

Investigation of the Contribution of Radiotherapy Therapist Education to Working Life: A National Survey Study

Evren Ozan Göksel¹, 

¹Acıbadem Mehmet Ali Aydınlar University
Vocational Service Of Health School
Radiotherapy Program, Istanbul-Turkey

Evren Ozan Göksel
0000-0002-0674-1016

Abstract

Background/Purpose: To investigate the perception of working radiation therapists (RTTs) regarding the contribution of RTTs training provided in Turkey to their working lives.

Methods: The study employed a questionnaire consisting of 22 questions. The questionnaire was distributed via email to RTTs working in Turkey. The questionnaire explored various aspects of the participants' education, including their internship opportunities, the duration of their internships, the treatment devices they worked with, and the adequacy of their experiences.

Results: One hundred and eighty-one RTTs participated in the survey. The majority of participants (57.3%) completed their education at foundation universities, while 42.7% attended state universities. During their education, 80.5% of participants found the internship opportunities offered by their schools to be adequate. 92.6% of the participants reported that the experience they gained during their internship had a positive impact on their working life. A statistically significant relationship was observed between the adequacy of the treatment device variety used during the internship and the contribution of the internship to their working life ($p < 0.05$).

Conclusion: The majority of RTTs who participated in the survey found that the education they completed were largely sufficient in terms of contributing to their working lives.

Keywords: Radiation Therapist, Education, Training

Özet

Amaç: Bu çalışmada ülkemizde verilen radyoterapi teknikerliği (RTT) eğitiminin çalışma hayatına olan katkısının çalışan

RTT'ler tarafından nasıl algılandığı araştırılmıştır.

Yöntem ve Gereç: Ülkemizde çalışan RTT'lere 22 sorudan oluşan bir anket e-posta aracılığıyla gönderilmiştir. Katılımcılara eğitimleri sırasında okullarının sunduğu staj imkanları, staj yaptıkları süreler, staj yaptıkları klinikteki cihaz çeşitliliği ve kazandıkları tecrübenin yeterliliği yanı sıra aldıkları teorik derslerin klinik pratiğe olan katkılarıyla ilgili sorular yöneltilmiştir.

Bulgular: Ankete yüzseksenbir RTT katılmıştır. Katılımcıların %57,3'ü vakıf üniversitelerinde, %42,7'si devlet üniversitelerinde eğitimlerini tamamlamışlar ve eğitimleri sırasında okullarının sunduğu staj imkanlarını %80,5 oranında yeterli bulmuşlardır. Yüzde 92,6 gibi büyük bir çoğunluk stajları sırasında edindikleri tecrübenin çalışma hayatlarına katkısı olduğunu belirtmişlerdir. Staj yapılan klinikteki cihaz çeşitliliğinin yeterliliği ile stajın çalışma hayatına katkısı arasında istatistiksel olarak anlamlı bir ilişki bulunmuştur ($p < 0,05$).

Sonuç: Sonuç olarak, ankete katılan RTT'ler eğitimleri sırasında aldıkları teorik dersleri ve yaptıkları stajları çalışma hayatlarına olan katkıları açısından değerlendirdiklerinde çoğunlukla yeterli bulmuşlardır.

Anahtar kelimeler: Radyoterapi Teknikerliği, Eğitim, Öğretim

Correspondence:

Assistant Prof. Evren Ozan Göksel Acıbadem
Altunizade Hastanesi, Radyoterapi Bölümü,

Phone: +90 (535) 351 66 67

E-mail: e.ozangoksel@gmail.com

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Introduction

Radiation therapy requires an interdisciplinary team effort, consisting primarily of radiation oncologists, medical physics specialists and radiation therapists (RTTs) (1). The success of treatment in radiotherapy depends equally on the knowledge and experience of the employees of these three disciplines. Radiation oncologists are responsible for determining the treatment scheme, medical physics specialists are responsible for ensuring the quality of treatment devices and creating treatment plans, while RTTs are responsible for accurately and precisely administering the prescribed radiation dose to the patient (2). In addition, since they are in contact with the patient in each fraction, they are also responsible for monitoring side effects and referring the patient to the nurse or physician (3).

In an era when imaging and treatment techniques are more complex due to technology, the role and level of responsibility of RTTs are constantly developing and expanding (4). Given the complexity of modern radiotherapy, it is necessary to develop special training programs specific to the RTTs profession. Educational programs should provide RTTs with the scientific theoretical basis of the profession and ensure that they, as practitioners, are able to synthesize, evaluate and apply their knowledge in a clinical setting (5).

