Training Requirements for the Specialty of Radiation Oncology/Radiotherapy

European Standards of Postgraduate Medical Specialist Training

Preamble

The UEMS is a non-governmental organisation representing national associations of medical specialists at the European Level. With a current membership of 39 national associations and operating through 43 Specialist Sections and European Boards, the UEMS is committed to promote the free movement of medical specialists across Europe while ensuring the highest level of training which will pave the way to the improvement of quality of care for the benefit of all European citizens. The UEMS areas of expertise notably encompass Continuing Medical Education, Post Graduate Training and Quality Assurance.

It is the UEMS' conviction that the quality of medical care and expertise is directly linked to the quality of training provided to the medical professionals. Therefore the UEMS committed itself to contribute to the improvement of medical training at the European level through the development of European Standards in the different medical disciplines. No matter where doctors are trained, they should have at least the same core competencies.

In 1994, the UEMS adopted its Charter on Post Graduate Training aiming at providing the recommendations at the European level for good medical training. Made up of six chapters, this Charter set the basis for the European approach in the field of Post Graduate Training. With five chapters being common to all specialties, this Charter provided a sixth chapter, known as “Chapter 6”, that each Specialist Section was to complete according to the specific needs of their discipline.

More than a decade after the introduction of this Charter, the UEMS Specialist Sections and European Boards have continued working on developing these European Standards in Medical training that reflects modern medical practice and current scientific findings. In doing so, the UEMS Specialist Sections and European Boards did not aim to supersede the National Authorities' competence in defining the content of postgraduate training in their own State but rather to complement these and ensure that high quality training is provided across Europe.

At the European level, the legal mechanism ensuring the free movement of doctors through the recognition of their qualifications was established back in the 1970s by the European Union. Sectorial Directives were adopted and one Directive addressed specifically the issue of medical Training at the European level. However, in 2005, the European Commission proposed to the European Parliament and Council to have a unique legal framework for the recognition of the Professional Qualifications to facilitate and improve the mobility of all workers throughout Europe. This Directive 2005/36/EC established the mechanism of automatic mutual recognition of qualifications for medical doctors according to training requirements within all Member States; this is based on the length of training in the Specialty and the title of qualification.

Given the long-standing experience of UEMS Specialist Sections and European Boards on the one hand and the European legal framework enabling Medical Specialists and Trainees to move from one country to another on the other hand, the UEMS is uniquely in position to provide specialty-based recommendations. The UEMS values professional competence as "*the habitual and judicious use of communication, knowledge, technical skills, clinical reasoning, emotions, values, and reflection in daily practice for the benefit of the individual and community being served*"[1]. While professional activity is regulated by national law in EU Member States, it is the UEMS understanding that it has to comply with International treaties and UN declarations on Human Rights as well as the WMA International Code of Medical Ethics.

This document derives from the previous Chapter 6 of the Training Charter and provides definitions of specialist competencies and procedures as well as how to document and assess them. For the sake of transparency and coherence, it has been renamed as "Training Requirements for the Specialty of Radiation Oncology/Radiotherapy". This document aims to provide the basic Training Requirements for each specialty and should be regularly updated by UEMS Specialist Sections and European Boards to reflect scientific and medical progress. The three-part structure of this documents reflects the UEMS approach to have a coherent pragmatic document not only for medical specialists but also for decision-makers at the National and European level interested in knowing more about medical specialist training.

[1] Defining and Assessing Professional Competence, Dr Ronald M. Epstein and Dr Edward M. Houndert, Journal of American Medical Association, January 9, 2002, Vol 287 No 2

Introduction

The European Society for Radiotherapy and Oncology (ESTRO) developed a "Minimum Curriculum for the Theoretical Education in Radiation Oncology in Europe" in 1991. This Core Curriculum was a great success and played a pivotal role in establishing comparable standards for training across Europe. With the marked evolution in radiation oncology technology and methods a second edition was published in 2004. This was endorsed by thirty-five National Societies. It was integrated into legal or national guidelines in several European countries and provided a significant step towards harmonisation across Europe. The third edition published in 2011, endorsed by 28 national societies, changed the focus from theoretical to competency based education defining the minimum observable abilities radiation oncologists/radiotherapists needed for optimal patient outcomes. It was based on the seven roles of a physician identified in the CanMEDS 2005 physician competency framework and was endorsed by the European Union of Medical Specialists (UEMS). Since that time:

- Radiotherapy technology and techniques have continued to develop and to be more widely adopted.
- Survival rates for many cancers have increased increasing the importance of managing survivorship.
- The CanMEDS framework was revised in 2015. The role of "Manager" was changed to "Leader" and there were changes in all the roles emphasising the patient's perspective and patient safety [1].
- The CanMEDS 2015 framework contained the concept of Entrustable Professional Activities (EPAs), "A key task of a discipline that can be entrusted to an individual who possesses the appropriate level of competence" [1]
- A Delphi survey by the Global Radiation Oncology Collaboration in Education (GRaCE) group defined a leader role curriculum for radiation oncology [2].
- The European Commission Expert Group on Cancer Control established a European Union Implementation Group tasked with exploring the training of clinical cancer specialists with particular emphasis on the interdisciplinary training of doctors in the clinical cancer specialties. They proposed competences in, radiation oncology, systemic therapy and surgery that should be acquired by all cancer specialists regardless of discipline.

