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Original Research Article

Learning radiation oncology in Europe: Results of the ESTRO multidisciplinary survey

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ABSTRACT

Introduction: Radiotherapy education can be very different across Europe, despite the publication of the ESTRO core curricula in 2011. The purpose of the current study is to map the different RO European education systems, to report their perceived quality and to understand what could be improved to better teach RO.

Methods: An online survey consisting of 30 questions was sent to RO professionals under 40 years of age via email and social media. Clinicians, radiobiologists, physicists and radiation therapists (RTTs) were invited to answer questions regarding (1) demographics data, (2) duration, (3) organization, (4) content, (5) quality and potential improvements of national education programs.

Results: Four hundred and sixty three questionnaires were received from 34 European countries. All disciplines were represented: 45% clinicians (n = 210), 29% physicists (n = 135), 24% RTTs (n = 108) and 2% radiobiologists (n = 10). Male and female participants were well-balanced in each speciality, except for radiobiologists (80% males). Median age was 31.5 years old (range 21–40). A large range of the duration of the National RO education programs was observed: median = 9 years (range: 3–15). In half of the surveyed countries the European Credit Transfer System (ECTS), that facilitates mobility for trainees, has been implemented. Participants declared only a minority of countries have implemented the ESTRO Core Curriculum (n = 5). A quarter of participants indicated that their national education program is insufficient.

Conclusion: This is the first study to examine the different RO education systems in Europe. Large differences in organization and duration of national education programs have been found, along with perceived quality across Europe within each speciality. These results show the necessity of a discussion on how to move forward in this diversity of education programs and the potential contribution that the ESTRO may fulfil.

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Introduction

One of the missions of the European SocieTy for Radiotherapy and Oncology (ESTRO) is to promote dissemination of science

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through its educational courses (the ESTRO School), meetings and publications. In 1991, ESTRO published the first version of the European core curriculum on radiotherapy [1]. In 2004, an updated version was published [2], followed eight years later, by the last available version for clinicians, medical physicists and radiation therapists (RTTs) [3]. Due to different national regulations, this curriculum could only describe the knowledge and skills for the use of ionizing radiation. Currently, each national society defines the level and knowledge of skills necessary in their own country. This curriculum goal is to enable the harmonizing of the different education programs. However, there are no data to assess the countries differences. Moreover, national programs organization, duration and the resulting perceived quality may differ significantly across countries. Many studies have been published to assess quality of education in France [4–7], Germany [8], United Kingdom [9], Italy [10], Canada [11] and the United States [12,13]. However, no study has ever compared these results across several countries in Europe, for each speciality within radiation oncology (clinicians, physicists, radiobiologists and RTTs).

The aim of this survey was to describe the organization, duration and cost of European national RO education programs, their perceived quality, and how they can be improved. The relevance and the role of ESTRO in education was also assessed.

Methods

An anonymous survey was conducted online using the web-based Survey Monkey platform (www.surveymonkey.com). The survey was open from October 28th 2016 to February 21st 2017. Participants were invited via (1) email after identification of RO professionals under 40 years old in the ESTRO membership database, (2) social media (Facebook and Twitter) and (3) Young National Societies. Participants were able to answer the survey only once. Percentages were calculated using returned questionnaires.

Survey description

There is no consensus on the appropriate methodology to assess the quality of education programs [7]. Therefore, the ESTRO Young Committee designed a 30 item-based, non-validated, self-produced questionnaire (Appendix A). It was then validated by the ESTRO Education council. The questionnaire addressed the demographic data of the participants, national education (graduate and postgraduate) program organization, duration and cost, European mobility as RO professionals, ESTRO's School and meetings relevance for education, ways to improve education, use of online education tools, and experienced obstacles hampering adequate RO education. A 5-point Likert scale was used to categorize qualitative answers (1 = less important to 5 = most important) when required. No external testing of the questionnaire was performed.

