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# Best practice in radiation oncology: A project to train the trainers: Review of 2008–2023

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### ABSTRACT

The European Society of Radiotherapy and Oncology (ESTRO) and the International Atomic Energy Agency (IAEA) project on 'best practice in radiation oncology: a project to train the radiation therapist trainers' commenced in 2008.

The aim of the project was to influence education programmes throughout, mainly, eastern Europe to increase the radiation therapy-specific education of their programmes. This is to enable graduates of these programmes to be radiation therapists that are fit for purpose in the clinic. This paper provides an update on the successes of the project to date, the challenges that remain and the new approaches to project delivery by the faculty over this period.

### Introduction

In 2018 a review of ten years of the Best Practice in Radiation Oncology: a project to train RTT trainers was published [1]. This paper describes the achievements of the project over a 15-year period from 2008 to 2023.

At the time of initiation of the project it was recognised that tertiary education programmes for radiation therapists (RTTs) were inadequate in preparing graduates for the roles and responsibilities that they were expected to take on in modern radiotherapy centres. The majority of programmes relied on content from other professional courses and provided very limited dedicated radiation therapy content, frequently taught by non-RTTs. This was confirmed as part of the 3rd review of the core curriculum for RTTs published in 2014 when a survey of practice and education status was carried out to inform the content [2]. Raising the standard of education of RTTs and thereby the treatment delivered to patients is consistent with the European Society for Radiotherapy and Oncology (ESTRO) Vision Statement of Radiation Oncology, optimal health for all, together [3]. The Vision statement encompasses ESTRO's

role in developing and promoting standards of education and of practice.

"ESTRO has always been at the forefront of education in radiotherapy and oncology in the broad sense, in Europe and beyond ... As a backbone, strong emphasis is put on harmonising the skills and competencies of radiation oncologists, medical physicists and RTTs through the definition of core curricula, supporting continuing professional and personal development (CPPD)" [3].

Education of RTTs is also consistent with and strongly supported by the International Atomic Energy Agency (IAEA), a cornerstone for delivering quality and safe radiotherapy [4]. For more than 30 years the IAEA has been promoting and supporting education and training for RTTs by providing IAEA fellows full academic and clinical training, providing opportunities for clinical fellowships for RTTs, and organising national and regional training courses on relevant aspects of RTT work. The IAEA has a long history of advocating for the recognition of the profession of RTTs and establishment of national training programmes to replace inadequate educational practices. Globally RTTs are recognised by varying titles internationally such as 'radiation therapist',

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‘therapeutic radiographer’, ‘manipulateur’, and ‘electroradiologist’, to name just a few. RTTs are directly responsible for preparation and delivery of radiotherapy. The lack of consistency in title has had a direct influence on provided education, ranging from very limited or none, a few weeks through another programme, to a four year honours degree. Despite the education provided, the RTT is expected to accurately deliver a safe and effective dose of high energy radiation. The IAEA developed and published a handbook for the education of RTTs in 2014 [5]. It is an international guidance framework document for the planning and implementation of education programmes for RTTs. The document was produced by an international group of experts representing different regions of the world (Europe, Africa, Asia, Latin America, India). It included theoretical and clinical curricula that could be adapted to individual national contexts. The IAEA curriculum is currently under revision and due for publication in the near future.

One of the most recent activities of the IAEA was the expansion of the African Radiation Oncology Network (AFRONET) to include RTTs. AFRONET was established in 2012 to support education development and improved clinical practice in Africa, where radiotherapy professionals often work in isolation and do not have access to continuous professional development activities [6].

Initially, the AFRONET-RTT focus was on education and training, but it became clear that other important issues required consideration. These include the lack of equipment, problems with maintenance and replacement, a paucity of RTTs and how these could be addressed both currently and in the future. Further attention was also given to linking such issues with the role of the RTT as members of the wider radiation oncology team and how education can best support practice.