The decision was therefore made to revise the core curriculum and this process was started in 2017 with a meeting of representatives of 20 European National Societies, a senior radiation oncology educationalist from Canada, representatives of yESTRO including trainees and RTTs. Radiobiologists and physicists have also contributed to the revision and multiple iterations have been developed with the advice of representatives of 27 European Countries. The final draft has been reviewed by senior radiation oncology educationalists from Australia and Canada.

The curriculum defines the EPAs and competences that trainees need to develop, the characteristics of Training Programs that will enable the trainees to develop these and the characteristics of assessment systems that will provide assurance that the trainees have developed them.

Role of radiation oncology in the multidisciplinary approach of cancer treatment

Definitions

Radiotherapy (Radiation Oncology) is the branch of clinical medicine that uses ionising radiation, either alone or in combination with other therapeutic modalities, for the treatment of patients with malignant or benign diseases. It may be practiced as an independent oncological specialty or may be integrated in the broader practice of clinical oncology.

Radiotherapy (Radiation Oncology) includes responsibility for the prevention, diagnosis, treatment, follow up and supportive care of the cancer patient with a responsibility to manage their care pathway across multiple disciplines and forms an integral part of their multidisciplinary management and investigation.

This specialised area of medicine is recognised under the term 'radiation oncology'. In this document, however, the double terminology 'radiation oncology/radiotherapy' will sometimes be used since, as defined by the European Union of Medical Specialists (UEMS), radiation oncology excludes non-oncological treatment for benign disease whereas radiotherapy may also be used for the treatment of non-malignant conditions. In the present document "external beam radiotherapy" will encompass the various forms of delivery (2D, 3D, IMRT, stereotactic RT) and types of beams (photons, electrons and various particles).

The aim of this curriculum is to describe the minimum competences necessary to deliver ionising radiation therapy including when this forms part of combined modality treatment with systemic therapies. It is recommended that all radiation oncologists should have sufficient knowledge of systemic therapies to be able to take clinical responsibility for the integration of care of the cancer patient.

Objectives

The objective of the training programme is to educate and train physicians in the medical specialty of Radiation Oncology/Radiotherapy to the level of competency allowing them to practice as an independent specialist.

Length of training

The training period should be sufficient to obtain the competences to become an independent specialist. In general, the training programme should be at least five years full time or an equivalent period part-time. At least 80% of the programme should be spent in clinical work including time in education.

Responsibilities for licensing

Responsibility for licensing doctors to practice in Radiation Oncology varies between European countries. Licensing should be based on objective assessment of completion of a training programme that fulfils the national guidelines.

Infrastructure and organisational aspects

Training programs

At the beginning of the training, the trainee should be presented with the curriculum and a written individual training programme. The training programme should describe the goals of the training, the time frame of each module and how the responsibilities for the training are distributed among the staff at the training institutions.

The training programme should correspond to the requirements outlined in the European core curriculum and to specific national requirements.

During the training the trainee should become gradually more responsible for patient care, with increasing autonomy and less dependent on supervision. A record clearly documenting the clinical competencies and activities of the trainee is advised as a tool to define the clinical responsibilities the trainee is authorised to undertake during different phases of their training.

Training institutions

If the minimum requirements for training institutions recommended in the core curriculum cannot be met by a single institution, several training institutions should combine and offer an integrated programme that meets these minimal requirements. Licensing for training institutions or integrated programmes should depend on fulfilment of their national guidelines.

Radiation oncology/radiotherapy resources in training institutions

Training institutions must be accredited in accordance with their national regulations. The training institutions, either alone, or in cooperation with other regional departments, should be adequately equipped to support both the workload and range of radiation oncology/radiation services required for training including new technologies and novel techniques.

There should be:

- Mega voltage machines available, at least one with high-energy electrons, equipped with IGRT and able to deliver IMRT
- Access to a dedicated CT-scanner
- Computerised treatment planning and technical support. This should include appropriate dosimetry
- Radiotherapy protection equipment
- Appropriate patient treatment aids
- The opportunity to become at least familiar with brachytherapy and stereotactic RT. This can be organised by collaboration with institutions in which these treatments are concentrated
- Beds for inpatients or at least sufficient access to them in other department
- Facilities for systemic therapies
- Facilities for supportive and palliative care

- Quality control programmes for patient care, treatment decisions, follow-up and outcome in a range of cancer sites,
- Access to regular Multidisciplinary Tumour Boards (MDTs)

To ensure there are an adequate number of patients and a varied case-mix, a minimum of 500 oncology patients should be irradiated annually in the parent institution or the integrated programme. An adequate case mix for each trainee should be ensured by continuous monitoring by means of a portfolio or logbook.

Organisational aspects of patient care and practical teaching vary widely between European institutions. In some institutions the patient is followed by the trainee for the whole process from the first visit over treatment planning and applications to follow-up, whereas in other institutions trainees see patients for only part of the process. For part of their training period they will see only patients during their first presentation, during other periods they perform solely treatment planning, and in other periods, follow-up. For this reason the number of patients seen by a trainee is defined as the equivalent to a patient undergoing the complete process (full case equivalent) and must be sufficient to acquire the required competences. The recommended number of full case equivalents seen by each trainee should be at least 450 during the entire clinical radiation oncology/radiotherapy training. A trainee should not treat more than 250 full case equivalents per year to ensure a good equilibrium between work experience and the time for more formal training.

