La radiologia medica
https://doi.org/10.1007/s11547-022-01586-2

RADIOTHERAPY

Are you planning to be a radiation oncologist? A survey by the young group of the Italian Association of Radiotherapy and Clinical Oncology (yAIRO)

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Received: 5 May 2022 / Accepted: 22 December 2022

Abstract

Background and purpose The Young Section of the Italian Association of Radiotherapy and Clinical Oncology (yAIRO) circulated an online questionnaire survey among residents currently enrolled within Italian radiotherapy residency schools to investigate the profiles, motivations, knowledge of the radiotherapy discipline, organizations and the needs of younger members.

Materials and Methods The survey was developed by the yAIRO steering committee and included questions about the demographic characteristics of the residents (Profile A), the background of their clinical experience during the school of medicine and national residency admission test performance (Profile B) and the residents' knowledge of the scientific associations active in the field of radiotherapy (Profile C).

Results Out of 400 residents actually in training, 134 responded to the questionnaire (response rate 33.5%).
According to most of the residents, radiotherapy was not adequately studied during the medical school (n. 95; 71%) and an Internship in Radiotherapy was not mandatory (n. 99; 74%). Only a minority of the residents had chosen to complete a master's degree thesis in radiotherapy (n. 12; 9%).
A low percentage of the residents stated that they were aware of the Italian Association of Radiotherapy and Clinical Oncology (AIRO), its young section (yAIRO) and the European Society for Radiotherapy and Oncology (ESTRO) when they were in School of Medicine (respectively, 11%, 7% and 13%).

Conclusions The results of the survey require a profound reflection on the current teaching methods of Radiation Oncology in our country, highlighting the need for a better integration in the framework of the School of Medicine core curriculum.

Keywords Radiation oncology · Residency training · yAIRO · Medical schools

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Published online: 31 December 2022

Introduction

Radiotherapy is well recognized among the most important approaches in cancer therapy together with surgery, chemotherapy and more recently, target therapy and immunotherapy [1].

It is estimated that half of cancer patients will receive radiotherapy during their disease course. Many technological and biological advances have completely changed the field of radiation oncology in the last decade, both increasing the safety of radiation dose delivery to target volumes and reducing unnecessary irradiation of the organs at risk, hence increasing the therapeutic ratio and the efficacy of radiotherapy. However, the shortage of radiation oncologists and the low motivation among medical students to choose this discipline and residency program represent a long-standing problem in Italy.

Medical education in Italy currently consists of six years within a Medical School programme to become a licensed physician. The selection process to gain access into the residency school was conducted for each single university until 2013. Yearly, each residency school published a notice with a predefined school, location and number of available places for interested candidates.

Since 2014, only one announcement was published by the Ministry of University and Research. All the positions available for each medical specialty were normally reported and assigned to the different active residency schools in the country. Candidates first had to compete for few chosen schools at the time of enrolment for the public examination which was before the competition itself.

In 2017, there was a shift to a nationwide competition with a single ranking list, where the choice of location and residency school were made after the publication of the merit list, starting from the highest ranking on the list, until all available places were filled.

Furthermore, the resident had the opportunity to re-participate in the national admission test during the chosen program and could change program after one or two years of training with no disadvantages.

In recent years, the total number of fellowships available to enter residency schools have increased significantly (from 5778 in 2014 to 18,847 in 2021) by the Ministry of University and Research in consultation with the Ministry of Health (Fig. 1), with a ratio of participants to available fellowships of 1,032 in 2021 (Fig. 2). In like manner, the number of fellowships for radiotherapy residency schools has also increased over time, from 92 in 2014 to 186 in 2021 (Fig. 3) [2]. Unfortunately, due to the high number of available positions, national test candidates preferred other programs to radiotherapy, making it one of the least competitive residency programs.

Over the years, there has also been a notable loss of fellowships in the radiotherapy residency schools for two main reasons: some fellowships were not utilized, as they were not selected by the successful candidates at the subsequent selection stage and physicians responsible for the specialty training in radiotherapy abandoned the fellowship for other specialties during the program.

In the last three years, the number of unassigned or abandoned radiotherapy residency fellowships were 42 out of 137 (30.7%) in 2019, 50 out of 179 (27.9%) in 2020, and 96 out of 186 (51.6%) in 2021. To date, a total of 250 of 822 (30.4%) resident positions in radiotherapy have been lost since 2016 (Fig. 4) [2].