RTTs training should include the steps of patient positioning and immobilization, image taking, contouring of organs at risk, control of compliance of treatment parameters with the planned one, verification of patient position and application of treatment, which they are responsible for in the clinic. In the RTTs course manual published by the International Atomic Energy Agency (IAEA), it is stated that when developing any training program, first of all, a short application survey should be conducted on the academic and clinical infrastructure that is already available. It has been pointed out that the information obtained from this survey will efficiently help identify needs and plan any new courses or expand existing programs (5).

Accordingly, in this survey study, it was aimed to investigate how the effects of the training provided in RTTs programs in Turkey on clinical practice are evaluated by working RTTs. This is the first study evaluating how the contribution of RTTs' training to working life is perceived in our country.

Materials And Methods

A questionnaire consisting of 22 questions was prepared on google forms (docs.google.com). The website link to the questionnaire was distributed via email and shared on social media platforms to radiation therapists employed

in Turkey through the Association of Radiotherapy Therapists. Based on personal communication with the association management, the number of association members in April 2023 was reported to be 168. For sample selection, the simple non-selective sampling method, which is one of the probability-based sampling methods, was employed. According to this method, a minimum sample size of 118 was calculated for a study involving a population of 168, with a 95% confidence interval and a margin of error of 0.05. The survey questions are designed to take about five minutes to complete. To ensure broad participation from RTTs working in diverse institutions across our country, the survey data collection was conducted over a week period. The first four questions directed to the participants were related to the institution they worked at, while the next three questions were related to the information about the school where they received RTTs training. The 14 questions in the second part question the contribution of the theoretical and practical trainings they received at their schools to their working lives with the Likert scale answer (from 1 to 5, completely agree, completely disagree). The questions related to theoretical courses were created by examining the information packages of the Turkish Higher Education Qualifications Framework of various state and foundation universities (6-9). Finally, there is an open-ended question in which recommendations for improving the contribution of RTTs training to clinical practice are questioned. The survey outputs were taken from the website and entered the SPSS program for statistical analysis.

This study was deemed ethically appropriate by the Acıbadem Mehmet Ali Aydınlar University Ethics Committee, with the reference number 2023-08/288, on May 12, 2023.

Statistical Analysis

Descriptive statistics were performed for all categorical variables. Correlations between the multiple independent categorical variables were evaluated by Chi-square test. Independent samples T-test was used for mean comparison. Statistically significant p value was accepted as <0.05 within %95 confidence interval.

Results

One hundred and eighty-one RTTs working in Turkey participated in the survey and all of them were taken into consideration. While 64.8% (n=116) of the participants are composed of those working in the Marmara region, the second rank is composed of those working in the Central Anatolia region with 15.6% (n=28). The lowest participation was from the Eastern 2.8% (n=5) and Southeastern Anatolian 0.6% (n=1) regions. The proportion of RTTs with up to five years of experience was found to be 57.1% and the proportion of those

with more than fifteen years of experience was found to be 18.6%. The answers given to the question "What tasks do you do in the institution you work for?" showed that RTTs mostly perform treatment, simulation, and contouring tasks. While 42.7% of the participants stated that they received education in state universities, 57.3% stated that they completed their education in foundation universities. When the participants are sorted according to the institutions they work, the most are 42.5% private hospital, 29.9% university hospital and 27.6% state hospital. There was a significant correlation observed between individuals who pursued their education at state universities (68.7%) and subsequently pursued careers in public hospitals, as well as individuals who attended foundation universities (73.9%) and later worked in private hospitals. ($p < 0.05$). When the adequacy of the internship opportunities of the institution they were trained in was questioned, only 8.9% of the participants stated that they were insufficient and 10.7% of them stated that they were very insufficient (Figure 1).

