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## ESTRO Core Curricula

## The updated ESTRO core curricula 2011 for clinicians, medical physicists and RTTs in radiotherapy/radiation oncology

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## ABSTRACT

**Introduction:** In 2007 ESTRO proposed a revision and harmonisation of the core curricula for radiation oncologists, medical physicists and RTTs to encourage harmonised education programmes for the professional disciplines, to facilitate mobility between EU member states, to reflect the rapid development of the professions and to secure the best evidence-based education across Europe.

**Material and methods:** Working parties for each core curriculum were established and included a broad representation with geographic spread and different experience with education from the ESTRO Educational Committee, local representatives appointed by the National Societies and support from ESTRO staff.

**Results:** The revised curricula have been presented for the ESTRO community and endorsement is ongoing. All three curricula have been changed to competency based education and training, teaching methodology and assessment and include the recent introduction of the new dose planning and delivery techniques and the integration of drugs and radiation. The curricula can be downloaded at <http://www.estro-education.org/europeantraining/Pages/EuropeanCurricula.aspx>.

**Conclusion:** The main objective of the ESTRO core curricula is to update and harmonise training of the radiation oncologists, medical physicists and RTTs in Europe. It is recommended that the authorities in charge of the respective training programmes throughout Europe harmonise their own curricula according to the common framework.

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ESTRO presented in 1991 a “minimum curriculum for the theoretical education in radiation oncology in Europe” [1] and the document was endorsed by 22 European national radiation oncology societies. The core curriculum (CC) was a great success and played a pivotal role in establishing comparable standards for training in radiotherapy/radiation oncology all over Europe. The success inspired in 1995 the European Radiation Technologists Education Development Group (ERTED) to develop a similar curriculum for RTT’s in order to set common recognisable standards for all member states [2]. Finally in 2004, the European Federation of Organisations for Medical Physics (EFOMP) published their first CC intended to provide a baseline standard for medical physics in radiotherapy [3].

A decade later, the fields of radiotherapy/radiation oncology had evolved substantially and the number of ESTRO member states increased. Therefore, in 2004, the second editions of the curricula for the Specialist Education and Training of Medical Practitioners in Radiotherapy (Radiation Oncologists) [4] and RTT’s (Radiation Therapist) [5] were updated and published in Radiotherapy & Oncology. This time endorsed by 35 member states. The curricula were integrated into national guidelines/law of several European countries and represented an important step towards harmonisation throughout the European Union.

In 2007 ESTRO proposed a third (for medical physics, a second) revision and harmonisation of all three curricula in order to further encourage harmonisation of education programmes, to facilitate mobility between EU member states, to keep up with the rapid development of the speciality and most importantly, to secure the best evidence-based education of the three professional disciplines/specialists across Europe.

## Materials and methods

Three working parties were established in the autumn of 2007. Each group included participation of resource persons from the ESTRO Educational Committee, local representatives involved in educational activities appointed by or representing the National Societies as well as support from ESTRO staff. Emphasis was put on a broad representation with a geographic spread, different experience in education and a link to the National Societies. The working parties were given full autonomy to organise their work, which involved meetings for the whole working party, meetings of the smaller writing groups and regular feedback to the National Societies in order to make the process as flexible, efficient and equitable as possible. The challenge was to increase the educational ambitions and create a common framework for the content of the education programmes for the three professions throughout Europe with respect to the national differences in the organisation and legislation of the specialities of radiotherapy/radiation oncology.

The third edition of the recommended ESTRO core curriculum for radiation oncologists/radiotherapist was accepted at the National Society meeting in Brussels March 2010 and has until now been endorsed by 27 National Societies. The second edition of the core curriculum for medical physicists in radiotherapy was accepted February 2011 by EFOMP. Finally, the updated third edition of the European CC for RTT’s was finalised and presented at the National Societies meeting in London in May 2011 for final comment and revision.