Since the early 1990s ESTRO and the IAEA have supported appropriate education for RTTs through workshops, educational events and publications. ESTRO has published core curricula for RTTs dating from 1997 [7] with revisions in 2004 [8] and 2011 [2] and benchmarking documents for RTTs at undergraduate level 6 [9] and postgraduate level 7 and 8 [10]. Despite these efforts, disappointing progress was made in improving education programmes to any significant level globally. Progress was measured by evaluating the changes made to the radiotherapy-specific content of education programmes aimed to graduate RTTs including a paper published in 2022 [11] and elicited through surveys carried out as part of a number of staffing and education and training projects under the umbrella of the European Union (EU) which will be completed and published in the near future. We also elicited verbal information on the status of education programmes from the newer participants of this project.

In 2008 the IAEA and ESTRO together developed the concept of an educational project called “Best Practice in Radiation Oncology: a project to train RTT trainers”. It was initiated to address significant gaps in RTT education across Europe by supporting RTTs to develop short education programmes themselves, delivering these courses to their local and national colleagues and influencing education institutes to amend their programmes to include more radiation therapy-specific education. This paper provides an update on the successes of the project to date, the challenges that remain and the new approaches to project delivery by the faculty over this period. The faculty consists of three RTT educators with combined experience of over 60 years, a clinical radiation therapy manager and the operations manager of one of the largest radiation therapy departments internationally. Successes were determined by the number of short courses delivered, efforts that were made to address the educational shortfalls and advances in the professional profile of the RTTs (e.g. through the development of national societies).

## Methodology

The project followed a ‘train the trainers’ methodology. A team would represent a given country, and their task was to prepare three short courses on radiation therapy practice within a two-year period.

The team was best placed to select the topics of the short courses for their own country. The same team was permitted to represent the country in multiple iterations of the Train the Trainers programme. To meet the aims of the project it was agreed that teams of three RTTs, preferably representing the clinical, education and professional organisations, would participate. This team method was informed by experience of challenges when an individual RTT was tasked with completing a project alone. The team approach is also more representative of how RTTs work in the clinic. Another consideration was the failure of the education institutes to address the curriculum in any meaningful way [1], which would be difficult for an individual RTT to challenge. A team would be able to support each other in preparing and delivering short courses, in revising the education programme and in ensuring the support of the national professional society. However, it was not possible to achieve this aim. This was primarily, due to a lack of RTTs employed in education institutes and no RTT-specific professional societies. Predominantly the groups participating comprised three representatives of the clinical setting, typically composed of RTTs, medical physicists and radiation oncologists. This team approach has proven to be very beneficial as it often became apparent that the other radiation oncology professionals also had educational needs. There was a very much increased level of mutual respect and the benefits of working together was clearly demonstrated.

The project was designed to run over a two-year period comprising a one-week workshop where participants would be assisted in developing a short course on a topic considered important in their setting, the delivery of at least one short course over the following year and a follow up workshop where the experiences of the group would be discussed. The group was then expected to deliver a further two courses over the next year. In this way the first workshops were not topic specific, but participants were encouraged to select a topic that reflected the recommended core curricula for RTTs. Over the 15-year period changes were made to the structure based on experience and new faculty members were recruited to reflect clinical requirements and the geographic spread of participants. The project was a joint venture between ESTRO and the IAEA with ESTRO supporting the resources including the faculty and the IAEA supporting participation of RTTs from countries who were part of their European Technical Co-operation programme.

The initial faculty was selected from clinical and academic RTTs across Europe and their function was to empower, enable and support the participants in developing their own courses. The faculty were selected as they had experience in developing local, national and international programmes in radiation therapy.

Initially the format of the first week was lectures focussed on aspects of course development including teaching methodology, assessment, selection of lecturers, potential attendees and how to address the necessary resources required to enable effective course delivery. Each course developed was designed to meet local or national RTT requirements, to improve the quality and safety of radiation therapy delivery, to improve the patient experience and to benefit groups at all stages of clinical practice or level of education in their country. Following the experience from the first two iterations, the format of the first week was modified by introducing a series of guided workshops with individual group and full group feedback. This allowed the faculty to give expert input and advice throughout the week but also allowed other participants to contribute if appropriate or to consider where there was potential to work together if topics selected were similar. The flexibility of this approach also meant that changes to the programme could be dynamic as appropriate to meet the needs of the participants. This resulted in a revision of the faculty to include an international management RTT expert and a previous RTT participant of the project itself.

