

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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Abstract

Background

Despite the pivotal role of Radiation Oncology in cancer therapy, the shortage of radiation oncologists and the low motivation amongst medical students to choose this discipline and join the residency program represents a long-standing problem in Italy.

The Young Section of the Associazione Italiana di Radioterapia ed Oncologia clinica (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, and organizations and the needs of younger members.

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

A total of 134 residents responded to the questionnaire, out of a total of 400 residents actually in training (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 a master degree thesis in Radiotherapy (n.12; 9%).

A low percentage of the residents stated that they knew the Associazione Italiana di Radioterapia ed Oncologia Clinica (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 of Radiation Oncology in our country, highlighting the need for a better-defined position in the framework of the School of Medicine core curriculum.

Regular surveys and comparisons over time could be helpful to evaluate the results of AIRO strategies aiming to increase the knowledge of radiotherapy and to create a networking platform for young professionals. With this aim in mind, the results of the survey must be interpreted as a benchmark for future comparisons.

Introduction

Radiotherapy (RT) is 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, thus increasing the therapeutic ratio and the efficacy of [radiotherapy](#) RT.

Despite that, the shortage of radiation oncologists and the low motivation among medical students to choose this discipline and residency program represents a long-standing problem in Italy.

Medical education in Italy currently consists of six years within a Medical School educational programme to become a licensed physician.

The selection process to have access to the residency was held for each single university until 2013. Each Residency School yearly published a notice with a predefined number of available places for interested candidates and both the school and the location were predetermined.

Since 2014, a single announcement is published by the Ministry of University and Research. All the positions available for each medical specialty are reported and assigned among the different Residency Schools active in the country.

Candidates firstly had to compete for few chosen schools at the time of enrolment in the public exam and thus 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 is made after the publication of the merit list, starting from the highest ranking on the list, until all available places are filled.

Furthermore, the resident maintains the possibility to re-participate to the national admission test during the chosen program, changing it after one or two years of training with no disadvantages.

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 measures in the field of RT, specifically for younger members. yAIRO aims also to promote the engagement of medical students and residents in the radiation oncology community, together with the AIRO society and the Professorship Council (2).

yAIRO surveyed online radiotherapy residents to investigate the profiles, the motivations, the knowledge and the needs of younger members and better describe the current characteristics of physicians applying for a residency programme in Radiation Oncology.

Materials and Methods

The questionnaire was specifically designed to investigate demographics, motivations and suggestions to provide a global judgment on the appealing of radiation oncology profession among young residents.

The target 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 completion took about 20 minutes.

The survey was firstly open from May 2021 till 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 for three times (from July to October 2021). The completed questionnaires were collected and analysed 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, in order to assess the understandability and the neutrality of the items.

The initial questionnaire was modified according to the received suggestions.

External reviewers were lastly called to test face-validity , improve contents, wording and flow of the items.

The 28 items were grouped in 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 were used.

Exploratory factor analysis and psychometric properties to estimate internal consistency were not 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.

Checklist for Reporting Results of Internet E-Surveys (CHERRIES) (3) is available in the supplementary materials.

Results

A total of 134 residents responded to the questionnaire, out of a total of 400 residents currently in training (response rate 33,5%).

Demographic characteristics of respondents (Profile A, Table 1)

There were 95 females and 39 males. Thirty-six were from the North, 79 from the Center and 19 from the South of Italy.

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

A significant percentage of responding residents attended the first year of residency school (45.5%), whereas other years were less represented (second 20.8%; third 31.14% and fourth 19.4%, 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 School of Medicine

According to the majority of the residents, 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%).

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 (n. 113, 84%) during their education period.

Q5, Q6 and Q7: Voluntary internship in other Specialties and Degree thesis

The majority of the residents attended voluntary internships in other Specialties (n. 120, 89%). The most frequent answer 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 majority of 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%), despite only 25 residents described it as their first choice (19%).

Eighteen residents stated that radiotherapy was chosen because it was the only available option not to move in another city (13%) and nine residents stated that it was the only available option for them in general (7%).

Q9 and Q10 National Residency Test

A significant percentage (31%) of the residents decided not to report their score of the national admission test. Notably, only six residents (4%) classified among the first 4000, with the majority resulting between 4001 and 12000 (41%) for the four 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, the majority of the residents stated that they are motivated to finish the residency program, with only eighteen residents planning to re-try the national admission test in the next years (13%).

Residents' Knowledge of the Scientific Associations of Radiotherapy (Profile C, Table 3)

Q1, Q2 and Q3 Radiotherapy Scientific Societies knowledge

The majority of the residents stated to have firstly got in contact with the Associazione Italiana di Radioterapia Oncologica (Italian Association of Radiotherapy and Oncology, AIRO), its young section (yAIRO) and the European Society for Radiotherapy and Oncology (ESTRO) only during the residency program (80%, 83% and 85% respectively).