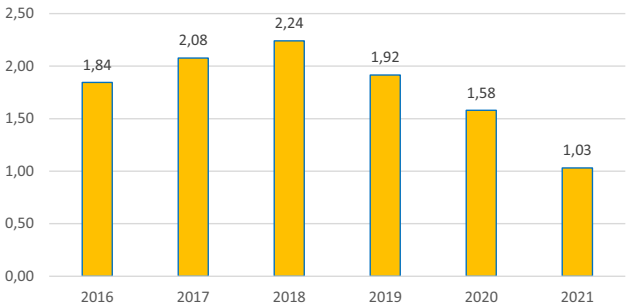

Fig. 2 Ratio total participants / total fellowships

Fig. 1 Available annual fellowships in all residency schools

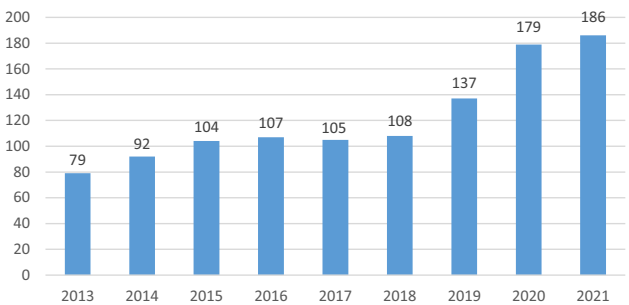

Fig. 3 Available annual fellowships in radiotherapy

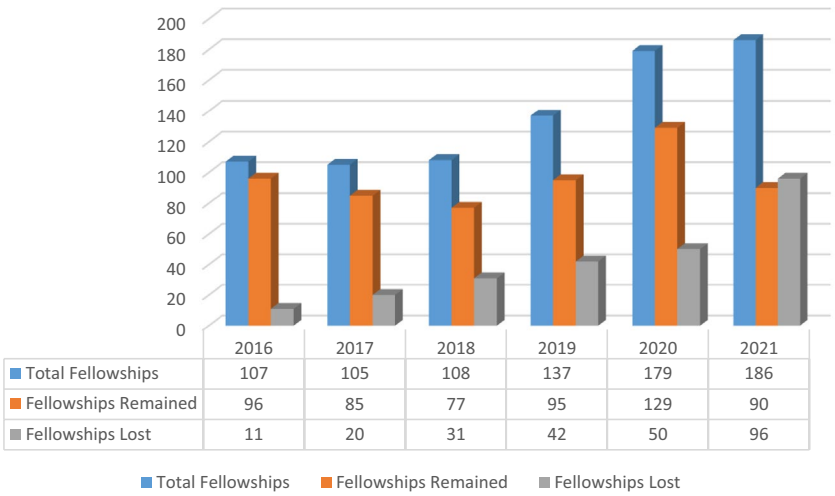

Fig. 4 Summary of fellowships in radiotherapy from 2016 to 2021

A more detailed analysis shows that in 2019, among the 42 positions lost: 11 (26.2%) were not assigned and 31 (73.8%) were abandoned fellowships; in 2020, among the 50 lost positions: 2 (4%) were not assigned and 48 (96%) were abandoned; in 2021, among the 96 lost positions: 90 (93.8%) were not assigned and 6 (6.2%) were abandoned. The decrease in the number of the participants/fellowships ratio led to an increase in both unassigned and abandoned fellowships (Fig. 5) [2].

The Young section of the Associazione Italiana di Radioterapia ed Oncologia Clinica (young section of the Italian Association of Radiotherapy and Clinical Oncology, yAIRO) represents the young Italian Radiation Oncology community, consisting of radiation oncologists and residents younger than 40 years. Its aim is to foster high-level educational, scientific and professional standards in the field of RT, specifically for younger members. yAIRO also aims to promote the engagement of medical students and residents in the radiation oncology community with the AIRO society and the Professorship Council [3].

To this end, yAIRO provided an online survey for radiotherapy residents to evaluate the profiles, ambitions, knowledge and desires of younger members and to better describe the current experiences of physicians applying for a residency program in Radiation Oncology.

Materials and methods

The questionnaire was specifically designed to capture demographics, motivations and suggestions to provide a general understanding of the ideas of the radiation oncology profession among young residents.