## Results and discussion

### Short courses delivered

In the majority of countries participating there was very little evidence of radiotherapy specific short courses in place to fill the gaps in their initial national education programmes. Where CPD was offered it was often general and delivered by staff other than RTTs. Since the commencement of the project a total 29 countries across Europe have participated with 91 short courses having been delivered. Several countries participated in more than one project sending new teams and ensuring continuity of activities within the country (Table 1).

Across the 91 short courses, twenty-six topics were covered in total with seven focussing on anatomic site-specific areas. All topics were considered integral to RTT specific education (Table 2).

Non-site-specific courses included four on the treatment of paediatric patients and one on the management of older patients in the department. Two technique related courses covered total body irradiation (TBI) and craniospinal irradiation with two courses relating to brachytherapy. Thirteen courses focussed on risk management, quality assurance (QA) and safety with Croatia developing a comprehensive series of courses relating to different aspects of QA. Several other teams integrated QA into their site-specific courses highlighting the importance of this as a topic for RTTs. One course focussed on the use of orthovoltage, four on the introduction of advanced techniques into clinical practice in their department and one on Intensity Modulated Radiotherapy. Patient management was the focus of seven courses, including communication and radiobiology as they related to patient preparation and side effect management. Positioning, immobilisation and verification (including Image Guided Radiotherapy) were covered in six courses with planning, plan evaluation and organ at risk contouring the topic of six courses. The remaining four courses focussed on education including clinical practice and workflow and efficiency.

This wide range of topics reinforces the decision not to predetermine a topic for the project enabling participants to focus on what is a particular requirement in their setting. It also proved useful in teams working together on the same topic across countries. A number of countries also opted to attend peer courses thus widening the benefit for a larger number of RTTs and increasing the knowledge base. This was particularly evident in Eastern Europe where a strong collegiate approach has been established and progress in overall educational development has been seen.

The numbers of attendees at the courses varied with the size of the radiotherapy service and whether the course was aimed locally or nationally. While the courses were primarily aimed at RTTs the audience was mixed in many cases with medical physicists, radiation oncologists and nurses also attending. Numbers ranged from five where the course was delivered locally to the full RTT staff to 200 for a course offered nationally with attendance from almost all centres in the country. Some courses reported international participants. The faculty who developed and ran the courses were made up of project participants, as well as local RTTs, medical physicists and radiation oncologists and other professionals as appropriate to the course topic and content.

Where practical sessions or workshops were included, the success was more limited. This was seen when the number of attendees could not be facilitated effectively in specific environments, for example, the CT simulation or treatment planning room. It was recommended to avoid practical sessions in the future. The level of confidence amongst all the project participants was seen to improve with an eagerness to present and participate actively in the follow up sessions and an enthusiasm to apply what they had learnt from the experience to improve their second and third courses. Disappointingly there were some negative comments reported with organised lecturers initially not engaging and arriving ill prepared on the day.

The advantage of the flexible train the trainer project methodology meant that the faculty could respond immediately and revise the course

**Table 1**

Overview of courses achieved to date as a result of the Train the Trainers Project.

