



Contents lists available at [ScienceDirect](https://www.sciencedirect.com)

Technical Innovations & Patient Support in Radiation Oncology

journal homepage: www.sciencedirect.com/journal/technical-innovations-and-patient-support-in-radiation-oncology



Exploring radiation therapist education and training

Mary Coffey, Amara Naseer, Michelle Leech*

Discipline of Radiation Therapy, Trinity St. James's Cancer Institute, Trinity College Dublin, Ireland

ARTICLE INFO

Keywords:

Education
Training
Radiation Therapist

ABSTRACT

Radiation therapy has become increasingly complex over time and is rapidly evolving. Radiation therapists play a key role within the interdisciplinary team and their education must prepare them to function effectively in the future in order to ensure a safe, high quality radiation therapy service.

The aim of this research was to evaluate the current status of radiation therapist education to establish the duration of education programs, the percentage of radiation therapy-specific content and the professional title on graduation.

A survey was developed, based on the questionnaire used for the ESTRO 3rd Revision of the Core Curriculum for Radiation Therapists. This was piloted by colleagues to verify the validity of the survey and also its use outside of the European context. The final survey was distributed purposively through Survey Monkey via a local gatekeeper to key radiation therapy personnel covering all of Europe and Australia, New Zealand, USA and South Korea in January 2021 who distributed it to educational institutes and clinical departments in their respective countries. 101 responses were received of which 58 were fully complete and available for analysis representing 30 countries, 26 European and 4 beyond Europe.

The duration and radiation therapy-specific content of education programs varied considerably with dedicated radiation therapy programs from the respondents offered only in Ireland, Australia, New Zealand, and the U.S.A. 17 countries in the survey offer 'combined' programs with the majority dedicating less than 20% of their content to radiation therapy. Of note is that several respondents were unable to state the percentage of content related to radiation therapy and there was a variation in content and duration of programs, even within a single country.

This survey has demonstrated that there remains a significant deficit in the educational programs of radiation therapists in many regions.

Introduction

Radiation therapy is indicated in the treatment of between 50 and 60% of all cancer patients and is responsible for 40% of cancer cures, on its own or in combination with other therapies [1]. Radiation therapy is prepared and delivered by an interdisciplinary team consisting primarily of radiation oncologists, medical physics experts, and radiation therapists [2]. However, the final responsibility for accurate treatment delivery remains with radiation therapists, encompassing the safe and accurate delivery of the radiation dose, the clinical care and support of the patient on a daily basis throughout all preparation and treatment phases. The radiation therapist is often the link person for the patient within the multidisciplinary team. Radiation therapists liaise also with other allied health professionals in ensuring high quality supportive care of the patient [3–5].

Radiation therapy has become increasingly complex over time and is

rapidly evolving. Radiation therapists now and in the future need to be able to link clinical and technical evaluation of their patients prior to treatment and on treatment plan selection. In this setting radiation therapists play a key role within the interdisciplinary team and their education must prepare them to function effectively in the future in order to ensure a safe, high quality radiation therapy service.

Education and training are central components in ensuring equity, quality, and safety of radiation therapy delivery and to achieve this, it is important that common education and training standards and associated curricula should be promoted internationally. The failure to implement standards of education for radiation therapists has resulted in a disparity of education and training across Europe [6] and beyond [7]. Furthermore, the provision of appropriate education for radiation therapists has previously been reported as varying widely and cannot be assumed to provide the knowledge, skills, and competences necessary for accurate and safe treatment delivery [5,8].

* Corresponding author.

E-mail address: leechm@tcd.ie (M. Leech).

<https://doi.org/10.1016/j.tipsro.2022.09.006>

Received 26 August 2022; Accepted 26 September 2022

Available online 30 September 2022

2405-6324/© 2022 The Authors. Published by Elsevier B.V. on behalf of European Society for Radiotherapy & Oncology. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

The aim of this research was to evaluate the current status of radiation therapist education to establish the duration of education programs, the percentage of radiation therapy-specific content and the professional title on graduation.

Method

This research was approved by the School of Medicine Research Ethics Committee, Trinity College Dublin, Ireland.

A survey was developed, based on the questionnaire used for the ESTRO 3rd Revision of the Core Curriculum for Radiation Therapists. This was piloted by colleagues to verify the validity of the survey and also its use outside of the European context. The final survey was distributed purposively through Survey Monkey™ via a local gatekeeper to key radiation therapy personnel covering all of Europe and Australia, New Zealand, USA and South Korea in January 2021 who distributed it to educational institutes and clinical departments in their respective countries. 101 responses were received of which 58 were fully complete and available for analysis representing 30 countries, 26 European and 4 beyond Europe. Descriptive statistics were performed using SPSS (IBM SPSS Statistics for Windows, Version 22.0. Armonk, NY: IBM Corp. IBM Corp.).