Results

Participants' characteristics

The survey was sent to 1813 European RO professionals under 40 y.o. and 463 answered (response rate = 26%). The respondents were clinicians (n = 210, 45%), followed by physicists (n = 135, 29%) and RTTs (n = 108, 24%). Ten radiobiologists answered the survey (2%). Two hundred and forty six were females (53%) and 217 were male (47%). Median age was 31.5 years (range: 21–40). Participants came from 34 different European countries: France (n = 95, 21%), Spain (n = 80, 17%), The Netherlands (n = 79, 17%), Germany (n = 45, 10%), and Italy (n = 39, 8%) were the most represented countries. Two hundred and sixty-nine of them were still trainees (57%), 108 participants were working in the public healthcare system (23%). Six participants had an academic position (1%). Two participants were working in the pharmaceutical industry (0.4%). Of note, 8 respondents declared they were unemployed (1.7%). Participants' characteristics are detailed in Table 1. A gratifying (n = 225, 49%) and challenging career (n = 212, 46%) with a stimulating working environment (n = 197, 42%) were the main motivations for choosing a career in RO. Having met a good mentor was also an important motivator (n = 108, 17%). Seventy-seven percent (n = 359) of participants would be interested in working in a country different from where they were trained. The main career priority for participants is the RO clinical practice (87%, n = 403), followed by RO research (41%, n = 191) and teaching (23%, n = 106). In their weekly professional time allocation, clinical practice was the most frequent activity (60% to 100% for 61% of respondents), followed by studying (15% to 45% for 46% of participants). Research took up to 15% of the time for 57% of the participants. Thirty-five percent were rather satisfied with their professional weekly time allocation (n = 165), 28% were rather dissatisfied (n = 130). Five percent (n = 23) were very satisfied and 8% (n = 37) were very dissatisfied.

Radiation oncology educational programs across Europe and disciplines

National education program organization, duration and cost

National RO education programs (including pre and postgraduate) median duration is 11 years (range: 3–15). The median student cost of education was 3000€/year for clinicians, 2000€/y for physicists, 2000€/y for biologists and 1300€/y for RTTs (Table 2). National programs were reported to match the ESTRO Core Curriculum (ECC) in France, The Netherlands, Italy and Portugal for clinicians, in The Netherlands and Greece for Physicists and in Italy and Portugal for RTTs. The majority of participants did not know if their national program matched the ECC. The European Credits Transfer Scale (ECTS) system was implemented in 50% of the national programs. Data from the top-ten countries of respondents are presented for each speciality and country in Table 3. Eighty-four percent of participants (n = 384) declared that their degree allowed them to work in another European country. Continuous education is mandatory for 65% of participants (n = 301).

Effective education processes, barriers and potential improvements for RO education in Europe

The most important item for RO education was practical education (77% – most important item). Textbooks, online resources, journals, congresses and workshop were also considered as important (between 38% and 47% – important item). Detailed results are shown in Fig. 1. Participants declared that the most frequent barrier they encountered during their education was a lack of time (38%), followed by a lack of team spirit (22%) and financial issues (22%). National education programs were seen as inadequate by 26% of the respondents. Discrimination is the least important obstacle according to the participants (50%). Results are summarized in Fig. 2. Potential improvements to RO education were given by the participants and are shown in Fig. 3. Participants declared they mostly needed more time for training courses and more motivation from their mentor. A longer duration of education was not reported as an important item.

Online resources

Participants used search engines pertaining to practice, such as Medline (n = 367, 79%), scientific societies websites (n = 315, 68%), newsletters (n = 148, 32%) and mobile applications (n = 140, 30%). They also used social networks for education (n = 95, 20%). Twelve participants (3%) declared they did not use online tools for their

Table 1
Participants' characteristics.