Faculty in training institutions

Programme director

Each training institution or integrated programme should appoint a single programme director responsible for trainee education. It is considered preferable that the roles of programme director and chairman of the department are held by different people. The programme director is responsible for the general administration, the structure and the content of the programme. The programme director ensures that the programme fulfils the criteria in the core curriculum and the national requirements. They must be a highly qualified radiation oncologist with considerable experience in trainee education and in organisational activities. The programme director should organise regular documented meetings with the teaching staff to review the goals, the effectiveness and proposals for future developments of the programme. At least one trainee representative should participate in the meetings.

Medical teaching staff

Adequate staffing levels in the radiation oncology/radiotherapy departments are essential for training. Several radiation oncologists with responsibility for training should be appointed. These teaching staff members need to devote dedicated professional time to the teaching programme. It is recommended that the number of trainees does not exceed the number of full time equivalent staff radiation oncologists/radiotherapists. Sufficient supervision of the trainees should be guaranteed.

Physics teaching staff

ESTRO has, in cooperation with the European Federation of Physics in Medicine (EFOMP), made recommendations previously on the minimal staffing levels for the safe provision of a routine

radiation oncology/radiotherapy physics service (REF). Full time medical physics support must be available in teaching institutions. Medical physics staff members responsible for teaching should be appointed. Medical trainees should be taught dosimetry and the dosimetric aspects of treatment planning under the supervision of an accredited medical physicist working in the field of radiation oncology/radiotherapy. The general principles of treatment planning should be learned under the clinical supervision of experienced radiation oncologists. The trainees should also be familiar with the safety procedures and quality assurance in the training institution and the national regulations pertaining to these.

Radiobiology teaching staff

Teaching institutions or integrated programmes should aim to have guaranteed access to a cancer biology laboratory and a chance to interact with its scientific staff. A minimum requirement is to provide mandatory training in radiobiology by formal accredited national or international courses.

Other facilities

Access should be available to:

- Adequate medical services in oncology-related specialties
- Current imaging techniques
- Pathology
- Clinical genetics relevant to oncology

A sufficient variety of journals, reference books, and resource materials (or electronic equivalents) pertinent to radiation oncology/radiotherapy and associated fields in oncology, basic sciences, and general medicine must be readily accessible for the trainee. The training institution should provide ready access to a computerised search system and rapid access to databases in medicine to permit literature reviews.

Components of the educational programme

The training programme must provide the trainee with in-depth knowledge in the basic and clinical sciences in the field of radiation oncology/radiotherapy and must train the trainee to be proficient in the clinical practice of radiation oncology/radiotherapy.

Training institutions or integrated programmes must schedule regular conferences, teaching rounds, case presentations and scheduled lectures. These teaching activities must include trainee participation that increases with experience.

Training institutions should facilitate access to teaching courses on a national or international level. These courses should attempt to put specific items of the European core curriculum in an international perspective. They should be sufficiently wide-ranging to offer different point of views on the same subject; facilitate interactions of trainees from different countries and promote radiation oncologists

visiting different radiotherapy institutions in Europe. These recommended teaching courses should be adapted according to the national requirements and the specific needs of the individual training programme. To add a European dimension to the education, it is recommended that at least one teaching course should be at a European level. A further recommendation is that each trainee should participate in at least one international scientific meeting on radiation oncology/radiotherapy.

Teaching courses in radiation protection have to be provided according to national regulations.

Training institutions must allow the trainees sufficient protected time during their working hours for study of the literature, preparation of case presentation, etc. It is suggested that the minimum should be an average of 10% of the weekly working time. The remaining 90% of time should be mainly devoted to supervised and unsupervised clinical activities in proportions that will vary depending on the experience of the trainee.

Trainees should actively participate in tumour-boards, journal clubs and research conferences.

Trainees should be encouraged to engage in a research project or quality improvement project under the supervision of experienced staff (experimental research, clinical research or trainers with expertise in quality improvement). They should be encouraged to spend a period of training in another institution (national or international) with an accredited teaching programme, which is accepted by the trainee's national society. These activities should also be recorded in a portfolio/logbook.

Practical teaching sessions

Member of the teaching staff should schedule regular practical teaching sessions with the trainees. There should be continuous feed-back to the trainees about their management of patients including their competences in radiotherapy planning. A minimum of one and preferably several practical training sessions between the teacher and the trainee should be scheduled per week to enable the trainee to reach the required levels for the EPAs.

Audit of teaching programmes

Regular external audit of the training programme is recommended.

Reciprocity of training

It is recommended that training periods undertaken by trainees in an accredited training programme in any member state should be accepted as equivalent to the same period of training in their own state.

Entrustable Professional Activities, Competences and Enabling Competences

The numbered statements under each domain may be regarded as Entrustable Professional Activities (EPAs) or just headings depending on the choice of each National Society.