Results

Duration and focus of education programs

Outside of Europe three programs were dedicated specifically to radiation therapy (Australia, New Zealand and the U.S.A) with their duration ranging from 2 to 4 years. New Zealand also reported offering a combined program including diagnostic radiography and nuclear medicine as well as a radiation therapy-specific program.

In 17 European countries that responded, the most common approach to radiation therapist education and training was a combined program covering diagnostic imaging, nuclear medicine, and radiation therapy, with significant variation in content between countries and even between programs in the same country with no national standard in place (Table 1, Fig. 1). There was also a concerning lack of knowledge on the structure of the academic program by clinically based radiation therapists. In 4 European countries (Armenia, Belgium, Denmark, and Russian Federation) the qualification to work as a radiation therapist was nursing with no radiation therapy component and in 2 countries there was no professional qualification required. Ireland offers a 4-year honours degree in radiation therapy only, and Cyprus send their students to the UK for 3-year radiation therapy only degree programs.

In 17 countries that responded, the education programs were combined covering diagnostic radiography and nuclear medicine as well as radiation therapy. The duration varied between 3 and 4 years with one country, Switzerland, offering a five-year combined program. Three countries (Belgium, South Korea, The Netherlands) also offered a hospital-based certificate or diploma course with a significant in-service training component.

Table 1
Combined education programs (Diagnostic Imaging, Nuclear Medicine and Radiation Therapy).

Combined Program Duration		
2 years	3 years	4 years
Slovenia, Turkey and the USA	Albania, Austria, Belgium, Bosnia, Bulgaria, Croatia, Denmark, Estonia, France, Italy, Macedonia, The Netherlands, Poland, Serbia, Slovenia, South Korea and Switzerland	Albania, Greece, Hungary, Malta, The Netherlands

Radiation Therapy-specific content

The radiation therapy component of the combined programmes varied from 10 to 50% but where hours and European Credit Transfers (ECTs) were also cited, there was a clear contradiction, and the hours were not consistent with the number of ECTs provided. This demonstrates a lack of understanding of the application of ECTs to curricula, making program assessment and free movement of personnel limited. Some respondents did not give any detail on the radiation therapy component of the education programme. Where there was more than one programme in a country this is detailed individually in Table 2.

In addition to the radiation therapy specific content, issues related to clinical practice teaching and assessment and responsibility for teaching the radiation therapy components in the academic programme were identified. Again, a major difference in practice both within and across countries with very little standardization of approach was reported. The study found that radiation therapists were involved in the delivery of the education program in 14 of the 28 countries (Armenia, Australia, Belgium, Bosnia and Herzegovina, Bulgaria, Croatia, Denmark, Ireland, Malta, New Zealand, Slovenia, South Korea, Switzerland, The Netherlands). For combined courses the subjects taught varied considerably both within and across countries, in many instances the content taught was clinically related such as positioning and immobilisation, image guided radiation therapy (IGRT), simulation, treatment techniques and communication skills. In dedicated radiation therapy programs, most of the content is taught by radiation therapists and includes higher level topics such as risk management, research and evidence-based practice. In countries where radiation therapists are not involved in the academic component of the education programs radiation oncologists, medical physics experts and nurses were responsible for the delivery of the radiation therapy content. Two countries reported having radiation therapists involved in one of their national programs but not the other. Conversely 20% of countries stated that radiation therapists had no input into the clinical component.

With respect to the clinical component of the education programme, 11 countries stated that there were standards that a clinical department must meet with respect to equipment levels and standards of practice to educate students (Armenia, Australia, U.S.A, Bosnia and Herzegovina, Croatia, Cyprus, Denmark, Hungary, Ireland, Serbia, Turkey). There were conflicting responses from three countries Greece, Slovenia, and The Netherlands.

Assessment of the clinical component of the education programme was extremely varied with only 5 countries having formal clinical assessment (Australia, Ireland, New Zealand, U.S.A and Croatia). Three countries gave varying responses indicating the heterogeneity across a country (Denmark, Serbia, and The Netherlands) and in the remaining countries there was no formal clinical assessment in place.

Continuing Professional Development/Continuing Medical Education (CPD/CME)

CPD was stated as being compulsory in 9 countries and not compulsory in 9 countries with varied responses from Belgium and The Netherlands.