	Clinicians n (%)	Physicists n (%)	Radiobiologists n (%)	Radiation Therapists n (%)	Total n (%)
Total	210 (45)	135 (29)	10 (2)	108 (24)	463
Sex					
Male	103 (49)	65 (48)	8 (80)	41 (38)	217 (47)
Female	107 (51)	70 (52)	2 (20)	67 (62)	246 (53)
Age					
Median	33	30	39	30	31.5
Range	24–40	23–40	31–40	21–40	21–40
Country					
France	30 (14)	23 (17)	2 (20)	40 (37)	95 (21)
Spain	21 (10)	44 (33)	2 (20)	13 (12)	80 (17)
The Netherlands	27 (13)	10 (7)	1 (10)	11 (10)	79 (17)
Germany	26 (12)	10 (7)	3 (30)	6 (6)	45 (10)
Italy	24 (11)	7 (5)	–	8 (7)	39 (8)
Portugal	8 (4)	2 (2)	–	10 (9)	20 (4)
Greece	7 (3)	10 (8)	1 (10)	2 (2)	20 (4)
Belgium	11 (5)	–	–	5 (5)	16 (3)
United Kingdom	3 (2)	4 (2)	1 (10)	–	8 (2)
Slovakia	1 (<1)	9 (7)	–	–	8 (2)
Switzerland	6 (3)	1 (1)	–	–	7 (2)
Norway	5 (2)	1 (1)	–	–	6 (1)
Sweden	–	6 (4)	–	–	6 (1)
Others	41 (20)	8 (6)	–	13 (12)	62 (13)

Table 2
National education programs cost and duration.

	Clinicians n (%)	Physicists n (%)	Radiobiologists n (%)	Radiation therapists n (%)	Total n (%)
Charge	128 (61)	91 (68)	6 (60)	82 (76)	307 (66)
Median (Euro) – year	3000	2000	2000	1300	2500
Range (Euro) – year	80–70,000	100–13,000	500–7000	250–8000	80–70,000
Education duration					
Median (Years)	11	7	10	10	11
Range (Years)	8–15	4–12	4–11	3–11	3–15

education. Forty-seven percent of participants (n = 218) were not aware of the ESTRO online education platform DOVE (Dynamic Oncology Virtual ESTRO), while 31% of them knew it, but never used it (n = 144). Seventeen percent were satisfied with the platform (n = 81), but 5% declared they were not satisfied (n = 21). Among the respondents using social networks for education, most used ResearchGate (n = 130, 28%), Google Scholar (n = 125, 27%), LinkedIn (n = 89, 19%), SlideShare (n = 62, 13%) or Facebook (n = 57, 12%).

National societies and ESTRO's relevance in education

Fifty-two percent of the participants were ESTRO members (n = 241) and 48% were also members of their national society (n = 223, Table 4). Thirteen percent were members of their Young National Society (n = 97). Forty-six percent had attended an ESTRO course (n = 215), and 10% did not know about ESTRO courses, (n = 50) unequally distributed over the different disciplines; a majority of clinicians and radiobiologists had already attended an ESTRO course (57% and 60% respectively), while 40% of the physicists and 30% of the RTTs already had. Seventy-one percent of participants found the ESTRO school program relevant (n = 334). Seventeen percent of participants attended the ESTRO congress regularly (n = 78), while 51% attended their national society annual meeting every year.

Discussion

This study is the first to attempt to comprehensively assess the national education program organizations, their durations, costs and their perceived quality. More than 460 young RO professionals answered the survey from more than 30 European countries. We explored experienced barriers and potential ways to improve education, the use of online education tools and the role of ESTRO's School and meetings. A potential bias of this study relies in its declarative nature: answers reflect the knowledge of participants, but not always the truth about their education programs, notably for ECTS and ECC implementation, as we'll discuss later. We argue that if RO professionals have no precise knowledge of these themes, this is in itself an issue. However, we showed that consistent differences in education systems within each speciality across Europeans countries exist, despite efforts of several governments and scientific societies' effort of harmonizing them. Another bias is the number of participants: while we have been able to assess the number of emails sent via ESTRO (n = 739) and the number of people that saw the survey on Facebook (n = 1074), we cannot account for the number of young RO professionals who received the email through national societies and from each other. The response rate could be overestimated.