## Results

One of the major changes, common for all three updated curricula, was the shift from a focus based on theoretical knowledge and skills to competency based education and training. Optimal education/training requires that the student is able to

integrate knowledge, skills and attitude in order to be able to perform a professional act adequately in a given situation. For the clinicians these competencies are described as the seven roles of a physician identified by the CanMEDS system [6] originally developed by the Royal College of Physicians and Surgeons of Canada in order to ensure that postgraduate specialty training programs are fully responsive to societal needs. These roles involve (Fig. 1): medical expertise, communication, collaboration, knowledge/science, health advocacy/social actions, management/organisation and professionalism. In Fig. 2 an example on how this can be put into practice for radiation oncology/radiotherapy is shown. Based on this model competencies have also been defined for the RTT’s and medical physicists and form the basis of their CC.

This change from knowledge and skills to knowledge, skills and attitude requires that the education is broadened to include the defined competency areas with additional emphasis on training in a practical environment, competency based supervision and evaluation during training. Methods of assessment of learning outcomes within this new framework differs between professions but could include direct observations in practical situations, mini-CEX evaluations (which is a 15 min snapshot of professional/patient interaction and designed to assess the clinical skills, attitudes and behaviours of trainees), 360 degree evaluations (a multi-rater written feedback from supervisors and other medical people around the trainee), delineation tools and tests like the FALCON project and formal supervision during medical practice or clinical placement.

It is intended that the individual national societies and local departments of radiotherapy and oncology develop and use the teaching, assessment and evaluation methods that are most suitable for their local/national situation. The new CC outline different useful teaching, assessment and evaluation methods but it is up to the education institute and/or the national society to suggest which methods should be used, how they should be used and how fast they should be implemented. This should be in accordance with the national guidelines set by the different bodies responsible for the teaching programmes and for the certification. ESTRO wants to support this process and have organised workshops for the national representatives on the implementation of the competency based training and assessment during the annual ESTRO meetings in 2010 and 2012. Additional changes, specific to the individual CC for the professional group, are outlined in the next sections.

### Clinicians’ core curriculum

The updated third version of the CC for clinicians can be found in full text at the ESTRO website [7] or downloaded as supplementary



Fig. 1. The seven roles of a physician identified by the Canadian CanMEDS system. Figure modified from <http://rcpsc.medical.org/canmeds/index.php>.

Learning Outcomes	Knowledge	Skills/Expertise
<b>10. Able to develop a radiotherapy treatment strategy and technique</b>	Knows the radiotherapy modality and possible beam arrangements Knows the patient position and immobilization technique Knows the method of tumour localisation	Able to communicate effectively to the planning radiographers and physicists the imaging and treatment technique and document all aspects of the planning process clearly
<b>11. Able to determine the GTV, CTV, ITV, PTV, OAR and PRV as appropriate for external beam radiotherapy and brachytherapy</b>	Able to interpret diagnostic imaging (including CT, PET and MR) Understands the use of cross-sectional imaging in planning Understands the clinical and radiological parameters associated with planning 2D conventional and 3D conformal radiotherapy	Able to define a treatment volume Able to define organs at risk and outline them Able to define DVH based 3D conformal planning constraints
<b>12. Able to evaluate an external beam radiotherapy/brachytherapy treatment plan in collaboration with physicists and radiographers and knowing the responsibilities of own and others actions</b>	Knows the ICRU guidelines for prescribing, reporting and recording dose Knows the general process and workflow to achieve a treatment plan, treatment sessions and follow up (national or local recommendations)	Able to critically assess the dose distribution within the treatment volume and organs at risk Able to identify whether a treatment plan is adequate and suggest ways of improving an inadequate plan Able to take responsibility for the complete treatment plan
<b>13. Able to evaluate the risk of a EBRT/brachytherapy treatment plan</b>	Knowledge of the tolerance of the organs at risk and dose limitations	Able to critically assess the dose distribution within the treatment volume and organs at risk Able to balance tumour control against potential damage to organs at risk

Fig. 2. Example on competences (Medical expertise) from the clinician's core curriculum taken from [7].