Country	No. of courses	Title of Courses
The Republic of Albania	3	Gliomas Code of Practice
The Republic of Armenia	1	
The Republic of Azerbaijan	2	Total Body Irradiation Introduction to IGRT
The Kingdom of Belgium	1	
Bosnia and Herzegovina (Sarajevo, Banja Luka, Tuzla)	6	Professionalism in radiotherapy Education including clinical practice Patient positioning verification and MV imaging P&I head and neck Improving workflow
The Republic of Bulgaria	7	CT planning in radiation oncology Contouring organs at risk Patient positioning and verification Patient positioning and immobilisation Breast Cancer
The Republic of Croatia	8	QA in radiotherapy technology Legislation, Regulations, Recommendations QA – patient positioning QA – an introduction to IGRT Competencies and skills Evaluating treatment plans QUART6
The Republic of Cyprus	4	An introduction to IMRT Risk Management
The Czech Republic	1	Radiobiology
The Republic of Estonia (Tallin, Tartu)	6	Improved QA for 3DCRT Acute and late adverse events Advanced techniques and technologies in radiotherapy Communication and side effect management Improved treatment accuracy through RTT plan evaluation As above with IGRT
Georgia	4	Positioning and immobilisation in oesophageal cancer Practical aspects in head and neck cancer Practical aspects of craniospinal irradiation Positioning and immobilisation and side effects, communication before and after treatment
Hungary	1	IGRT basics
The Republic of Kazakhstan	4	Pelvic cancers High tech radiation therapy for RTTs Positioning, immobilisation, fixation and control for craniospinal radiotherapy
The Kyrgyz Republic (Kyrgyzstan)	4	Positioning and immobilisation in oesophageal cancer Image acquisition, treatment planning and patient management on treatment Positioning and immobilisation for head and neck cancers
The Republic of Latvia	1	Strengthening knowledge and skills in radiotherapy quality and safety Radiobiology
The Republic of Lithuania	1	Radiobiology
Republic of Malta	2	State of the art radiotherapy in Malta 3DIGRT and VMAT
Montenegro	2	Portal imaging Positioning in breast cancer
The Republic of North Macedonia	4	Brachytherapy techniques CT simulation for breast cancer Skin cancers First treatment of patients with rectal cancer – standard position vs bellyboard

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**Table 1** (continued)

Country	No. of courses	Title of Courses
The Republic of Poland	3	QA in prostate cancer Positioning in breast cancer in CT simulation Symposium
The Portuguese Republic	1	Incident reporting, evaluation and prevention
Romania	1	Management of side effects for head and neck cancer
The Russian Federation	5	1 day per month for 6 months to improve knowledge and skills of RTTs
The Republic of Serbia (Belgrade, Nis, Sremska, Kamenica)	9	Breast cancer – contemporary radiotherapy Modern transcatheter RT Contemporary approaches in radiotherapy Brachytherapy Importance of communication with patients in radiotherapy Orthovoltage radiotherapy and QA Head and neck radiotherapy Positioning and immobilisation in paediatric radiation oncology Challenges in radiotherapy treatment of elderly patients Role of radiotherapy in paediatric cancer
The Slovak Republic	2	Positioning and immobilisation in head and neck malignancies Quality Assurance
The Republic of Slovenia	1	
The Republic of Türkiye	4	Side effects of nasopharyngeal cancer radiotherapy and patient care Positioning and immobilisation techniques in head and neck cancer Quality Improvement team in radiation oncology – where do RTTs stand RTT role in IGRT in lung cancer
Ukraine	1	Positioning and immobilisation for radiation therapy of breast cancer
The Republic of Uzbekistan	1	Head and neck cancers and organs at risk

**Table 2**

Treatment/Anatomical Site-specific courses.

Site	No. of courses
Head and neck	9
Breast	5
Oesophagus	2
Skin	1
Nasopharynx	1
Lung	1
Pelvic including gynae and prostate and use of bellyboard	4

to reflect how to manage difficulties as they arose. Generally, the hospitals of participants were very supportive providing space and resources as far as possible, although some groups reported some negativity and lack of support initially within their departments, but this did improve with subsequent courses as a greater understanding of what could be achieved became evident.