One of the examples for harmonization is the ECTS, a credit system designed to make it easier for students to move between European countries [14]. ECTS is based on the education achievements and workload of a course. Student can transfer their ECTS credits from one university to another. It is a central tool in the Bologna Process, which aims to make national systems more compatible [15]. Sixty credits are the equivalent of a full year of study or work. A typical "first cycle" (or Bachelor's) Degree, would consist of 180 or 240 credits, and a "second cycle" (or Master's) Degree, would consist of 90 or 120 credits. The use of ECTS at the "third cycle" (or Ph.D. level) varies. ECTS has been adopted by most of the

Table 3
National RO education programs in the top ten responding countries. –: participants did not know the answer or there were not enough respondents to make a conclusion.

	Clinicians	Physicists	Radiobiologists	Radiation Therapists
Program matches ESTRO Core curriculum				
France	Yes	–	/	–
Spain	–	–	/	–
The Netherlands	Yes	Yes	/	–
Germany	–	–	/	–
Italy	Yes	–	/	Yes
Portugal	Yes	–	/	Yes
Greece	–	Yes	/	No
Belgium	–	–	/	–
United Kingdom	–	–	/	–
Switzerland	–	–	/	–
Program includes a final exam				
France	No	Yes	–	Yes
Spain	No	No	No	–
The Netherlands	No	Yes	No	Yes
Germany	Yes	Yes	No	Yes
Italy	Yes	Yes	–	Yes
Portugal	Yes	Yes	–	Yes
Greece	Yes	Yes	–	Yes
Belgium	Yes	Yes	–	Yes
United Kingdom	Yes	Yes	–	–
Switzerland	Yes	Yes	–	Yes
Program is organized with ECTS				
France	No	Yes	–	No
Spain	No	Yes	Yes	–
The Netherlands	Yes	Yes	Yes	No
Germany	No	Yes	Yes	No
Italy	Yes	No	–	Yes
Portugal	Yes	Yes	–	Yes
Greece	Yes	Yes	–	No
Belgium	Yes	Yes	–	Yes
United Kingdom	No	No	–	–
Switzerland	No	Yes	–	Yes