Medical Expert

1) Develop a management plan for patients with a cancer diagnosis
2) Implement a treatment strategy
3) Develop and implement a management plan for survivorship

Contribute effectively to tumour board discussions	Explain the pathological factors that determine treatment decisions
	Discuss the optimal imaging staging strategy including national or international guidelines
	Stage the cancer appropriately
	Apply national or international guidelines to the management of an individual patient
	Apply research evidence to the management of an individual patient
	Discuss the role of radiotherapy in the management of the patient. This may include patients with benign disease.

	Discuss the role of systemic therapy in the management of the patients. This may include, for example Chemotherapy Hormonal therapy Monoclonal antibodies Tyrosine kinase inhibitors Immunotherapy With curative, neoadjuvant, adjuvant and palliative intent
	Discuss the role of chemoradiotherapy in the management of the patient
	Discuss the role of surgery in the management of the patient Describe when surgery is the primary curative modality in the treatment of a cancer Describe at a basic level the operations that are indicated for particular cancers including regional nodal surgery Discuss the role of surgery in enabling other treatments modalities (for example, placement of clips, pelvic spacers or omentum) to enable optimal radiotherapy treatment
	Discuss the scheduling of radiotherapy, systemic therapy or surgery in patients treated with combined modality therapy
	Discuss how radiotherapy, surgery, systemic therapies may interact during the therapeutic phase of treatment
	Discuss the implications of hereditary gene mutations on the management of a patient
	Discuss the management of a patient when there is therapeutic uncertainty, complexity and ambiguity
	Identify when a patient should be offered the opportunity to enter a research trial

	Justify a decision that radiotherapy, systemic therapy and surgery are not indicated
	Discuss the role of palliative care in the management of the patient
Undertake the initial outpatient consultation	Structure the consultation effectively
	Take a focused history, undertake a careful clinical examination and order relevant imaging and laboratory examinations
	Elicit and manage psychosocial factors
	Evaluate and discuss with the patient the possible management strategies taking into account the factors related to the cancer, the patient's goals, their comorbidities and frailty and the adverse effects of the possible options
	Facilitate shared decision making with the patient
	Explain the implications of hereditary genetic abnormalities and refers appropriately for genetic counselling
	Discuss a radiotherapy treatment strategy including: Pre-treatment procedures such as dental review Goals of treatment Simulation including immobilization and the use of contrast Fractionation regimen Acute toxicities and supportive measures Late toxicities

	Identify when brachytherapy, SCRT, SBRT, proton therapy or IORT may be of value and outline the procedure to the patient
	Identify when systemic therapy alone or combined with radiotherapy may be of value and outline the process to the patient
	Describe the acute and long term toxicities of the commonly used systemic therapies either alone or combined with radiotherapy
	Identify when emergency surgery is indicated e.g. bowel obstruction or perforation or upper airways obstruction
	Identify when surgery may palliate symptoms or prolong life e.g., bile duct obstruction, hydronephrosis
	Diagnose oncological emergencies including spinal cord compression SVC obstruction Neutropenic sepsis Thromboembolic disease Metabolic abnormalities such as hypercalcaemia, hyponatraemia and hyperkalaemia Manage them or collaborate with other specialties to do so
Implement the treatment strategy	Determine and outline the GTV, CTV, ITV, PTV, OAR and PRV using appropriate diagnostic scanning techniques including CT, MRI and PET/CT for external beam and brachytherapy plans, using planning atlases when indicated
	Evaluate the dose constraints for normal tissues as defined on a DVH
	Evaluate the external beam/brachytherapy treatment plan in collaboration with physicists and RTTs including conformal 3D and IMRT plans Know the ICRU guidelines for prescribing, recording and reporting dose Critically evaluate the dose distribution in the tumour volume and the OAR Identify an adequate plan and suggest options for improving an inadequate plan Take overall responsibility for the treatment plan.

	Evaluates the risks and benefits of an external beam/brachytherapy treatment plan. Able to balance tumour control against potential damage to OAR and resulting toxicities
	Modify treatment plan according to individual characteristics such as comorbidities and systemic treatment
	Verify radiotherapy treatments, describes techniques available for real time image guidance. Assess accuracy of patient set up and recommend adjustments
	Know the level of tolerance accepted for set up margins in their department and how this influences PTV
	Discuss the indications and aims of brachytherapy. Describe the methods available Describe the principles of dose prescription Apply radiation protection principles when assessing patients
	Assess and manage early radiation reactions in patients receiving external beam, brachytherapy and combined modality treatment
	Know the common acute toxicities of systemic therapies but when given as single modalities and when combined with radiotherapy
	Administer and take clinical responsibility for delivery of radiation therapy and systemic agents or collaborate with other specialties to do so
	Assess the acute toxicities of systemic therapies combined with radiotherapy and manage them or collaborate with other specialties to do so
	Modify treatment to adjust for gaps in treatment using the principles of radiobiology
	Evaluate response to treatment using RECIST and other commonly used criteria for formally evaluating response