to this paper and is divided into four parts. The first part describes the role of radiation oncology in a multidisciplinary approach of cancer treatment, the infrastructure and organisational aspects as well as the components of the educational programme. The second part describes the general competencies in the CC using the CanMEDS system, whereas the third part describes the specific competencies. This part is recognisable from the previous edition of the core curriculum but the levels of knowledge have been further described using Blooms taxonomy (Fig. 3). The level at which the trainee is expected to interact with the information is listed after each statement and makes it easier for the trainers and trainee to know what is expected during the training. However, it is important to state, that the indications of levels presented in the curriculum should be considered as minimum competencies for all countries and that the national societies can define if upgrading is more appropriate for the national situation. The fourth and last part is dealing with assessment during training. Evaluation of competencies is an ongoing process taking place from the very start of training and therefore in many ways is different from the classical examination. When evaluating competencies one must bear in mind that "scoring" of competencies is probably of minor importance and it is often more important to discuss the assessment with the trainee in order to secure progress in knowledge and skills. It is realised that assessment of competences can be done in many ways and each country should decide on criteria that determine successful training or failure. It is up to the national societies and/or

authorities to decide which methods should be used. The ESTRO Clinicians CC Group wishes to follow the development of and experience gained with the different assessment tools and will obtain an update of this information for future editions of the CC.

Besides the shift to competency based training and the expanded palette of assessment methods, one of the most important changes in the updated curriculum for clinicians is the emphasis on the multimodality approach of treating cancer. Radiation oncology includes responsibility for the diagnosis, treatment, follow up, and supportive care of the cancer patient and forms an integral part of their multidisciplinary management and investigation. One of the examples of this is the use of concomitant drugs to radiotherapy. The staff in the radiotherapy departments sees the patient every day during the course of radiotherapy and the side effects of many systemic treatments enhances not only the effects but also the side effects of radiotherapy. It is therefore recommended that all radiation oncologists should have at least a basic knowledge of medical oncology, being able to recognize and initiate treatment of medical oncology emergencies and taking clinical responsibility for the delivery of radiation therapy together with systemic agents. Due to the more complex and intensified treatments it is also recommended that the department should have beds for inpatients or at least sufficient access to them in other departments.

Since the last version of the curriculum, the advance in technology has been tremendous and therefore is the new curriculum on

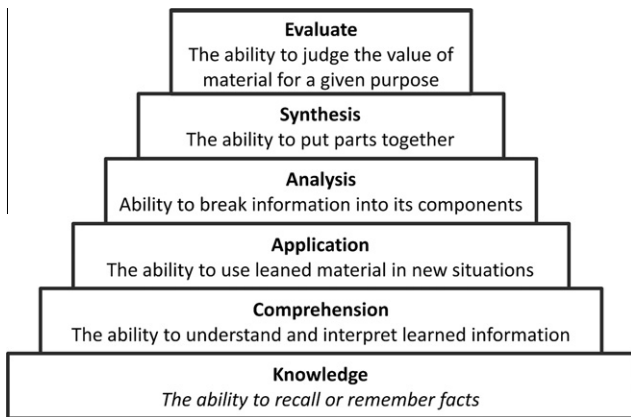


Fig. 3. Blooms taxonomy, modified after Krathwohl [8].

this point substantially revised. This includes the ability to define target volumes; organs at risk, ability to evaluate and give final approval to IMRT, IGRT and stereotactic radiotherapy plans and to define DVH based 3D conformal planning constraints – just to mention a few of the items.

#### Medical physicists' core curriculum

The second edition of the core curriculum for medical physicists in radiotherapy can be found on the ESTRO education website [7] or downloaded as supplementary to this paper. The previous version was reviewed considering the contemporary requirements of radiotherapy, associated treatment modalities and technology. However, additionally, a specific effort to emphasize the 'enabling skills' for the modern medical physicist working in a multidisciplinary team was included. These considerations include an awareness of their own role and impact within the clinical service and the need to integrate and communicate effectively within the team. The importance of quality management, governance/ risk management and a systematic approach to technology is also highlighted. In the preparation of the document, a further guiding principal was to produce a framework that the national societies could use as a guide or benchmark, for their own curriculum development. This baseline standard should aid the development consistency in education and clinical training across the European states. The structure and application of the curriculum, however, are intended to be flexible in order to cater for different national situations, recognising national differences in initial physics qualifications, in existing radiotherapy physics education and training programmes, structures and accreditation.