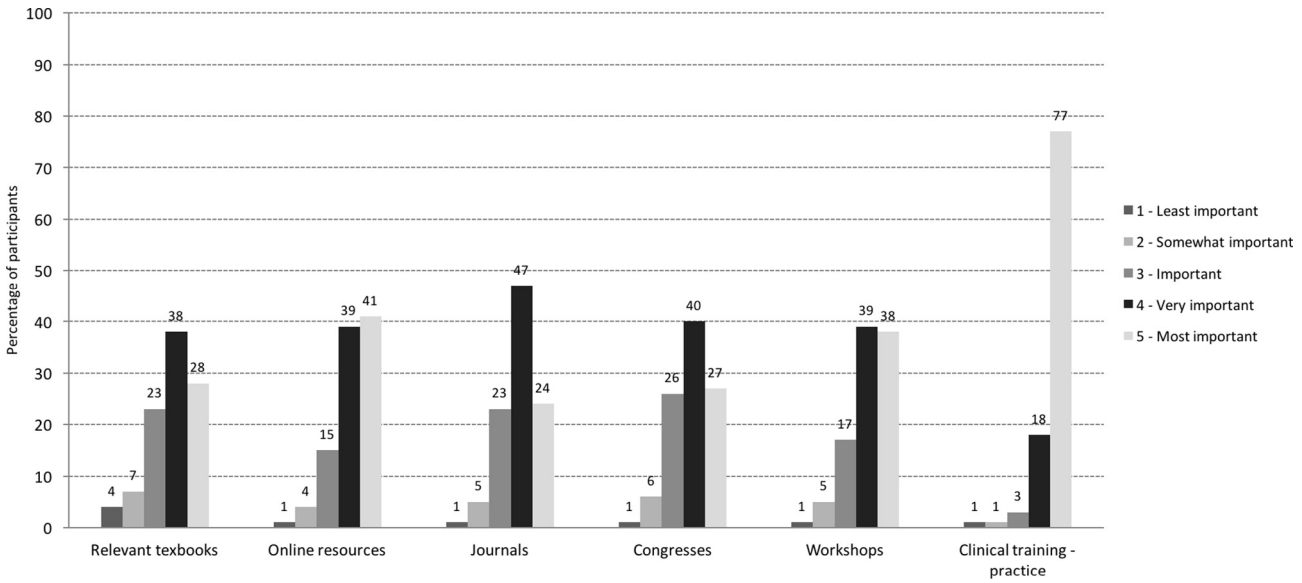

Fig. 1. Usefulness and effectiveness in current education. A 5-point scale was used to categorize qualitative answers (1 = less important to 5 = most important).

countries in the European Higher Education Area (EHEA). The benefits of ECTS include studying a Bachelor in an EU-country and a Master in another EU-country and finding work in any EU country. However, in medical programs and more generally in healthcare, the ECTS has not yet been largely implemented. In our study, ECTS are only available in half of the programs, which could be a significant barrier for professional mobility within EU countries. Considering that 77% of participants (n = 359) would be interested in working in a country different from where they graduated, this is a major issue.

ESTRO could take a leading role in lobbying stakeholders, Universities and schools, in order to push them to adopt the ECTS in all clinicians, physicists, radiobiologists and RTTs programs.

Eighty-four percent of participants (n = 384) declared their degree allowed them to work in another European country according to the EU laws. This conflicts with the low proportion of

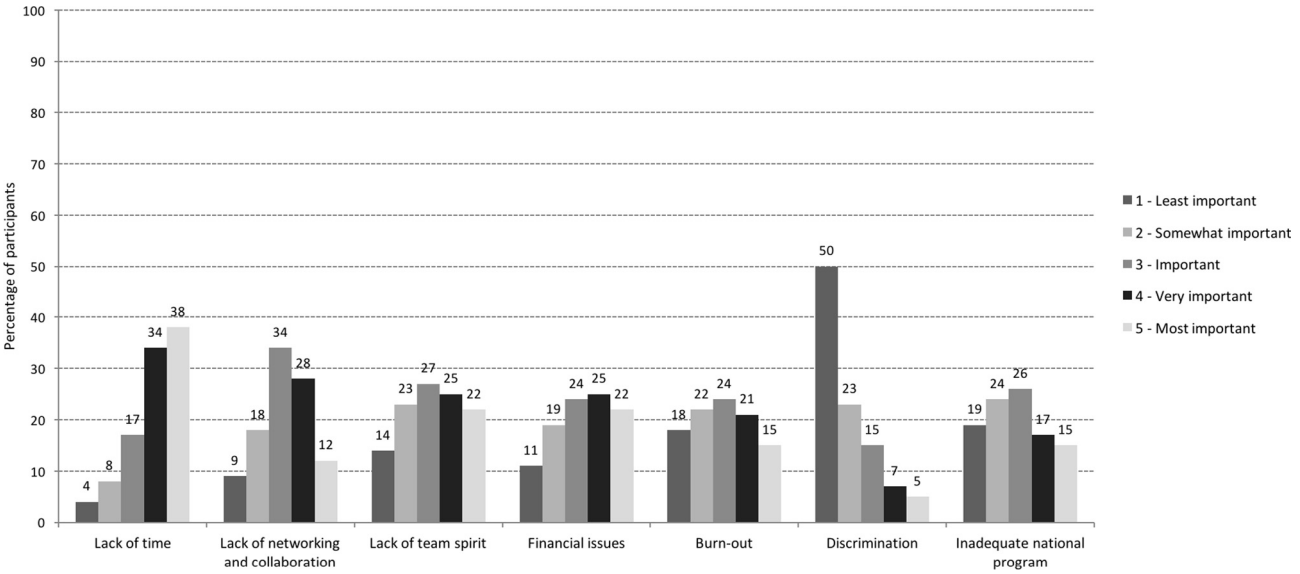

Fig. 2. Obstacles to learning RO in Europe. A 5-point scale was used to categorize qualitative answers (1 = less important to 5 = most important).