Manage survivorship	Develop a long term strategy for follow up of the patient
	Discuss the role of exercise or diet and smoking cessation and alcohol as appropriate
	Construct a plan for patient specific rehabilitation
	Take a focused history to diagnose the common psychological sequelae following a cancer diagnosis and treatment for cancer, manage them or refer appropriately to other specialties
	Take a focused history, undertake a careful clinical examination and order relevant investigations to diagnose long-term toxicities from cancer therapies including secondary malignancies and multiple cancers. Discuss the options for managing these and implement them or refer appropriately to other specialties
	Discuss the physical and psychological impacts of surgery. Identify patients who may benefit from surgical procedures to ameliorate these e.g., resiting of a stoma
	Discuss the role of surgery in improving function, ameliorating deformities and improving cosmesis including treatment for long term toxicities from radiation therapy
Manage patients with relapsed disease	Take a focussed history, perform a careful clinical examination and request relevant investigations to diagnose relapsed disease
	Evaluate the possible management strategies taking into account the factors related to the cancer including whether there is a possibility of curative treatment, the patient's goals, their comorbidities and frailty and the adverse effects of the possible options
	Discuss the benefits and toxicities of radiotherapy treatment including reirradiation
	Describe when surgery may be curative e.g., liver metastasis

	Discuss the role and timing of surgery in palliative care
	Discuss the role of radiofrequency ablation and cryotherapy in the management of metastases
	Discuss the role, benefits and common toxicities of systemic therapies in palliative care. This may include, for example: Chemotherapy Hormonal therapy Monoclonal antibodies Tyrosine kinase inhibitors Immunotherapy
	Implement the radiotherapy treatment strategy
	Recognise when radiotherapy, systemic therapy and surgery are not indicated
	Discuss the role of palliative care in the management of the patient. Implement treatment to control symptoms or refer appropriately to other specialties

Communicator

4) Communicate appropriately and effectively with patients and their relatives

Build a therapeutic relationship with patients and their relatives	Know the theory underpinning communication skills
	Demonstrate empathy, respect and compassion
Elicit and synthesise accurate and relevant information from patients	Provide a clear structure for and manage the flow of the consultation
	Demonstrate active listening

	Communicate clearly with patients respecting their social, political, cultural, religious and sexual standpoint
	React to body language and verbal cues with relevant observations and questions
Develop management plans with patients and their families that reflect their health care needs and goals	Give clear objective information about standard treatments, randomised trials and experimental treatments including the process, side effects and risks
	Ascertain if the patient and their families have understood the information and take effective measures if this is not the case
	Assist patients and their families to access reliable sources of information including websites
	Discuss their beliefs regarding alternative and complementary therapies
	Take informed consent from patients and know the legal position if the patient lacks capacity
Manage emotionally charged conversations	Elicit the patients' wishes regarding the information they wish to receive and break bad news in an appropriate way
	Discuss critical issues such as life with cancer, sexual issues, acceptance and death
	Disclose errors and adverse safety events appropriately
Document accurately and share appropriately information about the consultation	Document in a timely and accurate manner details of the consultation and management plan, either in a written or digital form, complying with national legislation
	Communicate this information clearly to the appropriate health care team
	Maintain patient confidentiality

Collaborator

5) Work effectively with other health care professionals to provide safe care and to optimise the quality of treatment

Work effectively with physicians and other members of the health care professions	Contribute to effective discussions in multidisciplinary teams (MDT). Willing to compromise to reach a consensus. Respect the views of others and the conclusions of the MDT
	Understand and value the roles of physicists, RTTs, nurses and other health care professionals and encourage team working to optimise treatment
	Negotiate overlapping responsibilities for shared care of patients
Transfer care safely to another health care professional	Determine when care should be transferred to another physician or health care professional
	Facilitate continuity of care by timely, effective communication
Support colleagues	Identify when colleagues are under pressure and offer help

Leader

6) Discuss the context in which they work and apply the principles of change management including quality improvement methodology in this context
7) Use resources appropriately
8) Demonstrate the ability to work in, build and lead teams

Contribute to the improvement of cancer care delivery in teams and the wider health care system	Identify where quality improvements may be initiated in the work environment
	Demonstrate knowledge of the steps and tools that may be applied to quality improvement processes including the use of data to drive change
	Describe key quality indicators for monitoring service performance in radiation oncology
	Describe radiation oncology incident reporting and monitoring systems

	Participate in the development and implementation of patient safety initiatives
	Participate in the investigation of a radiation-related adverse event, “near miss” or system error
Engage in stewardship of cancer care resources	Demonstrate knowledge of the radiation therapy utilisation rates in the region/country of practice
	Discuss current major challenges in health care including how these impact on radiation oncology
	Describe local and international guidelines and initiatives to promote resource stewardship
	Discuss factors involved with resource stewardship including financial and other costs of cancer patient care
	Discuss funding arrangements for radiation oncology service delivery in region/country of practice
	Discuss prioritisation of patients on waiting lists
Demonstrate elements of leadership in practice	Prioritise tasks including patient assessment and treatment
	Discuss the conceptual differences between the radiation oncologist as a manager and as a leader
	Describe leadership theories and styles and how these may apply in practice
	Engage in developing self-awareness - strengths, weaknesses, values, behaviours drivers and impact on others
	Run effective and efficient meetings
	Take responsibility for effective communication around the vision for, and purpose of, change with radiation oncology team members, patients and other stakeholders
	Engage and support team members to bring them through a change process
	Demonstrate the ability to negotiate and problem-solve with other team members
	Demonstrate awareness of the roles and organisational structures of relevant professional societies and how radiation oncologists contribute to these