The curriculum was presented in five sections which are summarised here.

- (I) *Introduction*: The rationale and background of the curriculum are discussed. The aims and scope of the document itself are presented.
- (II) *Definitions*: Useful high level statements to help interpret the philosophy of the document.
- (III) *General competencies*: The non-technical 'enabling qualities' that a modern medical physicist should be aware of and strive to develop and perfect.
- (IV) *Radiotherapy physics knowledge, skills and competencies*: This is the main section of the document and covers in detail the technical/scientific aspects of the curriculum. It is further broken down to subsections concerned with fundamental knowledge, skills and competencies and those specific to radiation physics. The component for the training is also covered in this section.

- (V) *Assessment methods to evaluate competences*: This section was intended to give example approaches and not to be prescriptive.

A standard format for each of the subject areas in Sections III and IV was used to describe the requirements. A 'brief introduction' placed the subject area in context, competency list and core curricular items provide the practical aspects and knowledge base required and where possible a short list of recommended literature. A suggested time to be spent on each area is given which, used literally or as an indication of the relative time to be spent on each component, was intended to provide guidance for those constructing new, or revising existing, training schemes and associated academic courses.

#### RTT's (Radiation Therapist) core curriculum

The updated third version of the core curriculum for RTTs can be found in full text at the ESTRO website [7] or downloaded as supplementary to this paper. To define the core competences for RTTs the working group prepared a detailed questionnaire on current education programmes and scope of practice for RTTs in a wide range of clinical settings. The questionnaire was circulated to all member states and 28 responses received. These responses were then analysed and ten core clinical competences identified. These competences then formed the basis for the third revision of the core curriculum.

Given the wide variation in the duration and content of education programmes for RTTs identified through the questionnaire this core curriculum was designed to increase the level of awareness of the role of the RTT within the multidisciplinary team and the associated need for specialist education and therefore included detail that could be considered useful to an individual or group establishing a new programme or upgrading an existing one.

The core curriculum has four broad components. The first describes the background, the process of the third revision, the professional identity of the RTT including the new agreed title endorsed by ESTRO and detail of an appropriate education environment for the education of RTTs. The second describes the ten clinical competences in terms of the learning outcomes, knowledge and understanding and the application/synthesis/evaluation. Each competence is outlined in a short description with the findings of the survey included for context. An example is given in Fig. 4. The third gives detail of the curriculum topics under the subsections of general academic and radiation specific competencies. These are linked directly to Bloom's taxonomy with the general academic topics providing knowledge and understanding and the radiotherapy specific leading to synthesis, application and evaluation. The fourth includes an outline of commonly used teaching and assessment methods applicable to both academic and clinical components of an education programme.

Given the existing difficulties relating to the education of RTTs this curriculum has been designed to be flexible and enable development of education programmes at a range of levels reflecting the local/national situation. It aims to encourage and support RTTs working to improve their education programmes by detailing the appropriate content to support clinical practice expectations. At the basic level the curriculum topics can be selected that underpin the basic core competences expected of all RTTs in any clinical setting and at a higher level to reflect the necessary content for RTTs taking significantly greater responsibility over a wider range of tasks. This facilitates future growth and development leading to greater harmonisation and potential for greater mobility.

It is acknowledged that graduate competency can be achieved in many ways and each country should decide on criteria that determine successful training or failure. It is the responsibility of

## Clinical Competence: Positioning and immobilisation

### Short description

Patient positioning and immobilization is one of the most important aspects of accurate and reproducible treatment delivery and is considered a core skill of the RTT. The student must understand the importance of correct positioning and how it can be achieved. This incorporates understanding the appropriate immobilization methods and materials for each site, the referencing system, the physical and psychological condition of the patient and the limitations of both imaging modalities and treatment delivery. From the survey all experienced RTTs are involved in the preparation of immobilization devices. In 40% of responses the RTT carries this out alone with 8% requiring additional training. Experienced RTTs are also involved in the preparation of electron cut-outs and bolus, the majority independently.