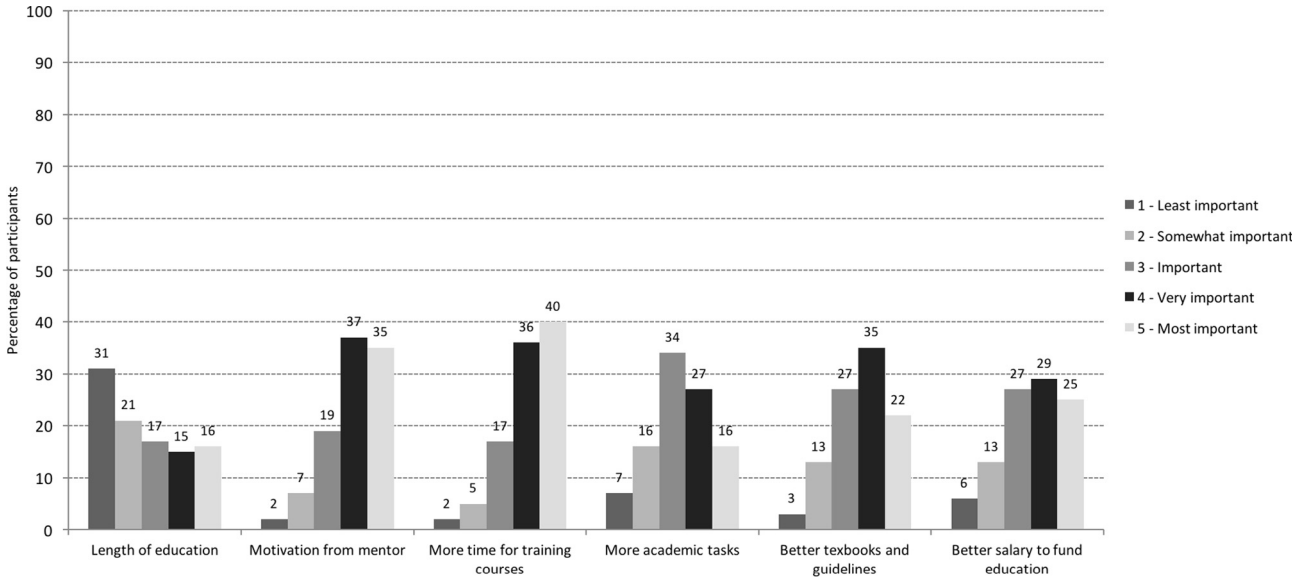

Fig. 3. Potential ways to improve education. A 5-point scale was used to categorize qualitative answers (1 = less important to 5 = most important).

Table 4
Society membership and ESTRO course attendance across disciplines.

Society membership	Clinicians n (%)	Physicists n (%)	Radiobiologists n (%)	Radiation therapists n (%)	Total n (%)
National Societies	110 (52)	76 (56)	5 (50)	32 (30)	223 (48)
ESTRO	140 (67)	53 (39)	6 (60)	42 (39)	241 (52)
EORTC	13 (6)	2 (1)	1 (10)	4 (4)	20 (4)
ESMO	23 (11)	3 (2)	2 (20)	6 (6)	34 (7)
ESO	11 (7)	–	–	2 (2)	13 (3)
ASTRO	14 (7)	–	1 (10)	–	15 (3)
ASCO	16 (8)	2 (1)	–	2 (2)	20 (4)
EACR	5 (2)	5 (3)	2 (20)	–	12 (3)
ESTRO course attendance					
Yes	120 (57)	54 (40)	6 (60)	32 (30)	212 (46)
No	81 (38)	65 (48)	3 (30)	56 (52)	205 (44)
Don't know about ESTRO Course	10 (5)	16 (12)	1 (10)	20 (18)	47 (10)

countries using ECTS, according to participants. However, the EU Directive on the free movement of professionals, states that which doctors, physicists and RTTs are free to work in other EU countries even if they did not graduate there [16].