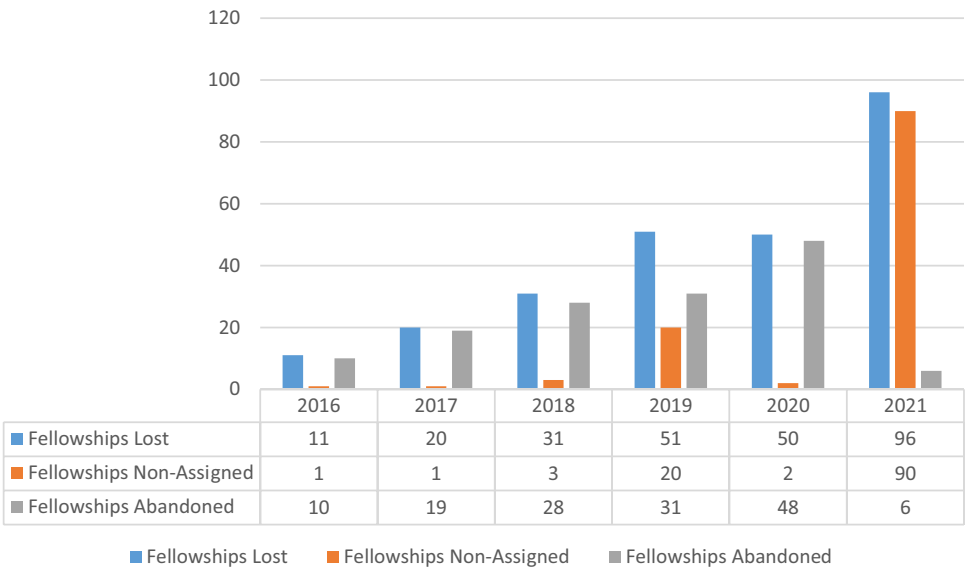

Fig. 5 Fellowships non-assigned vs fellowships abandoned

The targets of the survey were the radiotherapy residents currently enrolled in the Italian residency schools.

All the radiotherapy program directors received an email invitation in May 2021 with the request to encourage all the residents to respond to the survey.

The survey was conducted online, employing the Internet-based Survey-Monkey platform (www.surveymonkey.com), and took about 20 min to complete.

The survey was firstly open from May 2021 until July 2021. Due to the low response rate, the directors received two reminders (in August and September 2021) to be shared with their residents and the survey deadline was extended from July to October 2021. The completed questionnaires were collected and analyzed anonymously in January 2022.

Questionnaire development

The full survey consisted of 28 items, self-produced and non-validated, that was developed by the yAIRO steering committee (see *Supplementary* Materials). A sample questionnaire was administered in a preliminary phase, to other members of yAIRO not involved in the drafting step, to avoid any form of bias. The initial questionnaire was later modified according to the received suggestions and external reviewers were lastly contacted to test face-validity, improve contents, wording and flow of the content items.

The 28 items were grouped into different domains: demographic characteristics of the residents (Profile A); background of the clinical experience of the residents during the school of medicine and the national residency admission test (Profile B) and residents' knowledge of the Scientific Associations of Radiotherapy (Profile C).

Profile A consisted of five, B of ten, C of five multiple choice questions, respectively. Binary responses were reported as a yes/no mutually exclusive choices, whereas other items included nominal responses. No Likert scale, exploratory factor analysis or psychometric properties used to estimate internal consistency were performed, due to the simplicity of the questions.

The final item solicited suggestions to better describe the unmet needs of radiotherapy residents as a free text answer.

The Checklist for Reporting Results of Internet E-Surveys (CHERRIES) [4] is available in the supplementary materials.

Results

A total of 134 residents out of a total of 400 residents currently undergoing training (estimated number considering the total Fellowships assigned and abandoned) [2, 5] responded to the questionnaire, with a response rate of 33.5%.

Demographic characteristics of respondents (Profile A, Table 1)

Of the residents that participated in this survey, 95 (70.9%) were female, while 39 (29.1%) were male. Thirty-six (26.9%) were from the North, 79 (58.9%) from the Center and 19 (14.2%) from the South of Italy.

The majority of residents attended the Main Campus University Hospital (n. 117, 87.31%), while 13 (9.7%) and 4 (2.99%) attended a university linked institution, respectively.

A significant percentage of responding residents attended the first year of residency school (n. 61, 45.5%), whereas other years were less represented: second 20.9% (n. 28); third 14.2% (n. 19) and fourth 19.4% (n. 26), respectively.

Background of the clinical experience of the residents during the school of medicine and the national residency admission test (Profile B, Table 2)

Q1 and Q2: Radiotherapy in the School of Medicine

Most of the residents were of the opinion that radiotherapy was not adequately studied during the school of Medicine (n. 95, 71%). Radiotherapy was mainly associated with radiology (n. 65, 49%), oncology (n. 38, 28%), or both the disciplines in their university programs (n. 27, 20%).