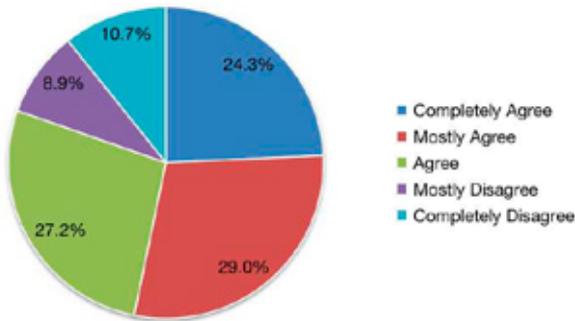


Figure 1 Percentage graph where the adequacy of internship opportunities provided by the school is evaluated

There was no significant correlation between the institution where the training was received and the adequacy of internship opportunities ($p > 0.05$). Both those who completed their education at state universities and those who completed their education at foundation universities found their internship experiences during their studies to be satisfactory, with percentages of 81% and 80%, respectively. It has been observed that 77% of students studying at foundation universities consider the diversity of equipment in the clinics where they conducted their internships to be sufficient, whereas for students from state universities, this percentage dropped to 68%. However, despite this differences, students from both state and foundation universities have reported that their internships had a positive impact on their professional lives, with percentages of 89.4% and 95%, respectively. Figure 2 also shows the percentage graph of the internship periods during their education.

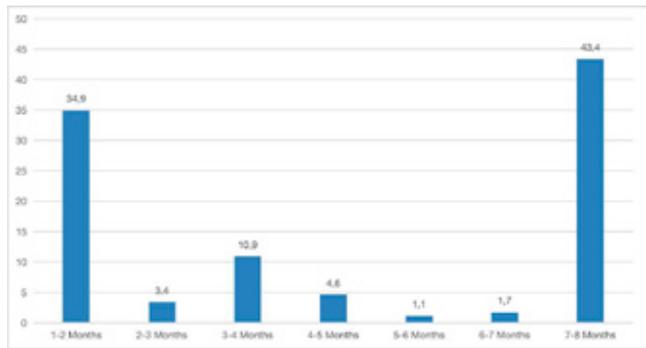


Figure 2 Percentage chart of internship periods during training

When the contributions of their internship experience to working life were questioned, it was stated that 36.4% were highly satisfied, 36.9% were very satisfied and 19.3% were satisfied. While 26.6% of the participants stated that the variety of treatment devices in the place where they did their internship was insufficient, 73.4% stated that it was sufficient (Figure3).

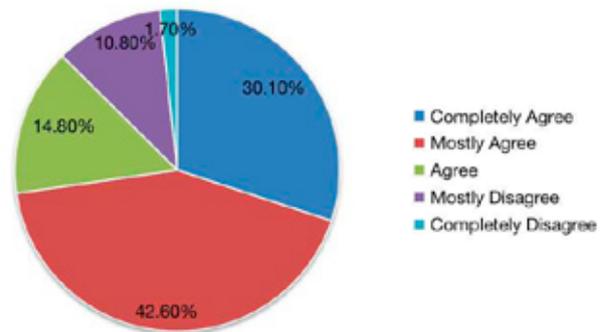


Figure 3 Percentage graph in which the adequacy of the treatment device variety in the clinic where the internship is performed is evaluated

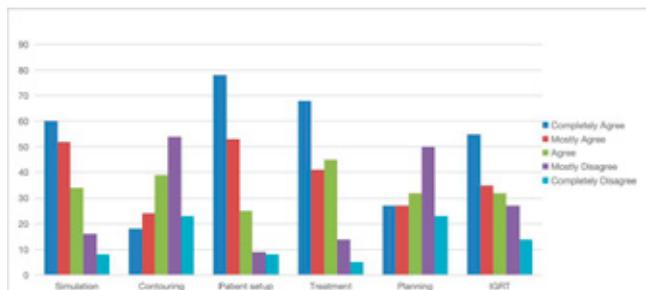


Figure 4 Percentage chart showing the adequacy of the experience gained in different fields during the internship period

A significant relationship was found between work experience and the perception that internship is beneficial to working life ($p = 0.04$). Those with 0-5 years of work experience stated that the internship they did during their education did not contribute to working life, while

those with 5-15 years of work experience stated that it contributed. The evaluation of the contribution of the theoretical courses they studied during their education to their working life is given in Table 1.

TABLE 1: Percentage distribution of the contribution of theoretical courses taken during RTTs trainings to working life.

