Original Research Article

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

Jean-Emmanuel Bibault a,b,c,* Pierfrancesco Franco a,d, Gerben R. Borst a,e, Wouter Van Elmpt a,f, Daniela Thorwhart a,g, Maximilian P. Schmid a,h, Kasper M.A. Rouschop a,i, Laura Mullaney a,j, Kathrine Røe Redalen a,k, Ludwig Dubois a,f, Christine Verfaillie b, Jesper Grau Eriksen b,l

a European Society for Radiotherapy & Oncology (ESTRO) Young Committee, Brussels, Belgium
b European Society for Radiotherapy & Oncology (ESTRO) Education Council Brussels, Belgium
c Radiation Oncology Department, Hôpital Européen Georges Pompidou, Assistance Publique – Hôpitaux de Paris, Université Paris Descartes, Paris Sorbonne Cité, Paris, France
d University of Turin School of Medicine, Turin, Italy
e Department of Oncology, Radiation Oncology Department, The Netherlands Cancer Institute – Antoni van Leeuwenhoek Hospital, Amsterdam, The Netherlands
f Department of Radiation Oncology, CRON – School for Oncology and Developmental Biology, Maastricht University Medical Center, The Netherlands
g Section for Biomedical Physics, University Hospital for Radiation Oncology Tübingen, Tübingen, Germany
h Medical University of Vienna, Vienna, Austria
i Department of Radiotherapy I, Maria-Skłodowska Curie Institute – for Radiation Oncology Centre, Warsaw, Poland
j Applied Radiation Therapy Trinity Research Group, Discipline of Radiation Therapy, School of Medicine, Trinity College Dublin, Dublin, Ireland
k Institute of Clinical Medicine, University of Oslo, Oslo, Norway
l Department of Experimental Clinical Oncology, Aarhus University Hospital, Denmark

ARTICLE INFO

Article history:
Received 24 January 2018
Revised 5 February 2018
Accepted 6 February 2018
Available online 8 February 2018

Keywords:
Radiation oncology
Education
ESTRO

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.
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 SurveyMonkey 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 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 (49%) 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 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
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 European 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 1 | Participants’ characteristics. |
|---------|-----------------------------|
| Clinicians n (%) | Physicians 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 | 24–40 | 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. |
|---------|-----------------------------------------------|
| Charge | Clinicians n (%) | Physicians n (%) | Radiobiologists n (%) | Radiation therapists n (%) | Total n (%) |
| Median (Euro) – year | 3000 | 2000 | 2000 | 1300 | 3500 |
| Range (Euro) – year | 80–70,000 | 100–13,000 | 500–7000 | 250–8000 | 80–70,000 |
| Education duration | Clinicians n (%) | Physicians n (%) | Radiobiologists n (%) | Radiation therapists n (%) | Total n (%) |
| Median (Years) | 11 | 7 | 10 | 10 | 11 |
| Range (Years) | 8–15 | 4–12 | 4–11 | 3–11 | 8–15 |
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

### 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.

| Program matches ESTRO Core curriculum | Physicians | Radiobiologists | Radiation Therapists |
|---------------------------------------|------------|-----------------|---------------------|
| France                                | Yes        | –               | –                   |
| Spain                                 | –          | –               | –                   |
| The Netherlands                       | Yes        | Yes             | –                   |
| Germany                               | –          | –               | –                   |
| Italy                                 | Yes        | –               | Yes                 |
| Portugal                              | Yes        | Yes             | –                   |
| Greece                                | –          | Yes             | Yes                 |
| United Kingdom                        | –          | –               | –                   |
| Switzerland                           | –          | –               | –                   |

| Program includes a final exam          | Physicians | Radiobiologists | Radiation Therapists |
|---------------------------------------|------------|-----------------|---------------------|
| France                                | No         | Yes             | –                   |
| Spain                                 | No         | No              | No                  |
| The Netherlands                       | No         | Yes             | No                  |
| Germany                               | Yes        | Yes             | No                  |
| Italy                                 | Yes        | –               | Yes                 |
| Portugal                              | Yes        | Yes             | –                   |
| Greece                                | Yes        | Yes             | –                   |
| Belgium                               | Yes        | Yes             | –                   |
| United Kingdom                        | Yes        | Yes             | –                   |
| Switzerland                           | Yes        | Yes             | Yes                 |

| Program is organized with ECTS        | Physicians | Radiobiologists | Radiation Therapists |
|---------------------------------------|------------|-----------------|---------------------|
| France                                | No         | Yes             | –                   |
| Spain                                 | No         | Yes             | Yes                 |
| The Netherlands                       | Yes        | No              | No                  |
| Germany                               | Yes        | Yes             | No                  |
| Italy                                 | Yes        | No              | Yes                 |
| Portugal                              | Yes        | Yes             | –                   |
| Greece                                | Yes        | Yes             | –                   |
| Belgium                               | Yes        | Yes             | –                   |
| United Kingdom                        | No         | No              | –                   |
| Switzerland                           | No         | 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).
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 (%) | Physicians 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 competencies. 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.

Acknowledgement

The ESTRO Young Committee thanks the Young National Societies from France, Spain, Portugal, Italy, Germany, United Kingdom, Greece and the Young Radiation Oncology Group from EORTC for their help in distributing this survey.

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.