Table 1 Demographic characteristics of radiotherapy residents

Number	Question	N	%
A1	Gender	39	29%
	Males	95	71%
	Females		
A2	Age	56	42%
	≤29 years	52	39%
	30–32 years	26	19%
	≥33 years		
A3	Geographic Region	36	27%
	North Italy	79	59%
	Center Italy	19	14%
	South Italy		
A4	Work Place	117	87%
	Main University Hospital	13	10%
	Other University Hospital	4	3%
	Other Non-University Hospital		
A5	Year of Residency	61	45%
	I year	28	21%
	II year	19	14%
	III year	26	20%
	IV year		

Table 2 Background of the clinical experience of radiotherapy residents

Numbers	Questions	N	%
B1	During the Medicine degree, Radiotherapy was adequately studied?	39	29%
	Yes	95	71%
	No		
B2	During the Medicine degree, Radiotherapy was associated with:	65	49%
	Radiology	38	28%
	Oncology	27	20%
	Both	4	3%
	Other		
B3	During the Medicine degree, an internship period in Radiotherapy was mandatory?	35	26%
	Yes	99	74%
	No		
B4	During the Medicine degree, did you attend a voluntary internship in Radiotherapy?	21	16%
	Yes	113	84%
	No		
B5	During the Medicine degree, did you attend a voluntary internship in other Specialties?	120	90%
	Yes	14	10%
	No		
B6	Other Specialty attended internship:	39	29%
	Internal Medicine Specialties	20	15%
	Oncology	1	1%
	Radiology	20	15%
	Surgery Specialties	39	29%
	Multiple Choices	15	11%
	No responders		
B7	Discipline of the Degree Thesis	28	21%
	Internal Medicine Specialties	22	16%
	Oncology	3	2%
	Radiology	14	10%
	Surgery Specialties	12	9%
	Radiotherapy	54	41%
	Other	1	1%
	No responders		
B8	Why did you choose Radiotherapy residency school?	25	19%
	It was my first choice	82	61%
	It was considered among my favourite options, despite not the first choice	18	13%
	I chose it because I didn't want to move to another city	9	7%
	It was the only available option		
B9	National Residency Test Score	41	31%
	NA	6	4%
	Range 1–4000	30	22%
	Range 4001–8000	25	19%
	Range 8001–12,000	24	18%
	Range 12,001–16,000	8	6%
	Range 16,001–20,000		
B10	Will you try again the National Residency Test?	115	86%
	No, I want to finish Radiotherapy Residency School	18	13%
	Yes, I will try the test again	1	1%
	No responders		

Q3 and Q4: Internship period in radiotherapy

An internship in radiotherapy was not mandatory in the majority of the university (n. 99, 74%). Also, the majority of the residents did not attend a voluntary internship in radiotherapy during their education period (n. 113, 84%).

Q5, Q6 and Q7: Voluntary internship in other specialties and degree thesis

A high percentage of the residents attended voluntary internships in other Specialties (n. 120, 89%). The most attended was Internal Medicine Specialties (n. 39, 29%) and

multiple internships (n. 39, 29%), followed by Oncology (n. 20, 15%), Surgery (n. 20, 15%) and Radiology (n. 1, 1%).

The most undertaken degree thesis was in the field of Internal Medicine (n. 28, 21%), followed by Oncology (n. 22, 16%), Surgery (n. 14, 10%), Radiology (n. 3, 2%). Only 12 current residents (9%) had a thesis in radiotherapy.

Q8: Motivation of the residency school

The majority of the residents stated that radiotherapy was considered among the favourite options (n. 82, 61.2%), despite the fact that only 25 residents (18.7%) described it as their first choice.

On the other hand, 18 residents (13.4%) stated that radiotherapy was chosen because it was the only available option to avoid moving to another city, while 9 (6.7%) residents stated that it was the only available option for them in general.

Q9 and Q10 National residency test

A significant percentage (n. 42, 31%) of the residents decided not to report their score of the national admission test. Notably, only 6 residents (4%) were classified among the first 4000 candidates, with the majority (n. 55, 41%) falling into the group between 4001 and 12,000 for the 4 considered years. The remaining residents ranked very low in the national admission test (≥ 12.001, 24%).

Despite the overall low performances at the admission test, a good number of the residents stated that they were motivated to finish the residency program, with only eighteen residents planning to re-try the national admission test in the next years (n.17, 13%).