Advocate

9) Advocates for cancer patients

Advise the patient on behaviour and lifestyle	Advise the patient on relevant changes in behaviour and lifestyle prior to treatment to increase the chance of tumour response and to cope with acute toxicities e.g., smoking cessation and diet
	Advise the patient on relevant changes in behaviour and lifestyle to enable them to cope optimally with late toxicities due to previous treatment and the side effects of present medication
	Advise the patient on relevant changes in behaviour and lifestyle to reduce the risk of them developing further cancers
Support patients to navigate the health care system	Enable patients to access the available resources, including information, to obtain treatment in a timely manner

Scholar

10) Plan personal learning experiences and use them to enhance patient care
11) Educate others to enhance patient care
12) Contribute to the knowledge base that underpins patient care

Develop and follow a continuing personal development plan	Assess gaps in knowledge and identify resources to meet these
	Critically review medical information
	Develop or revise local evidence based guidelines, integrating evidence into personal practice
Deliver and enhance learning experiences	Assess learning needs of the audience
	Plan and deliver the learning activity to meet these needs

	Plan how to revise the learning activity in the light of evaluations
	Undertake workplace based assessments with more junior trainees
Participate in research activities	Provide feedback to enhance learning and performance
	Evaluate learning experiences and programmes appropriately
	Discuss the scientific principles of research, the design of clinical trials and their statistical analysis
	Discuss the organisations that design and run trials nationally and internationally and how to access information regarding their trials
	Undertake accurate and timely activities for local and/or multicentre trials and research projects
	Evaluate the design of research projects and clinical trials
	Build collaborative networks through participation in local, regional, national or international societies and meetings
	Aware of rules for writing scientific papers and how to submit them for publication
	Present summary of findings of research in both written and verbal form

Professional

13) Demonstrate that the care of their patients is their first concern
14) Manage their work life balance to maintain their own wellbeing

Adhere to high ethical standards	Identify the ethical issues in caring for patients
	Discuss ethical principles and be able to apply them
	Demonstrate honesty, integrity, humility, commitment, respect, humility, altruism

	Respect diversity. Do not disadvantage a patient on grounds of their gender, race, and culture, philosophical or religious beliefs. Show understanding for patients' ethical concerns and divergent viewpoints.
	Maintain patient confidentiality and be able to inform patients on the legal situation regarding information held on them in medical notes
	Apply codes of research ethics
	Provide the patient with all relevant information when taking consent
	Manage conflicts of interest appropriately
	Exhibit appropriate behaviour in the use of communication on the internet
Aspire to excellence	Work according to professional codes and laws
	Keep knowledge and skills up to date
	Recognise own competency limits and refer appropriately
	Take responsibility for actions
	Respond appropriately to negative feedback
	Work collaboratively with other health care professionals to optimise patient care
	Recognise and respond to unethical behaviour in other health care professionals
Maintain own wellbeing	Exhibit self-awareness and manage personal and professional demands to reduce the risk of burn out

Basic Sciences

The practice of radiation oncology is underpinned by basic sciences. In order to achieve these learning outcomes trainees require formal teaching. This will often be provided in national or international courses such as the ESTRO courses.

The learning outcomes have been expressed employing the Bloom classification of learning outcomes in the cognitive domain. Bloom et al [3] recognised that there was an ascending order of thinking behaviours from factual recall to analysis and evaluation. They suggested verbs that may be associated with different levels. This list has been extended by various authors [4]. The verbs associated with the practice of radiation oncology/radiotherapy have been added to the classification with the appropriate levels being defined in Figure 1. The six levels of learning outcomes may be defined as:

- Knowledge - the ability to recall or remember facts
- Comprehension - the ability to understand and interpret learned information
- Application - the ability to use acquired knowledge in new situations to solve problems
- Analysis - the ability to breakdown the information into its components; to look for the relationships between the components
- Synthesis - the ability to put the component parts together to build a pattern from them. In the 2001 revised edition of the taxonomy Anderson & Krathwohl [5] this level is replaced by "Create"
- Evaluate-the ability to judge the value of material for a given purpose

Evaluate

Appraise, Evaluate, Estimate, Justify, Review, Revise

Synthesis

Construct, Develop, Diagnose, Document, Plan, Prevent

Analysis

Analyse, Assess, Compare, Contrast, Determine, Recognise, Review, Stage

Application

Advise, Apply, Build, Communicate, Compare, Contribute, Demonstrate, Exhibit, Elicit, Enable, Engage, Facilitate, Implement, Inform, Manage, Modify, Negotiate, Participate, Perform, Provide, Respond, Run, Structure, Support, Undertake

Comprehension

Discuss, Explain, Understand

Knowledge

Define, Describe, Determine, Identify, Know, Outline, State

Cancer Biology

Molecular and Cell Biology

Define the terminology and outlines the techniques of molecular biology
Describe the genetic mechanisms underlying carcinogenesis, and genetic alterations affecting tumour suppressor genes, oncogenes and DNA repair systems
Discuss epigenetic, transcriptional and post-transcriptional regulation of gene expression
Describe hereditary cancer syndromes and relates these to the underlying genetic abnormalities
Discuss cell cycle phases, regulation and checkpoints, their relationship to carcinogenesis and treatment-induced different types of cell death
Discuss signal transduction pathways and molecular targets for cancer therapies
Explain the importance of genome maintenance mechanisms for preventing cancer
Describe the tumour-to-stroma interactions and the effect of the microenvironment on tumour growth
Explain the components of the immune system and the interaction between the host's immune system and the tumour