Learning Outcomes	Knowledge/Comprehension	Applications / Synthesis / Evaluation
Able to correctly position the patient	<ul style="list-style-type: none"> <li>Define the common co-morbid conditions that patients may suffer from</li> <li>Be familiar with the techniques and equipment used</li> <li>Know the protocols used in the department</li> </ul>	<ul style="list-style-type: none"> <li>Evaluate the patient condition and the limitations that may result from any co-morbid conditions</li> <li>Analyse the information and integrate to define the optimum patient position</li> <li>Inform the patient about the procedure</li> </ul>
Able to prepare and / or produce immobilisation devices	<ul style="list-style-type: none"> <li>Know the immobilisation devices available</li> <li>Know how to use each device</li> <li>Recognise the associated health and safety issues</li> </ul>	<ul style="list-style-type: none"> <li>Construct the most appropriate device for the individual patient within the context of the protocol</li> <li>Apply the necessary precautions in production</li> </ul>
Able to complete accurate documentation	<ul style="list-style-type: none"> <li>Recognise the importance of accurate documentation</li> <li>Know what should be included</li> <li>Know to whom the documentation should be sent</li> <li>Be aware of the legal issues relating to documentation</li> </ul>	<ul style="list-style-type: none"> <li>Prepare the documentation</li> <li>Inform all the involved areas/personnel</li> <li>Ensure all legal requirements have been met</li> </ul>
Able to carry out QA of immobilisation devices	<ul style="list-style-type: none"> <li>Recognise the importance of regular quality checks on immobilisation devices</li> </ul>	<ul style="list-style-type: none"> <li>Implement correct storage and handling procedures for immobilisation devices</li> <li>Carry out regular quality assurance checks on all immobilisation devices</li> <li>Evaluate new devices prior to implementation</li> </ul>

Fig. 4. Clinical competence: positioning and immobilization.

the educational institutions in collaboration with the national societies and/or authorities to decide on how best to approach RTT education in their environment. ESTRO wishes to follow the development of and experience gained in using this core curriculum in the defining the educational needs of RTTs and will seek to identify the educational institutions who have taken responsibility for developing RTT education for future reviews.

Consistent with the other two curricula there is an emphasis on the role of the RTT within the multidisciplinary team and the importance of this approach in achieving the optimum treatment for all patients receiving radiotherapy. An understanding of all modalities used in cancer treatment and the synergistic effects give the RTT the necessary knowledge and understanding to more effectively prepare and carry out treatment delivery and to identify and report side effects.

While this curriculum focuses primarily on the core competences essential for RTT practice it builds in the flexibility to adapt to newly evolving technologies and procedures that will impact on the scope of practice and roles and responsibilities in the future.

### Discussion and conclusion

The updated and revised curricula cover all relevant issues from basic academic topics such as radiobiology to the radiotherapy specific components applicable in all aspects of clinical practice. With the introduction of competency based education and training the professions will move forward to meet all societal needs. By emphasising the need for knowledge and collaboration in multidisciplinary teams we state that treatment of cancer implies a

multidisciplinary approach of the three professions that involves the safe accurate application of radiotherapy on the one hand but also the importance of the multidisciplinary approach with related specialities that involves radiation oncology from initial diagnosis to death.

Finally, it has been a goal to make curricula that are suitable to all countries but also that motivate to increase the standards for training in radiation oncology, medical physics and RTT throughout Europe. It is the intention that these new core curricula will be a good guidance for developing and updating national guidelines for education and training in radiotherapy/radiation oncology. Hopefully, this will lead to further harmonisation throughout Europe and will facilitate the free exchange of labour force across the European boundaries.

The new curricula can be found on the ESTRO webpage [7] at <http://www.estro-education.org/europeantraining/Pages/EuropeanCurricula.aspx> or downloaded as supplementary to this paper.

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### Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at [doi:10.1016/j.radonc.2012.02.007](https://doi.org/10.1016/j.radonc.2012.02.007).

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