However, respondents from 18 countries did state that CPD was a requirement to maintain their qualification. Six respondents (Albania, Bosnia, Croatia, Ireland, The Netherlands, and Russia) did not know how much CPD was required, and a range of hours was given by the remaining respondents as follows: 6–10 h per year in Albania, Croatia, The Netherlands and Serbia, 11–15 h per year in Austria, Belgium, Denmark and New Zealand, and 16+ hours in Australia, The Netherlands, New Zealand, Serbia and the USA.

Fourteen countries stated that CPD/CME opportunities were available in their country with four stating that no such opportunities were available, and Belgium qualifying that it was available only for nurses working in radiation therapy.

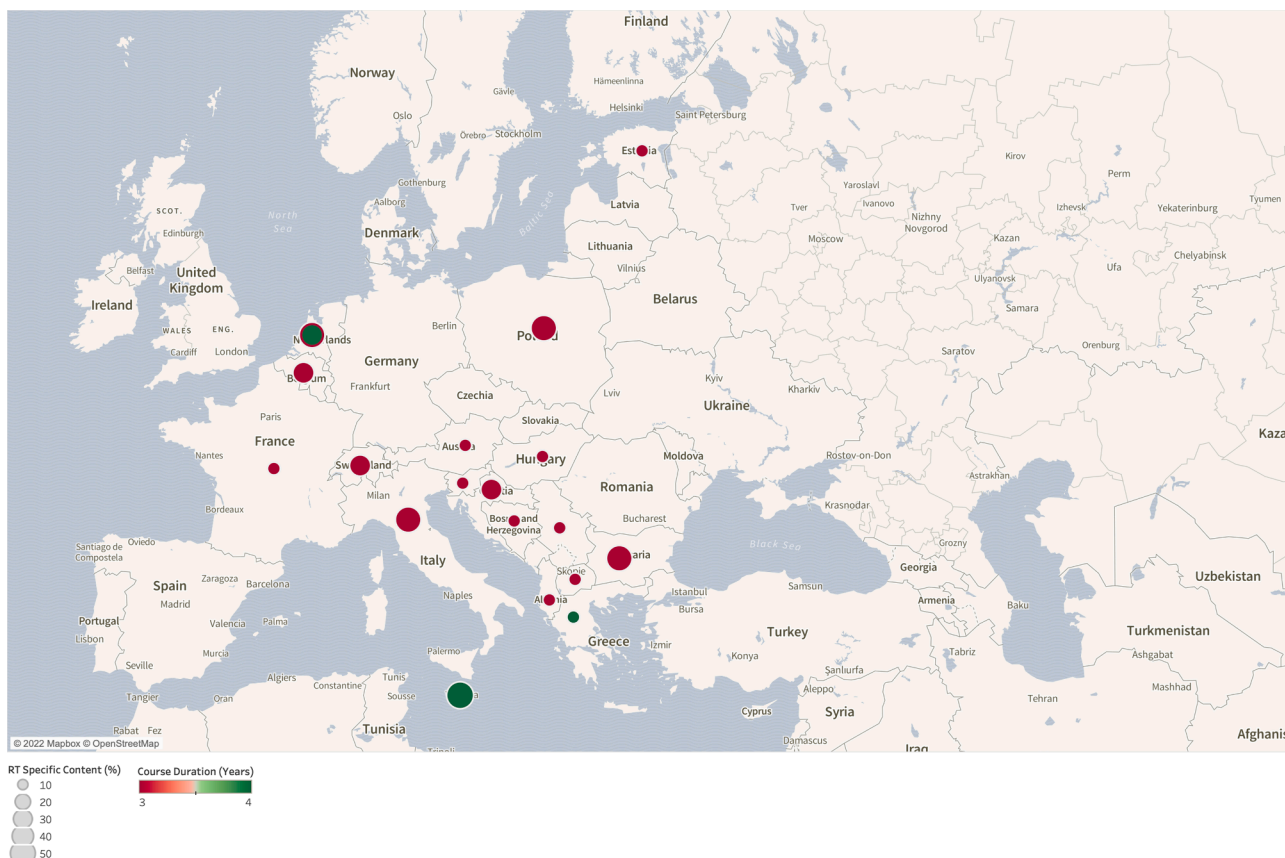


Fig. 1. The spread of 3 and 4 year combined programmes throughout the European respondents of the survey. It also indicates that percentage radiation therapy specific content in these programs. The larger the circle, the higher the RT-specific content.

Table 2
Radiation therapy specific content of education and training programmes for radiation therapists.

