues, as well as participating in the education of the public about radiotherapy. In level 7 the RTT can lead the development of continuous education programmes and advocate for the field of radiation oncology and the profession of RTT.

LEVEL 6 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K149–K151 S138–S140 C53–C54	K144. Describe the main approaches to teaching and learning K145. Explain different learning styles K146. Describe the main methods of assessment K147. Identify how teaching and assessment are interlinked K148. Have detailed knowledge of specialist area of teaching K149. Explain the principles of life-long learning and continuous professional development (CPD) K150. Identify the main professional national and international societies and bodies advocating for radiation oncology K151. Identify target groups (both in health care and the general public) that require education in the field of radiation oncology	S121. Liaise with the College staff on the clinical education programme S122. Liaise with the College staff to resolve any issues related to students or their clinical placement S123. Review the clinical education programme in the context of changing practice	C133. Monitor the clinical teaching within the radiotherapy department to ensure consistency C134. Make recommendations for changes to the clinical education programme for quality improvement and to ensure it is appropriate for current and future practice C135. Support an ethos of CPD within the department C136. Design, deliver and assess short courses as part of a CPD programme C137. Advocate for radiation therapy at a local, national and international level

Education

Level 8: Formal education programmes for RTTs

At level 8 the RTT should take a lead role in defining the content of education programmes for RTTs and managing their delivery. This should include level 6 qualifications (BSc) and level 7 & 8 postgraduate diploma to PhD.

LEVEL 7 KNOWLEDGE, SKILLS AND COMPETENCES	KNOWLEDGE [Highly specialised knowledge, some of which is at the forefront of knowledge in a field of work or study]	SKILLS [Advanced skills in a defined area based on increased knowledge and clinical experience]	COMPETENCES [A critical awareness of knowledge issues in a field and at the interface between different fields]
K144–151 S121–123 C133–137	K152. Define the content necessary to achieve the required competences of a graduate K153. Describe the teaching and assessment methods commonly used in higher education K154. List the potential Institutes that could deliver a suitable education programme	S124. Review other curricula for RTTs S125. Develop and co-ordinate modules in line with the defined curricula content S126. Define an area of research interest S127. Liaise with service departments within the education institute to develop specific content underpinning radiation therapy practice	C138. Design a full curriculum for a level 6 education programme for RTTs C139. Engage with the RTT community to establish networks C140. Be research active C141. Supervise student research C142. Lead a departmental research strategy and develop the research culture C143. Lead and manage academic staff as appropriate C144. Contribute to the continuous improvement of the curriculum in line with advances in radiation therapy C145. Interact with national and international groups to further the education of RTTs C146. Oversee, design or develop postgraduate programmes at level 7 and 8 C147. Actively participate in the education institution governance structures C148. Take overall responsibility for organisation and deployment of resources

　　　M. Coffey, M. Leech / Technical Innovations & Patient Support in Radiation Oncology 8 (2018) 22–40

Acknowledgements

The authors would like to acknowledge the following for their assistance in preparing this document:

Further reading

[1] Coffey M, Leech M, Poortmans P. Benchmarking Radiation Therapist (RTT) education for safe practice. The time is now. Radiother Oncol 2016;119(1):12–3.

[2] Learning Opportunities and Qualifications in Europe. Available from: <https://ec.europa.eu/ploteus/content/descriptors-page>.

[3] Dreyfus S, Dreyfus H. A five stage model of the mental activities involved in directed skill acquisition. Available from: <http://www.dtic.mil/dtic/tr/fulltext/u2/a084551.pdf>.

[4] Brenner P. Nursing theory: from novice to expert Available from. J Nursing 1982;82(3):402–7. <http://www.nursing-theory.org/theories-and-models/from-novice-to-expert.php>.

[5] Ielfs E. Creating good workplaces: retention strategies in health care organisations In: Buchan J, editor. Health Professional Mobility in a changing Europe: new dynamics, mobile individuals and diverse responses. WHO; 2014.

[6] Yildiz Z et al. The impact of nurses' motivation to work, job satisfaction and sociodemographic characteristics on intention to quit their current job: an empirical study in Turkey. Appl Nurs Res 2009;22:113–8.

[7] The European Qualifications Framework for Lifelong Learning. European Commission; 2008. Available at: <https://ec.europa.eu/ploteus/sites/eac-eqf/files/leaflet_en.pdf>.

[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. Available at: <https://eur-lex.europa.eu/legal-content/EN/ALL/?uri=CELEX%3A32008H0506%2801%29>.

[9] European Commission Professional Qualifications. Available at: <https://ec.europa.eu/info/publications/professional-qualifications_en>.

[10] EACEA-Education, Audiovisual and Culture Executive Agency. Available at: <http://eacea.ec.europa.eu/tempus/tools/glossary_en.php>.

[11] Education and Training- Supporting education and training in Europe and beyond Available at: <http://eac.europa.eu/education/tools/ects_en.htm>.

[12] Learning Opportunities and Qualifications in Europe. Available at: <http://ec.europa.eu/eqf/home_en.htm>.

[13] Tuning educational structures: Available at: <http://www.unideusto.org/tuning/>.

[14] Ringborg U, Bergqvist D, Brorsson B, et al. The Swedish Council on Technology Assessment in Health Care (SBU) Systematic Overview of Radiotherapy for Cancer including a Prospective Survey of Radiotherapy Practice in Sweden 2001–Summary and Conclusions. Acta Oncol 2003;42(5–6):357–65.

[15] Radiation Therapy Competency Profile. Canadian Association of Medical Radiation Technologists; 2014. Available at: <http://www.camrt.ca/wp-content/uploads/2018/06/Modified-Therapy-profile-Final-.pdf>.

[16] Turner S, Seel M, Trotter T, et al. Defining a Leader Role curriculum for radiation oncology: a global Delphi consensus study. Radiother Oncol 2017;123:331–6.

[17] ESTRO RTT Code of Ethics and Conduct; 2016. Available at: <https://www.estro.org/binaries/content/assets/estro/about/rtt/estro_rtt_code_of-conduct.pdf>.