The ESTRO Core Curriculum (ECC), created 26 years ago in 1991 and last updated in 2011 [1–3] describes the knowledge and skills for the use of ionising irradiation. The ideal formation encompasses the capacity to constructively gather knowledge, skills and attitude. This is related to the canMEDS framework created by the Royal College of Physicians and Surgeons of Canada to determine the characteristics of a physician in terms of competencies: medical expertise, communication, collaboration, knowledge science, health advocacy/social actions, management/organization and professionalism [17]. The education program reflected by the latest ESTRO core curriculum is shifting towards a competence based approach, replacing knowledge based educations with competencies. This major shift in paradigm towards competencies is however not implemented (yet) in all European countries in the field of RO. Most participants did not know if the ECC was implemented within their country for physicians, physicists and RTTs. France, The Netherlands, Italy and Portugal implemented the ESTRO Core Curriculum (ECC) for clinicians, The Netherlands and Greece for Physicists, and Italy and Portugal for RTTs. The participants' answers regarding ECC implementation might be unreliable, since recent data from the UEMS indicated that the ECC was well implemented [18]. However, we believe that the ESTRO should continue promoting the ECC to the National Societies and educational authorities in order to implement it effectively. It should also be promoted among trainees so that they can ask their program directors to use it.

Participants declared that the most important aspect of their education was practical skills, knowledge and competences. They prefer practical education in order to learn their profession rather than theory knowledge. This underlines and supports the competencies-based approach ESTRO took with the ECC.

More than a quarter of participants thought the national education programs were inadequate. There is major concern regarding this issue. Again, using the ECC could help improve these programs. ESTRO's role should be to promote adequate education programs across Europe in every field (clinicians, physicists, radiobiologists, RTTs) and also to continue providing high-quality education through the ESTRO School, and annual meetings. While the ESTRO School is seen as relevant by a majority of participants (71%), only 30 (RTTs) to 60% (radiobiologists) of them attended a course, which is still better than the 17% of participants that attended the ESTRO congress regularly. Progress could be made in that area.

One of the most important obstacle was the lack of time. Students have difficulties combining theoretical education with practice, research, administrative tasks and teaching less experienced colleagues/students. This is also shown by the low proportion of participants that declared that they were rather satisfied with their time allocation (35%).

More surprising was the lack of team spirit (22%) that was reported as another barrier to effective education. We believe that department heads and university chairs should take this into account when reviewing their programs.

The increasing use of online tools (websites, newsletter, applications), as reported in our study, can work against or in favour of a good education program. To guide and to stimulate an optimal use of online tools requires clear and easy to use tools from a validated high quality. ESTRO has also invested within this area with FALCON [19] and DOVE [20]. FALCON, a contouring workshop platform, was introduced in 2010 and is used in both live events and online (since October 2012). One hundred experts and 7000 participants have used it. The results for DOVE, a virtual environment with articles from the Green Journal, abstracts from the ESTRO meetings, webcasts and guidelines are more contrasted: a majority of participants did not know the platform (47%) and 31% of them knew it, but never used it. Only 17% percent were satisfied with the platform. Efforts to develop, promote and enhance this platform should be a priority. ESTRO has acknowledged this and is now moving to online and blended learning to meet the new needs of RO professionals [21].

Conclusion

Radiation oncology educational systems' organization, program and cost are different within Europe. The ESTRO School's role is prevalent in bringing quality education and bridging the gaps between European countries, especially since there is a large desire from young RO professionals to be mobile within Europe. The rise of online education is also a strong incentive to continue working on and enhancing appropriate platforms.

Competing interest statement

The authors declare no competing interests.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at https://doi.org/10.1016/j.ctro.2018.02.001.

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