Residents' knowledge of the scientific associations of radiotherapy (Profile C, (Table 3).

Q1, Q2 and Q3 radiotherapy scientific societies knowledge

When asked about their knowledge of the scientific associations of radiotherapy, 80% of the residents stated to have been affiliated with the Associazione Italiana di Radioterapia Oncologica (Italian Association of Radiotherapy and Oncology, AIRO), 83% were associated with its young section (yAIRO) and 85% were involved with the European Society for Radiotherapy and Oncology (ESTRO) only during the residency program.

Only few of the residents stated that they knew these Scientific Societies since the School of Medicine (respectively, 11%, 7% and 13%), while a small number of the residents admitted not to have heard about any of these Scientific Societies (8%, 10% and 1%, respectively).

Q4 and Q5

A large number of the residents claimed not to have attended any National Congress of AIRO (n.81, 60%) and just more than half of the residents stated that they had never submitted any scientific abstracts to the National Congress as authors or co-authors (n. 61, 46%).

Table 3 Residents' knowledge of the scientific associations of radiotherapy

Numbers	Questions	N	%
C1	Do you know European Society for Radiotherapy and Oncology (ESTRO) ?	18	13%
	Yes, I knew it during the Graduation Degree	114	85%
	Yes, I knew it during the Radiotherapy Residency	2	2%
	No		
C2	Do you know Italian Association of Radiotherapy and Oncology (AIRO)?	15	11%
	Yes, I knew it during the Graduation Degree	107	9%
	Yes, I knew it during the Radiotherapy Residency	12	80%
	No		
C3	Do you know Young Italian Association of Radiotherapy and Oncology (yAIRO)?	9	7%
	Yes, I knew it during the Graduation Degree	111	83%
	Yes, I knew it during the Radiotherapy Residency	14	10%
	No		
C4	Did you ever attend National Congress of AIRO?	52	39%
	Yes	81	60%
	No	1	1%
	No responders		
C5	Did you ever submitted Scientific Abstract (Oral Communication or Poster) at National Congress of AIRO?	68	51%
		61	45%
	Yes	5	4%
	No		
	No responders		

Discussion

The declining trend of Radiation Oncology residency schools in Italy may worsen over time due to further reduction in the ratio of participants to the number of available fellowships in the nearest future. In addition, the tendency of admission test candidates to choose residency schools seems more unlikely.

The lack of motivation from radiotherapy residents and the current dropout rate from radiotherapy residency programs are issues of great concern to the yAIRO steering committee, since the start of its activity. As a result, the committee is determined to identify, correct and if possible, prevent the possible causes.

The current situation of radiotherapy training in the framework of the School of Medicine study plan represents one of the most significant causes of these results.

Radiotherapy training is indeed currently associated with radiology, oncology or even with both disciplines in different course years, thereby reducing students' attitude toward the discipline.

Similarly, a mandatory internship in radiotherapy has not been effected in most of the Schools of Medicine, therefore limiting the possibilities of the medical students to become familiar with the discipline, both on the clinical and technological point of view.

Not surprisingly, nearly all of the interviewed residents (n. 127, 95%) agreed to the fact that radiotherapy was not adequately studied during their time at the School of Medicine and this may have negatively influenced their attitude toward the discipline in general.

These undesirable outcomes require a profound reflection on the current training methods of this discipline, highlighting the need for a better integration of the course in the framework of the School of Medicine education. This aim must be pursued under the guidance of Italian Professorship of Radiotherapy.

Furthermore, a dedicated internship program in this discipline should be encouraged in order to improve the knowledge of radiotherapy among medical students. Presenting and sensitizing the students about the different aspects of the discipline may add value to this program and could make it more appealing to the students.

The countermeasures proposed by both AIRO and yAIRO steering committee for the upcoming years will hopefully engage more students and lead to an increase of the number of radiotherapy degree thesis assignments, which could serve as a better and reliable teaching quality indicator.

To this end, yAIRO has developed a plan of action which is believed to help alleviate the current situation.

Firstly, it is important to enhance a constructive dialogue between the different scientific societies, to offer to residents and young radiation oncologists a wealth of experience and opportunities to refine their skills and gain access to the latest developments in the field, according to a shared European vision. yAIRO also aims to prioritize various initiatives to increase young members' participation in the society and to improve the communication with medical students.