Only a low percentage of the residents stated that they knew these Scientific Societies since the School of Medicine (respectively 11%, 7% and 13%), while a not negligible percentage of the residents stated that they currently do not know these Scientific Societies (8%, 10% and 1% respectively).

Q4 and Q5

The majority of the residents did not ever attend any National Congress of AIRO (n.81, 60%) and about half of the residents stated that they never submitted as author or co-author any scientific abstract to the National Congress (n. 61, 46%).

Discussion

In recent years, the total number of fellowships available to enter residency schools was increased significantly (from 5778 in 2014 to 18847 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). The number of fellowships for radiotherapy Residency School has also increased over time, from 92 in 2014 to 186 in 2021 (Fig. 3) (4).

Due to the advantages of such a high number of available positions, Radiotherapy has increased difficulties in attracting the choices of the national test candidates, regrettably representing one of the less competitive residency programs in this setting.

Over the years, there has been a significant loss of fellowships in radiotherapy for two reasons: some fellowships were not assigned as they were not selected by the successful candidates at the subsequent selection stage; –physicians in specialty training in radiotherapy abandoned the fellowship for another specialty during the education program–.

Considering the last three years, the abandoned or unassigned radiotherapy residency fellowships have been 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. A total of 250 of 822 (30,4%) resident positions in radiotherapy have been lost since 2016 (Fig. 4) (4).

A more detailed analysis shows that, in 2019, amongst the 42 lost positions: 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, amongst the 96 lost positions: 90 (93,8%) were not assigned and 6 (6,2%) were abandoned. The reduction of the participants/fellowships ratio led to an increase in both unassigned and abandoned fellowships (Fig. 5) (4).

This is a worrying trend for Radiation Oncology and will tend to worsen over the years in view of the further reduction in the ratio of participants to the number of fellowships that -is expected for the future and the tendency of admission test candidates to choose Residency Schools deemed more coveted.

The low motivation of Radiotherapy residents and the current dropout rate of Radiotherapy residency programs have been therefore reason of significant concern among the yAIRO steering committee since the very beginning of its activity and urged it to identify, correct and, when possible, prevent the possible causes.

The current position of Radiotherapy teaching in the framework of the School of Medicine study plan represents one of the most significant causes of these results.

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

Similarly, a mandatory internship in Radiotherapy is not foreseen in the majority of the Schools of Medicine, limiting the possibilities of the medical students to become familiar with our discipline, both on the clinical and technological point of view.

Not surprisingly, nearly the total of the interviewed residents (95%) answered that Radiotherapy was not adequately studied during their School of Medicine and this may have had of course significant consequences on their attitude towards the discipline in general.

These disheartening results require a profound reflection on the current teaching of our discipline, highlighting the need for a better defined allocation in the framework of the School of Medicine teachings. This aim must be pursued under the guidance of Italian Professorship of Radiotherapy.

Furthermore, a dedicated internship in this discipline should be encouraged in order to increase the knowledge of radiotherapy among medical students, presenting the different aspects of the discipline and adding value to its unquestionable appeal.

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

To this end, the action plan from the yAIRO consists of several points.

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

It's noteworthy to underline the efforts of European oncology organizations, such as the ~~the~~ European Society for Radiotherapy and Oncology (ESTRO), the European School of Oncology (ESO), ~~the~~ the European Society for Medical Oncology (ESMO), the European Society of Surgical Oncology (ESSO), that have recently proposed cancer education to medical students (5-8).

All these societies, often in collaboration among each other, offer summer courses to medical students to make the medical students familiar with basic cancer knowledge, diagnostic and therapeutic approaches, value of multidisciplinary cancer care.

As an example, ESO-ESSO-ESTRO offered a two-weeks 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 consideration to increase the number of participants potentially interested in the discipline.

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

Despite radiotherapy was considered among the first choices by the majority of the current residents and only a low percentage of the residents state that they are planning not to finish the residency school, the dropout rate has unequivocally raised in the last years, also due to more favourable current odds.

In this regard, the younger radiotherapy residents should be introduced as soon as possible to the yAIRO educational, scientific and professional networking platform in order to show the great potential of this discipline and to be early engaged in a more effective way.

This situation is similar both in Europe (9, 10) and in the rest of the world (11-14), and this phenomenon should be analysed in the context of the current activity of Radiotherapy Scientific Societies.