Course duration	% Radiation therapy specific content	Countries
3 years	40–50%	Bulgaria, Italy, Poland, The Netherlands
3 years	30%	Belgium, Croatia, Switzerland,
3 years	20%	Switzerland,
3 years	10–15%	Albania, Austria, Bosnia, Croatia, Estonia, France, Hungary, Macedonia, Serbia, Slovenia, South Korea,
4 years	50%	Malta
4 years	30%	The Netherlands
4 years	10–15%	Bosnia, Greece, Hungary

CPD was funded in 14 countries (Albania, Australia, Belgium, Croatia, Denmark, Hungary, Ireland, Italy, The Netherlands, New Zealand, Poland, Serbia, and the USA). The source of funding varied from professional chambers or national societies, the government in Malta and The Netherlands and by individual departments. One respondent from Australia stated that they were paid a CPD allowance as part of their salary. Departmental support was not guaranteed in most instances. A limited number of countries supported radiation therapists to attend international conferences with Denmark and The Netherlands indicating support for attendance at the European Society for Radiotherapy and Oncology (ESTRO) annual conference with departments either giving direct funding or support with time off to attend. Cyprus and Malta were supported to attend conferences by the International Atomic Energy Agency. Armenia, Bulgaria, Croatia, Hungary and Italy were not financially supported to attend international conferences. Their radiation therapy departments provided some support in terms of

time off and in Belgium this was contingent on presentation of a paper at the conference.

Nationally CPD was cited as being organised by the local department (Albania, Australia, Belgium, Bosnia, Denmark, Ireland, The Netherlands, Serbia, and Slovenia), by the National Society (Albania, Australia, Austria, Belgium, Bosnia, Croatia, Denmark, Ireland, New Zealand, Serbia, Slovenia) or by the University (Albania, Australia, Belgium, Bosnia, Ireland and Serbia).

Professional title

In this survey almost 70% of respondents stated that their title was RTT/radiation therapist/radiotherapy technologist. The other titles given were Medisch Beeldvormings-en Bestrahlings deskundige (MBBR), which is specific to The Netherlands, nurse, /engineer of medical radiology, radiographer, laborant, electroradiologist, radiologiefachperson and manipulator.

Discussion

Programme content and the European higher education area

One of the aspirations of the European Higher Education Area and the Bologna Process is to adopt reforms based on common values [4]. One such value is the free movement of students and staff, thereby making studies and courses more transparent through the adoption of the European Credit Transfer and Accumulation System (ECTs). However, our results illustrate limited or in some cases, no knowledge of the ECTs system and its application, indicating a lack of meaningful collaboration between the clinical departments and academic institutions and a failure to keep abreast of relevant developments. This

also makes the free transfer of radiation therapists across Europe difficult or impossible.

The duration and radiation therapy-specific content of the education programs cited in this survey varied considerably with dedicated radiation therapy programs offered only in Ireland, Australia, New Zealand, and the U.S.A, the latter being of shortest duration. 17 countries in the survey offer ‘combined’ programs with the majority dedicating less than 20% of their content to radiation therapy. Of note is that several respondents were unable to state the percentage of content related to radiation therapy and there was a variation in content and duration of programs, even within a single country. For example, in Belgium a 3-year combined program has been established but the regulatory requirement to practice remains a nursing qualification.

The formal recognition of a profession defines the roles and responsibilities of graduates which defines the educational content of an associated education program. There has been a significant increase in the use of the title Radiation Therapist (RTT) over the intervening period from the latest revision of the European Society of Radiotherapy and Oncology (ESTRO) core curriculum for Radiation Therapists [9] with a reduction in other titles indicating progress. The title ‘Radiation Therapist’ is now the officially recognized title for this profession by the European Commission, specifically the European Skills, Competences, Qualifications and Occupations (ESCO) [10] and is the recognized term for the profession by the IAEA [11].

Leadership of radiation therapy programmes

In most combined programs, the program leader was not a radiation therapist which potentially explains the lack of radiation therapy-specific content. This is in contradiction to the recommendations of the IAEA [11]. This may be influenced by the teaching staff, both academic and clinical, depending on the input and relationship between the three professions (radiography, nuclear medicine and radiation therapy). Dedicated radiation therapy programs in this survey were primarily headed by radiation therapists but with many of the combined courses, the radiation therapy component was headed by a radiation oncologist, medical physics expert or senior scientist. The failure to provide core radiation therapy content limits the potential for further education or research into the discipline, restricting the development of academic radiation therapy. The survey indicated that few radiation therapists are offered the opportunity to attend international conferences, and this further mitigates against development of the discipline and its professionals.