References

[1] Leer JW, Overgaard J, Heeren G. The European core curriculum on radiotherapy. Radiother Oncol J Eur Soc Ther Radiol Oncol 1991;22(3):153–5.
[2] Baumann M, Leer JWH, Dahl O, De Neve W, Hunter R, Ramping R, et al. Updated European core curriculum for radiotherapists (radiation oncologists). Recommended curriculum for the specialist training of medical practitioners in radiotherapy (radiation oncology) within Europe. Radiother Oncol J Eur Soc Ther Radiol Oncol 2004;70(2):107–13.
[3] Eriksen JG, Beavis AW, Coffey MA, Leer JWH, Magrini SM, Benstead K, et al. The updated ESTRO core curricula 2011 for clinicians, medical physicists and RTTs in radiotherapy/radiation oncology. Radiother Oncol J Eur Soc Ther Radiol Oncol 2012;103(1):103–8.
[4] Kantor C, Huguet F, Toledano A, Lafond C, Quero L, Servaggi S, et al. Radiation oncology training in France: demography, analysis of motivations of the young specialists, evaluation of the training. Cancer Radiother J Soc Francaise Radiother Oncol 2005;9(6–7):435–43.
[5] Bibault J-E, Leroy T, Blanchard P, Biau J, Cervellera M, Diaz O, et al. Mobile technology and social media in the clinical practice of young radiation oncologists: results of a comprehensive nationwide cross-sectional study. Int J Radiat Oncol Biol Phys 2014;90(1):231–7.
[6] Fumagalli L, Favier J-C, Thureau S, Bibault J-E, Diaz O, Leroy T, et al. Brachytherapy training: a survey of French radiation oncology residents. Cancer Radiother J Soc Francaise Radiother Oncol 2014;18(1):28–34.
[7] Favier J-C, Bibault J-E, Leroy T, Agopiantz M, Salleon J, Wack M, et al. Evaluation of the theoretical teaching of postgraduate radiation oncology medical residents in France: a cross-sectional study. J Cancer Educ Off J Am Assoc Cancer Educ 2017.
[8] Semrau R, Hansmann K, Adam M, Andratschke N, Brunner T, Heinzelmann F, et al. Quality of training in radiation oncology in Germany. Results of a 2006 survey. Strahlenther Onkol Organ Dtsch Rontgengesellschaft Al. 2008;184(5):239–44.
[9] Benstead K, Gilson D, Hanna L, Radhakrishna G, McAleeer J, Bloomfield D, et al. Training in clinical oncology: results of the royal college of radiologists’ survey of new consultants. Clin Oncol 2012;24(10):e143–8.
[10] Franco P, Ciammella P, Peruzzo Corretto A, De Bari B, Buglione M, Livi L, et al. The STYRO 2011 project: a survey on perceived quality of training among young Italian radiation oncologists. Med Oncol Northwood Lond Engl 2013;30(4):729.
[11] Debenham B, Banerjee R, Fairchild A, Dundas G, Trotter T, Yee D. 2009 Canadian radiation oncology resident survey. Int J Radiat Oncol Biol Phys 2012;82(4):1326–31.

[12] Gondi V, Bernard JR, Jabbari S, Keam J, de Amorim Bernstein KL, Dad LK, et al. Results of the 2005–2008 Association of Residents in Radiation Oncology survey of chief residents in the United States: clinical training and resident working conditions. Int J Radiat Oncol Biol Phys 2011;81(4):1120–7.

[13] Nabavizadeh N, Burt LM, Mancini BR, Morris ZS, Walker AJ, Miller SM, et al. Results of the 2013–2015 association of residents in radiation oncology survey of chief residents in the United States. Int J Radiat Oncol Biol Phys 2016;94(2):228–34.

[14] European Credit Transfer and Accumulation System (ECTS) – Education and training – European Commission [Internet]. Education and training. [cited 2017 Aug 12]. Available from: https://ec.europa.eu/education/resources/european-credit-transfer-accumulation-system_en.

[15] The Bologna Process and the European Higher Education Area – Education and training – European Commission [Internet]. Education and training. [cited 2017 Aug 12]. Available from: http://ec.europa.eu/education/policy/higher-education/bologna-process_en.

[16] Union PO of the E. Directive 2013/55/EU of the European Parliament and of the Council of 20 November 2013 amending Directive 2005/36/EC on the recognition of professional qualifications and Regulation (EU) No 1024/2012 on administrative cooperation through the Internal Market Information System (‘the IMI Regulation’) Text with EEA relevance, CELEX1 [Internet]. 2013. Available from: https://publications.europa.eu/en/publication-detail/-/publication/75080866-76dc-11e3-b889-01aa75ed71a1/language-en.

[17] CanMEDS 2000: Extract from the CanMEDS 2000 Project Societal Needs Working Group Report. Med Teach. 2000;22(6):549–54.

[18] Benstead K, Turhal NS, O’Higgins N, Wyld I, Czarnecka-Operacz M, Gollnick H, et al. Multidisciplinary training of cancer specialists in Europe. Eur J Cancer Oxf Engl 2017;1990(83):1–8.

[19] Eriksen JG, Salembier C, Rivera S, De Bari B, Berger D, Mantello G, et al. Four years with FALCON – an ESTRO educational project: achievements and perspectives. Radiother Oncol J Eur Soc Ther Radiol Oncol 2014;112(1):145–9.

[20] DOVE [Internet]. [cited 2017 Aug 12]. Available from: http://www.estro.org/school/articles/e-learning/dove.

[21] Eriksen JG, Leech M, Benstead K, Verfaillie C. Perspectives on medical education in radiation oncology and the role of the ESTRO School. Clin Transl Radiat Oncolol 2016;1(1):15–8.