Lectures	Highly Satisfied	Very Satisfied	Satisfied	Not Satisfied	Not at All Satisfied
Radiotherapy Physics	13%	22,6%	%40,7	%14,7%	9
Anatomy	%30,5	%26	%32,2	%8,5	%2,8
Radiological Anatomy	%36	%21,1	%29,1%	8	%5,7
Radiation Protection	%27,4	%21,7	%18,9	%5,7	%1,1
Radiation Oncology	%37,1	%27,4	%29,7	%5,1	%0,6
Quality Assurance	%18,6	%22,7	%34,9	%14,5	%9,3
Professional Ethics	%20,5	%25,1	%38,6	%12,3	%3,5
Medical Terminology	%25,9	%23,6	%35,6	%11,5	%3,4
Professional English	%6,9	%13,9	%28,3	%30,1	%20,8

To the expression "Having a radiotherapy laboratory in our school would have contributed to our education."; answers were given that 55.9% completely agree, 20% mostly agree, and 16.5% agree. The open-ended question "How do you think RTT education can be improved in Turkey?" was answered by 73 RTT. Mostly, the answers given are to increase the internship period (n=20), to reduce the quotas (n=11), to have undergraduate education (n=8) and to have laboratories in schools (n=7).

Discussion

In this study, we conducted a survey to investigate the impact of the education and training received by RTTs during their university education on their professional careers in Turkey. Our aim was to gain insights into the effectiveness of RTTs education and training in our country and identify areas that may require improvement. The results of this study could be used to inform future training programs and improve the overall quality of treatment provided by RTTs.

A total of 181 RTTs, predominantly from the Marmara and Central Anatolian regions, participated in this study, which aimed to investigate, for the first time, how RTTs training in Turkey was evaluated by working RTTs. A limitation of the study was the low participation rate from the Eastern and Southeastern Anatolia regions, which we believe is due to the limited number of radiotherapy clinics in these regions. Specifically, the Eastern Anatolia region has only nine radiation oncology clinics, and the Southeastern Anatolia region has only seven (10).

The ESTRO Young Committee stated that due to the absence of a consensus on the appropriate methodology to assess the quality of education programs, they used a non-validated, self-produced questionnaire (11). Similarly,

to measure how RTTs perceive the contribution of the education they receive to their working lives, we prepared an online questionnaire consisting of 22 questions. A significant relationship was found between RTTs who graduated from public schools and work in public hospitals, and those who graduated from foundation schools and work in private hospitals. We hypothesize that this may be because faculty members working in hospitals prefer to work with RTTs whom they have trained themselves.

According to the ESTRO Core Curriculum, "there are two components to an initial undergraduate education program for Radiation Therapists (RTTs): the academic and clinical components, and the learning outcomes of each should be complementary" (ESTRO Core, p9) (12). Additionally, according to the IAEA Handbook for the Education of Radiation Therapists, experienced clinical RTTs are expected to support students in gaining understanding and developing their technical and psychosocial skills. The clinical environment plays an essential role in providing students with practical learning experiences that will underpin their future practice. Students are expected to work the same hours as the clinical staff and full attendance is compulsory, unless otherwise notified (p51, 5). As emphasized in the ESTRO Core Curriculum and IAEA's Handbook, the proficiency of the internship is an important component of RTTs training.

When examining the results of the survey, it is evident that the majority of participants find their internships to be sufficient. However, only those with 5-15 years of experience stated that the internship is beneficial to

their working life. There may be two different reasons for this discrepancy between those with 5-15 years of work experience and those with 0-5 years of work experience who state that the internship does not contribute. One possible reason is that as RTTs gain more work experience, they better perceive the benefits of their internships during their education and more accurately evaluate their effects. The second reason could be that those with more than 5 years of work experience may have actually had a more beneficial internship period.

ESTRO emphasizes the importance of a variety of treatment devices being available in the clinic where internships are held, stating, "As a core requirement, students must spend a significant amount of time on dual modality multi-energy linear accelerators with imaging facilities and CT scanners/simulators for treatment planning purposes. It is also recommended that students have exposure to orthovoltage/superficial units, brachytherapy, and advanced technologies" (12, p.12). A large majority of the participants found the variety of treatment devices in the clinic where they completed their internships to be sufficient.