From the clinical perspective most programs have affiliated clinical departments for student practical experience with some countries using many different centres within their country. There were official teaching agreements between the academic and clinical centres in place in 14 countries but only 3 countries had set standards for the clinical departments where students were placed. Failure to set standards may result in perpetuating poor practice.

12 countries had practice tutors in place in the clinical environment with this role filled by radiation oncologists, medical physics experts, nurses, or senior radiation therapists in 8. Dedicated radiation therapy programs had formal clinical assessment in place but in most of the combined programs there was limited clinical assessment which was skill based or simply an oral discussion with the tutor, and not a measurable behaviour-based outcome assessment. In several countries there was some clinical teaching in the academic setting, this was generally related to basic skills. There was no indication of the actual content of the clinical component, however given the limited radiation therapy content overall in most programmes this was unlikely to be substantial. Despite the large number of clinical sites available within countries the deficit in clinical education and assessment is of concern.

Limitations

While there was good representation in this survey across Europe in particular, it is acknowledged that there were no respondents from Germany, Spain, Portugal and the United Kingdom.

Conclusion

This survey has demonstrated that there remains a significant deficit in the educational programs of radiation therapists in many regions. The majority of programs in the survey cited their radiation therapy-specific content as only 10–15%. One reason for this lack of content is likely related to the leadership of such combined programs, where academic faculty rarely includes a radiation therapist, contrary to international recommendations. This failure to implement acceptable standards of education jeopardizes the quality and safe preparation and delivery of radiation therapy and hinders the introduction of innovative techniques, as radiation therapists are not adequately prepared for the demands of modern radiation therapy. Given that between 50 and 60% of cancer patients will receive radiation therapy this is a significant societal issue. The current failure of education systems to recognize the importance of specialist radiation therapy content as reported in this study is an ongoing area of research and educational efforts by international bodies such as the IAEA and ESTRO. It now requires the concerted effort of governments, educational institutes, regulatory authorities, and clinical departments to insist that the education for radiation therapists treating cancer patients in their countries is fit for purpose.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: ‘Dr. Michelle Leech is Editor in Chief of tipsRO and Prof. Mary Coffey is an editorial board member. Given the purpose of this research article on radiation therapist education and training, we believe that this article fits the scope of tipsRO exactly. The open access nature of tipsRO also ensures that this important information is accessible to radiation therapists worldwide.’

References

- [1] Lievens Y, Borrás JM, Grau C. Provision and use of radiotherapy in Europe. *Mol Oncol* 2020;14(7):1461–9.
- [2] Lievens Y, Defourny N, Coffey M, Borrás JM, Dunscombe P, Slotman B, et al. Radiotherapy staffing in the European countries: final results from the ESTRO-HERO survey. *Radiother Oncol* 2014;112(2):178–86.
- [3] Coffey M, Leech M, Poortmans P. Benchmarking Radiation Therapist (RTT) education for safe practice: The time is now. (1879-0887 (Electronic)).
- [4] M, C.M.a.L. ESTRO European Higher Area Level 6. Benchmarking Document for Radiation Therapists. 2014 [cited 2021 May 2021]; Available from: https://www.estro.org/ESTRO/media/ESTRO/Education/ESTRO-RTT-Benchmarking-document_rebranded.pdf.
- [5] M, C., et al. Recommended ESTRO Core Curriculum for Radiation Therapists- 3rd Edition. 2014 [cited 2021 May 2021]; Available from: https://www.estro.org/ESTRO/media/ESTRO/Education/Revised_core_curriculum-RadiationTherapistT26_03_12.pdf.
- [6] Bibault J-E, Franco P, Borst GR, Van Elmpt W, Thorwhart D, Schmid MP, et al. Learning radiation oncology in Europe: Results of the ESTRO multidisciplinary survey. *Clin Transl Radiat Oncol* 2018;9:61–7.
- [7] Skubish S, Starrs C, McDonagh D. Exploring opportunities & pathways for advanced practice radiation therapy roles in the United States. (2405-6324 (Electronic)).
- [8] Coffey M, Rosenblatt E. Guest short communication: Is education of RTTs really unnecessary? *Tech Innov Patient Support Radiat Oncol* 2018;8:1–2.
- [9] Eriksen JG et al. The updated ESTRO core curricula 2011 for clinicians, medical physicists and RTTs in radiotherapy/radiation oncology. (1879-0887 (Electronic)).
- [10] Commission E. ESCO portal. 2022 [cited 2022 April 2022]; Available from: <https://esco.ec.europa.eu/en>.
- [11] Agency IAE. A Handbook for the Education of Radiation Therapists (RTTs). 2014, IAEA: Vienna, Austria.