### Secondary benefits

#### Culture change

Significant secondary benefits were achieved, which were not initially planned or anticipated. In developing and delivering the short courses a number of groups worked together and established their own networks, sharing course information, visiting each other's centres and participating in each other's courses. Networks have varied from two

faculties working together to facilitate courses to Eastern Europe collaborations involving eight countries participating in CPD, with over 15 cooperating groups. The most recent collaboration resulted from the 2022–2023 project with The Kyrgyz Republic and Uzbekistan establishing a network and training seminar. They teams stated that they saw the train the trainers project as “an opportunity to meet colleagues in radiation therapy and to organise cooperation between foreign centres for the benefit of patients”. The Kyrgyz Republic, Uzbekistan and Georgia have also established a network to provide core information online, share clinical practice experience and plan to work together to develop approved short courses for RTTs. Serbia and Croatia plan to work together to develop short courses on QA, Quality Control (QC) and the RTT role. Azerbaijan also plans on joining these courses. This level of co-operation is indicative of that observed throughout the 15-year period providing each other with additional, collaborative support.

In an increasing number of countries, teams have worked to develop either an independent RTT national society or to strengthen the RTT role within their existing national professional society. Eleven of the countries have now joined the ESTRO RTT Alliance and two representatives are elected to the RTT Committee playing an active role in promoting their profession at a European level. Alliance members are active in a range of ESTRO activities and participate in the annual conference. This has helped to raise the profile of the RTT in most countries. The recognition of the profession and the RTT role has improved communication within the wider radiation oncology team and also had an impact on education development in some instances.

Participants in the project also set up closed professional social media groups where they can discuss and problem solve together with topics covering clinical practice, leadership, quality, safety, patient care and interprofessional collaboration opportunities.

Four teams from Eastern Europe attended the first project iteration and continued to send participants throughout the 15 years of the programme resulting in continuity of education opportunities across the country. In turn this led to the establishment of the South and East Europe Technology in Radiation Oncology (SEETRO) platform. SEETRO was established by five of the participating countries as a direct outcome of collaboration between participating countries through the train the trainer's project. SEETRO is an international platform for educational and professional cooperation and has held six very successful conferences since 2013. These conferences have provided a means for RTTs from the region to showcase their work, to gain confidence in presenting and to network with their colleagues in a way that was not previously possible. The standard of the presentations and the organisation of the SEETRO has grown significantly over time. Other radiotherapy professionals frequently attend in recognition of the standard achieved and increasing the sense of team and community locally, nationally and regionally. Today the number of participating national societies has grown to nine countries. This has also led to the involvement of RTTs in national conferences organised by other radiotherapy professionals. In total 39 of the short courses on the train the trainers project have been delivered by countries related to the SEETRO initiative.

#### Policy changes

From a national education perspective, the impact of the project has been somewhat limited with little progress in improving education programmes for RTTs. This is largely as a result of a lack of dialogue between Ministries of Health and Education, hospital administrators and radiotherapy professionals and the difficulties encountered in engaging all key personnel in addressing the educational issues.

The large number of titles (over 28 including Manipulateur en électroradiologie, radiological technician, therapeutic radiographer, nurse, laborant, radiotherapy machine users) for the profession across Europe has also been problematic. This will be alleviated by the recent recognition of the title ‘Radiation therapist’ by the European Commission [11]. An inability to influence the policy dialogue around the radiation therapy workforce and the role of the RTTs are also key factors in

the failure to make significant progress.

### National education programmes

Three countries have succeeded in developing specific national education courses for RTTs: Serbia, Moldova and Estonia with Croatia, Russia and Bosnia/Herzegovina improving the content of their existing programmes. Moldova was unique amongst this group in establishing a national education programme where no formal programme for RTTs previously existed. There is an awareness that the initial education programme for RTTs must change but many obstacles still remain that inhibit this progress. The obstacles include a reluctance on the part of mixed discipline organisations and national societies to acknowledge radiation therapy as a discipline requiring specialist knowledge and education. Reluctance on the part of education institutions to change their existing programmes to include radiotherapy specific content and to appoint lecturers expert in the area is also problematic.

Individually some project participants have continued their education to Master and PhD levels facilitating their inclusion in education institutes as teaching faculty, ensuring that content delivered to RTTs is appropriate. Some participants have also taken leadership roles in their clinical setting and supporting education development to support these roles.