According to Coffey's study (3), 11 countries, including Turkey, indicated that their clinical departments set and fulfill standards in terms of equipment variety and practice to train students as part of the clinical component of the training program. However, when evaluating the adequacy of the experience gained during the internship in different areas, it was found to be sufficient for simulation, treatment, and IGRT, but insufficient, especially in the areas of contouring and planning (13). The knowledge of basic planning techniques gained during the internship is important for RTTs to accurately evaluate errors such as incorrect energy selection, higher than expected MU values, etc. that may arise during treatment planning (14). Additionally, RTTs who participated in the survey stated that they were mostly involved in contouring after treatment and simulation. Considering that in our country, tasks such as importing DICOM data to the planning system, registering different image sets, and OAR contouring are mostly performed by RTTs, it underscores the importance of students gaining sufficient experience in the fields of contouring and planning during internships. Therefore, it is crucial to ensure that students have more efficient internships in these areas as well. Dubois et al (15) conducted a similar study where they evaluated RTTs training using a questionnaire. They also concluded that RTTs require more hands-on teaching in areas such as planning, contouring, dose prescribing, and dosimetry, which is consistent with the findings of our study.

The ESTRO Core Curriculum states that "Laboratory-based education allows students to learn and train outside

of the clinical setting, without interfering with clinical patient data and with the added benefit of repetition of the exercises until the defined competence has been achieved. The students have the possibility to ask questions without disturbing the staff and the patient" (12, p.54). A large majority of the participants also agree that having a radiotherapy laboratory at the school will make a positive contribution to their education. Some even felt the need to reiterate the laboratory requirement in the open-ended question section. However, we could not find a statistically significant relationship between those who stated that the internship opportunities offered by their schools were insufficient and those who thought that having a radiotherapy laboratory in the school would be beneficial.

Another issue that stands out in the open-ended question section is the extension of the education period to the bachelor level. The International Atomic Energy Agency (IAEA) also endorsed the 2-year training program for Radiation Therapists (RTTs), while recommending that it may be increased to 3 years where possible. On the other hand, ESTRO recommends that the duration of training should be 3 years (5, 12). In their study, Coffey et al (3) presented the duration of RTTs training for 30 countries (26 European, 4 non-European) and emphasized that this period was 2 years in only 3 countries: the USA, Slovenia, and Turkey. It has been determined that the duration of education in only 5 countries is 4 years, while in others it is 3 years. Countries with a 4-year education period include Albania, Greece, Hungary, Malta, and The Netherlands. In a survey conducted by ESTRO for professionals working in the field of radiation oncology in Europe, the improvement of education was investigated (16). Four hundred and sixty-three respondents from 34 European countries participated in the survey, including 45% clinicians (n=210), 29% physicists (n=135), 24% RTTs (n=108), and 2% radiobiologists (n=10). When the participants were asked to evaluate the effectiveness of the training they received for different areas, it was seen that clinical practice was given the most importance (18% very important and 77% most important). In addition, when asked what could be done to improve education, it was stated that the duration of education should be increased, similar to the results of our study.

While the contribution of radiation oncology and radiation protection theoretical courses to the working life was mostly found to be satisfactory, the contribution of only the professional English course was mostly reported as unsatisfactory. This may be due to the short duration of the professional English course. However, no requests related to this issue were stated in the suggestions for improving

education. In fact, professional English is crucial for the working life of RTTs, as treatment devices and planning systems interfaces are in English. Additionally, operating manuals for these treatment devices and most scientific publications in the field of radiation oncology are also in English. Although the open-ended question "How can RTTs education be improved in Turkey?" was mostly answered by suggesting an increase in the duration of the internship, no statistically significant relationship could be found between the duration of the internship and the perceived benefit of the internship in working life.

Conclusion

Radiation therapy has become increasingly complex over time and is rapidly evolving with advances in technology. As radiation therapists play a vital role in the interdisciplinary team, their training must prepare them to work effectively in the future and provide safe and high-quality radiation therapy services. In conclusion, the participants of the survey largely found the education and internships they received during their RTTs training to be sufficient in terms of their contributions to their working lives.

Declarations

A part of this study was presented at the 3rd National Radiotherapy Congress and Training Seminars. 27-30 April 2023, Antalya, Turkey.

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Ethics approval: The authors state that they have obtained appropriate institutional review board approval or have followed the principles outlined in the Declaration of Helsinki for all human or animal experimental investigations. This study was evaluated and approved by Acibadem Mehmet Ali Aydinlar University Ethics Committee. (Date: 12.05.2023, Registration number: 2023-08/228).

Availability of data and material: The datasets generated during and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions: EG conceived and designed the study. EG prepared the first draft and subsequent drafts and the final paper.

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