Biological basis of systemic treatments

Explain the mechanisms of action of different groups of classical chemotherapy drugs
Describe the basis for common and drug specific side effects and their management
Explain the mechanism of action of molecular targeted therapies, including drugs, antibodies, tyrosine kinase inhibitors and gene therapy
Explain the mechanism of action of tumour immunotherapeutic agents, including checkpoint inhibitors, vaccines and CAR-expressing autologous T-cells
Describe tumour response assessment systems
Explain the mechanisms of drug resistance

Translational research

Explain the most common alterations leading to cancer development
Describe the techniques, their potential uses and limitations
Explain biological sample collection, process and storage
Define the role of biomarkers in clinical trials
Explain how translational research knowledge leads to relevant clinical trials

Proficiency in Treating Cancers at Different Sites

The incidence of tumour types and organisation of Cancer Treatment Services vary across Europe. In many countries there is increasing sub-specialisation with, for example, only a small proportion of trainees becoming proficient in the treatment of carcinoma of the cervix with brachytherapy as the incidence of this disease falls, while in other countries all trainees may be expected to become proficient. The levels of proficiency set out below are therefore suggestions of ranges including the minimum levels of proficiency. They will be modified by National Societies to provide specific outcomes for their programmes.

The degree of proficiency has been expressed as the level of the EPAs, the key tasks of the discipline listed in the "EPA, Competences and Enabling Competences" section, that trainees will be expected to achieve in relation to each tumour site. This includes the management of the primary tumour and metastases arising from it. The levels of EPAs are defined in Table below.

Level1	Observation only
Level 2	Direct proactive supervision, i.e., with a supervisor present in the same room
Level 3	Indirect reactive supervision, i.e., the supervisor is easily available if necessary
Level 4	Without immediate supervision but with post hoc report or remote supervision
Level 5	Trainee supervises more junior trainees

In the case of rare tumours and some procedures, the trainee may not have the opportunity to observe the management but should have knowledge of the treatment in order to refer patients appropriately. In the case of cancers where the main modality of treatment is systemic therapy, Radiation oncologists will be expected to have the systemic therapy competences listed in this curriculum that are based on knowledge of the role, side effects and interaction with radiotherapy and the ability to diagnose and provide treatment for the side effects of systemic therapy either personally or by onward referral. Clinical Oncology trainees will be expected to achieve competences in systemic therapy to manage patients with these conditions. The EPAs listed are based on Radiation Oncology practice. In view of the variation in the structure of training programmes across Europe, milestones, the expected ability of a trainee at a stage of his/her training, have not been specified.

Level	Site/type or treatment technique	Subsite/ subtype
4 - 5	Breast cancer	
	Lung cancer	Non-small cell Small cell
	Lower gastrointestinal cancer	Rectum
	Urological cancer	Prostate
	Carcinoma unknown primary	
	Systemic therapy-diagnosis of side effects, management either personally or by onward referral	
3-5	Acute oncological emergencies	
	Thoracic cancer	Mesothelioma Thymoma
	Upper gastrointestinal cancer	Oesophagus Stomach Pancreas
	Lower gastrointestinal cancer	Anal canal and anal margin
	Head and neck cancer	Larynx Pharynx Oropharynx Oral cavity Paranasal sinuses Nasopharynx Salivary gland tumours Thyroid Middle ear
	Sarcomas	Soft tissue
	Gynaecological cancer (External beam)	Cervix Endometrium
	Urological cancer	Bladder Kidney Penis Testicle-Seminomas
	Central nervous system tumours	Gliomas Meningiomas Pituitary adenomas
	Skin cancer	Basal cell Squamous Melanoma

Level	Site/type or treatment technique	Subsite/ subtype
1-2	Haematological	Hodgkin's disease Non Hodgkins Lymphoma Plasmacytoma Myeloma
	Head and neck cancer	Nasal passages Temporal bone tumours
	Sarcomas	Primary bone Ewing's sarcoma of bone and soft tissue (adult)
	Gynaecological cancer	Vulva and vagina
	Urological cancer	Ureter Urethra
	Central Nervous System tumour	Craniopharyngiomas Ependymomas Pineal lesions Primitive neuroectodermal tumours Primary cerebral lymphomas Medulloblastomas Skull based tumours
Knowledge-2	Skin cancer	Cutaneous lymphoma
	Paediatric and adolescent oncology	CNS tumours Wilm's tumours Neuroblastoma Rhabdomyosarcoma Ewing's tumours Lymphomas Leukaemia
	Ophthalmic/orbital tumours	
	Brachytherapy	Gynaecological tumours Prostate Head and neck Breast
	Total body irradiation	
	Total skin electron treatment	
	Stereotactic body irradiation	
	Proton treatment	
	Systemic therapies	