Continuing professional development/Continuing medical education for RTTs was very limited in the majority of countries participating in the programme at its outset. Even where it was a requirement for continuation of practice there was limited opportunity to attend radiotherapy-specific courses. This has changed with the project, not only as a result of the range of short courses offered, but with a raising awareness of the importance of providing ongoing education in a rapidly evolving discipline. There has also been increasing interest in attending further education evidenced by the increasing attendance at other faculty short courses and at annual conferences such as SEETRO and ESTRO where representation from participants of the project has increased. Several short communications and contributions to papers have also been successfully submitted and accepted to professional journals [12,13,14].

### Alignment with the Global Cancer Agenda

In 2017 many governments across the world adopted a resolution WHA70.12 “Cancer prevention and control in the context of an integrated approach”, highlighting cancer control as a critical health and development priority. Since then, the World Health Organisation launched three major global cancer initiatives on cervical cancer elimination [15], breast [16] and childhood cancers [17].

Access to radiotherapy is indicated as strategic priority actions in all cancer initiatives. Implementation of initiatives is conducted globally in partnerships, including the IAEA, and civil society (ESTRO and other professional societies; Global Coalition for Radiotherapy and other Non-Government Organisations, etc), academia, implementation partners and others. To achieve the goals of these initiatives appropriately educated staff are essential and the project is helping to address this aspect of cancer care.

The recent White House initiative “The United States of America’s Global Cancer Moonshot”, reaffirmed the importance of and brought renewed focus to cancer control, facilitating new collaborations, promoting equal access for all cancer patients to quality and safe treatment [18].

### Conclusion

The success of this project has exceeded expectations. The approach has reinforced the concept of empowering participants as well as supporting them in achieving their goals. The short courses have provided educational opportunities to a large number of participants in countries

where previously there were none. It has identified a previously unacknowledged resource, in highly motivated RTTs who are keen to address the problems within their country and work to bring about change. This project has spearheaded professional and educational development of RTTs across Europe and gained momentum that will continue into the future.

Plans for further courses are underway in participating countries and education development is ongoing.

The project has further consolidated the immense need for improvement in the radiotherapy specific education to RTTs across Europe to ensure optimal treatment of patients. The project has provided a platform for RTTs to demonstrate what can be achieved if they are given the necessary resources and support. It has empowered RTTs to lead their own practice and has strengthened the RTT position as a leader within the radiation oncology multidisciplinary team.

### Recommendations

Over this 15-year period, the project focussed on impacting on the education of RTTs to improve the radiotherapy specific content of existing or newly formed programmes. Whilst the project was very successful overall it did not succeed in widely influencing primary education programmes graduating professionals to work in a radiotherapy setting across Europe. For this reason, the project faculty considered if a different approach could consolidate and build on achievements to date but also help to achieve the ultimate goal. The approach is now to consider what in the clinical setting could be improved and consequently what knowledge and skills are required for RTTs to bring about the changes to improve quality and safe practice. As the majority of the project participants had little education related experience putting the emphasis on clinical change engaged the project participants more directly. Having defined the clinical question introducing curricula content and teaching methodology was more meaningful.

A revised approach focussing on improvement of clinical practice has been tested and will be the focus of this project in the future. For this approach participants will be asked to consider aspects of clinical practice where they feel RTTs could improve their current roles and responsibilities, could improve areas of practice or consider new ways in which they could impact on the preparation and treatment of patients. In an era of dynamic development of technology and techniques this approach will address the immediate need for continuous professional education but also drive RTT-specific education in the future. This will also support the position of RTTs as leaders within the multidisciplinary team.

In exploring how to improve or change practice RTTs may consider the multidisciplinary team perspective and how the interactions between the different professionals could be improved. The revised programme will also provide a platform to consider what elements are missing in existing education programmes that impede their current and future practice and how these may be addressed. In this way, the revised project will still aim to influence the education of RTTs but will also enable improved practice and enhance professional recognition.

### Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: The lead author (ML) is the EIC of tipsRO. PS, MC and CD are editorial board members of tipsRO. As this is reporting on an ESTRO activity, it is preferable for publication in the ESTRO Radiation Therapist journal, hence its submission.

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