It is noteworthy to underline the efforts of European oncology organizations, such as the European Society for Radiotherapy and Oncology (ESTRO), the European School of Oncology (ESO), the European Society for Medical Oncology (ESMO), the European Society of Surgical Oncology (ESSO), that have recently proposed cancer education to medical students [6–9].

All these societies, often in collaboration with each other, offer summer courses to medical students to make them familiar with basic cancer knowledge, diagnostics, therapeutic approaches and the value of multidisciplinary cancer care. For instance, ESO-ESSO-ESTRO offered a two-week multidisciplinary course in oncology dedicated to 24 students each year, on a competitive basis with an acceptance rate of 24%. In this regard, other forms of teaching courses such as open webinars should be taken in order to increase the number of participants potentially interested in the discipline.

All these strategies could guarantee continuity and guidance in planning a residency educational program.

Despite the fact that radiotherapy was considered among the first choices by many of the current residents and only a small number of the residents expressed their unwillingness to complete the residency school, the dropout rate has unequivocally increased in the last years, also due to more unfavorable odds. In this regard, we believe that the answers provided for Q10 may not have been so sincere, considering that a high number of respondents were first year residents, who may have had to repeat the test.

To avoid this high dropout rate, the younger radiotherapy residents should be introduced as early as possible to the yAIRO educational, scientific and professional networking platform in order to showcase the great potential of this discipline and to be early engaged in a more effective way.

A similar situation has been observed in other European countries [10, 11] and in other parts of the world [12–15], and this phenomenon should be analyzed in the context of the current activity of Radiotherapy Scientific Societies.

The exposure of Scientific Societies of Radiotherapy (yAIRO, AIRO and ESTRO) to medical students is indeed currently very low; thus, several efforts should be put in order to gain access to this group of students and to suggest the radiotherapy residency program as a possible career choice.

Finally, the presence of national Scientific Societies on social networks is currently still inadequate and must be

increased with precise strategies in the next years, targeting the multitude of hesitant medical students.

In spite of the relevance and advantages of carrying out this survey, it has its several limitations.

Firstly, the response rate was generally low, notwithstanding the two response reminders and three deadline extensions. The low response rate can be conversely considered an answer in itself, reflecting the low motivation of the radiotherapy residents to engage in the scientific society activities, especially when compared to previous response rates of yAIRO surveys, that ranged between 28 and 56% [16–20]. However to avoid selection bias, current residents were previously informed about the anonymity of the survey results.

Also, a large percentage of respondents (n. 61, 45.5%) were in their first year of the residency program and this could have influenced some of the answers (especially the *C profile,* relating to the Knowledge of the Scientific Associations of Radiotherapy). Considering that the dropout rate at the beginning of the residency school is a major problem, the opinions of younger residents are pivotal to develop future strategies to decrease the dropout rate.

Since our survey design was aimed at evaluating descriptive results and not particular solutions in terms of content and meaning of underlying domains, statistical analysis was not performed.

In addition, regarding the high dropout rate in the radiotherapy residency program, residents who aimed at changing residency programs may not have been interested in responding to the survey. Although, the decision to propose a survey instead of a semi-structured interview may have resulted in a low response rate, the anonymity of the participants was guaranteed.

Moreover, other biases can be associated with the this survey due to the fact that we did not randomize the answer options of the questions and recall bias, with regards to some questions referring to past events which could have led to some missing details as a result of the inability of current residents to completely recollect these events (i.e., the National Residency Test, previous Internships and similar).

Finally, our survey does not shed light on some professional motives which could have influenced the choice of the residents in choosing one specialty over another, such as free private practice. We recognize that the opportunity of free private practice is considered in the choice of residency schools, but at the same time the higher number of residencies in the last years could have an impact on this aspect that should be considered among young doctors.

Overall, regular surveys and comparisons over time are important in order to test and evaluate the results of the yAIRO, AIRO and Italian academic strategies. The ultimate goal is to improve the knowledge and accessibility of the radiotherapy program in the Schools of Medicine and to create a networking platform for young professionals. For this reason, we believe that the results of this survey will serve as a starting point for further developments in raising awareness of the current situation and proffer solutions to the impending problems.

Supplementary Information The online version contains supplementary material available at https://doi.org/10.1007/s11547-022-01586-2.

Acknowledgements The authors would like to thank the Scientific Committee and Board of the AIRO for their critical revision and final approval of the manuscript (Nr. 4/2022). The authors would also like to thank all the residents who are involved in building the future of our discipline with passion and commitment.

Funding The authors have not disclosed any funding.

Declarations

Conflict of interest The authors have not disclosed any competing interests.

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