Assessment

Purpose of Assessment

The purpose of the assessment system is to:

- Enhance learning by providing formative assessment, enabling trainees to receive immediate feedback, measure their own performance and identify areas for development
- Drive learning and enhance the training process by making it clear what is required of trainees and by motivating them to ensure they receive suitable training and experience
- Provide robust, summative evidence that trainees are meeting the curriculum standards during the training programme
- Ensure that trainees possess the essential underlying knowledge required for their specialty to protect patient safety by providing a baseline quality standard
- Identify trainees who should be advised to consider changes of career direction

Structure of Assessment

The assessment system is designed by National Societies in accordance with the legal requirements of each country. These vary for example some countries are required to set high stakes, summative assessments such as formal examinations while in others this is not allowed, however there are guiding principles that National Societies should take account of:

- Assessment of competences and performance require workplace based assessments
- Work place based assessments should use validated tools where these are available
- The trainee is primarily responsible for organising workplace based assessments
- Evaluation of the trainee's progress using trainers' reports and the results of workplace based assessments, if available, should occur at regular intervals at least annually
- High stakes, summative assessments should be focused on the assessment of competences and should include a practical component including assessment of radiotherapy planning competences
- Trainers in the workplace and examiners for national high stakes examinations should receive appropriate training

Methods of Workplace Based Assessments

Some workplace based assessments are used widely across different specialties while others are specific to the specialty. Workplace based assessments may focus on the following areas:

- Direct observation of radiotherapy planning
- Direct observation of interaction with a patient receiving systemic therapy (the competences being assessed will vary according to whether the trainee is in a radiation oncology or clinical oncology programme)
- Communication with patients (e.g. mini-CEX)

- Decision making when managing patients and recording of patient encounters (CBDs)
- Participation in MDTs
- Leading MDTs
- Evaluation by colleagues - this may include peers, trainers, nurses, RTTs, administrators (360 degree appraisal)
- Evaluation by patients
- Presentations:
    - Journal clubs
    - Quality improvement/audit projects
    - Personal research
- Direct observation of teaching delivered by the trainee

The trainee's competence may be assessed by multiple workplace based assessments, covering the domains of competence in the curriculum, undertaken throughout his/her training. Annual review of training meetings may be required to use national documentation. Where the National Society can specify how competences are recorded, they may wish to monitor the progress of the trainee by determining whether they have acquired the required level of competence in the tumour sites or by recording the level they have reached in the EPAs listed in this curriculum for each tumour site.

Documentation of Training and Assessments

The trainee should maintain a learning portfolio, either in hard copy or an e-portfolio, for the duration of the training. This can be used to monitor the progress of training by recording attainment of competences and should be shared with trainers as well as used for personal reflection. Possible contents include:

- Personal details
- Details of the training programme
- Timetable including educational sessions
- An up to date Personal Development Plan
- Results of workplace based assessments
- Log book of experiences managed by the trainee
- Records of meetings with the trainers/training programme director where the progress of the trainee is assessed
- Results of in-house tests and high stakes national summative assessments
- Statement by the trainer as to the level of clinical responsibilities/EPAs the trainee can undertake during the following period of training
- Submitted papers
- Papers, articles, abstracts, posters where the trainee is one of the authors
- Presentations by the trainee
- Educational sessions run by the trainee
- Meetings attended including educational meetings or courses, conferences and scientific meetings
- Leadership activities including membership of committees in the organisation, rota coordination, quality improvement projects, change management, membership of guideline development committees
- Reflections on incidents requiring advocacy

- Reflections on personal reading
- Reflections on significant incidents and complaints detailing the learning gained from these
- Declaration by the trainer confirming the accuracy of the portfolio. This may be held on line or in paper form depending on the requirement of the National Society.

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List of Abbreviations

2D 2 Dimensional
3D 3 Dimensional
ALARA As Low As Reasonably Achievable
CBDs Case Based Discussions
CT Computer Tomography
CTV Clinical Target Volume
DVH Dose Volume Histogram
EBRT External Beam Radiotherapy
EFOMP European Federation of Organisations for Medical Physics
EPAs Entrustable Professional Activities
ESTRO European Society for Radiotherapy and Oncology
GCP Good Clinical Practice
GI Gastrointestinal
GRACE Global Radiation Oncology Collaboration in Education
GTV Gross Target Volume
ICRU International Commission on Radiation Units and Measurements
IGRT Image Guided Radiotherapy
IMRT Intensity Modulated Radiotherapy
IORT Intra-operative Radiotherapy
ITV Internal Target Volume
LET Linear Energy Transfer
mini-CEX mini Clinical Examination Exercise
MRI Magnetic Resonance Imaging
MDT multi-Disciplinary Team
OAR Organ At Risk
PET Positron Emission Tomography
PRV Planning Risk Volume
PTV Planning Target Volume
QA Quality Assurance
RECIST Response Evaluation Criteria in Solid Tumours
RT Radiotherapy
SBRT Stereotactic Body Radiotherapy
SCRT Stereotactic Cranial Radiotherapy
SVC Superior Vena Cava
RTTs Radiation Therapists
TPS Treatment Planning System
TV Target Volume
UEMS European Union of Medical Specialists
yESTRO young European Society for Radiotherapy and Oncology