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

The presence on social networks of national Scientific Societies is currently still inadequate and must be increased with precise strategies in the next years, targeting the multitude of hesitant medical students.

Despite its clear message, this survey presents several limitations.

First of all, the response rate was overall low, notwithstanding two response reminders and three deadline extensions. The low response rate can be conversely considered an answer itself, reflecting a low motivation of the radiotherapy residents in their engagement in the scientific society arena, especially when compared to previous response rates of yAIRO surveys, that ranged between 28% and 56% (15-19). However, to avoid selection bias, current residents were previously informed about the anonymity of the survey results.

Our survey design process did not evaluate particular solutions in terms of content and meaning of underlying domains, but since the survey aimed at evaluating descriptive results, statistical analysis was not performed.

Since the survey invitation was emailed to all the Directors of Radiotherapy Residency programs in Italy, as for the relative reminders, sampling and non-response bias should be recognized for this analysis.

Considering the high drop-out rate in Radiotherapy residency program, residents who aimed at changing residencies could not be interested in answering the survey. Also, the decision to propose a survey instead of a semi-structured interview may have resulted in a low response-rate, but at the same time ensured the anonymity of the participants.

Other bias that can be recognized in the present survey are the items order bias, as we did not randomize the answer options of the questions and recall bias, with some questions regarding events that happened in the professional past of current Residents (i.e.: the National Residency Test, previous Internships and similar).

Regular surveys and comparisons over time are pivotal in order to test and evaluate the results of the yAIRO, AIRO and Italian academic strategies aiming to increase the knowledge and accessibility of radiotherapy in the Schools of Medicine and to create a networking platform for young professionals. With this aim in mind, the results of the survey must be interpreted as a starting point of further developments in the awareness of this urging need.

Tables

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

Table 1: Demographic characteristics of Radiotherapy Residents

Numbers	Questions	N	%
B1	During the Medicine degree, Radiotherapy was adequately studied?		
	Yes	39	29%
	No	95	71%
B2	During the Medicine degree, Radiotherapy was associated with:		
	Radiology	65	49%
	Oncology	38	28%
	Both	27	20%
	Other	4	3%
B3	During the Medicine degree, an internship period in Radiotherapy was mandatory?		
	Yes	35	26%
	No	99	74%
B4	During the Medicine degree, did you attend a voluntary internship in Radiotherapy?		
	Yes	21	16%
	No	113	84%
B5	During the Medicine degree, did you attend a voluntary internship in other Specialties?		
	Yes	120	90%
	No	14	10%

B6	Other Specialty attended internship: Internal Medicine Specialties Oncology Radiology Surgery Specialties Multiple Choices No responders	39 20 1 20 39 15	29% 15% 1% 15% 29% 11%
B7	Discipline of the Degree Thesis Internal Medicine Specialties Oncology Radiology Surgery Specialties Radiotherapy Other No responders	28 22 3 14 12 54 1	21% 16% 2% 10% 9% 41% 1%
B8	Why did you choose Radiotherapy residency school? It was my first choice It was considered among my favourite options, despite not the first choice I chose it because I didn't want to move to another city It was the only available option	25 82 18 9	19% 61% 13% 7%
B9	National Residency Test Score NA Range 1-4000 Range 4001-8000 Range 8001-12000 Range 12001-16000 Range 16001-20000	41 6 30 25 24 8	31% 4% 22% 19% 18% 6%
B10	Will you try again the National Residency Test? No, I want to finish Radiotherapy Residency School Yes, I will try the test again No responders	115 18 1	86% 13% 1%

Table 2: Background of the clinical experience of Radiotherapy Residents

Numbers	Questions	N	%
C1	Do you know European Society for Radiotherapy and Oncology (ESTRO) ? Yes, I knew it during the Graduation Degree Yes, I knew it during the Radiotherapy Residency No	18 114 2	13% 85% 2%
C2	Do you know Italian Association of Radiotherapy and Oncology (AIRO)? Yes, I knew it during the Graduation Degree Yes, I knew it during the Radiotherapy Residency No	15 107 12	11% 9% 80%
C3	Do you know Young Italian Association of Radiotherapy and Oncology (yAIRO)? Yes, I knew it during the Graduation Degree Yes, I knew it during the Radiotherapy Residency No	9 111 14	7% 83% 10%

C4	Did you ever attend National Congress of AIRO?		
	Yes	52	39%
	No	81	60%
	No responders	1	1%
C5	Did you ever submitted Scientific Abstract (Oral Communication or Poster) at National Congress of AIRO?		
	Yes	68	51%
	No	61	45%
	No responders	5	4%

Table 3: Residents' Knowledge of the Scientific Associations of Radiotherapy

Figures

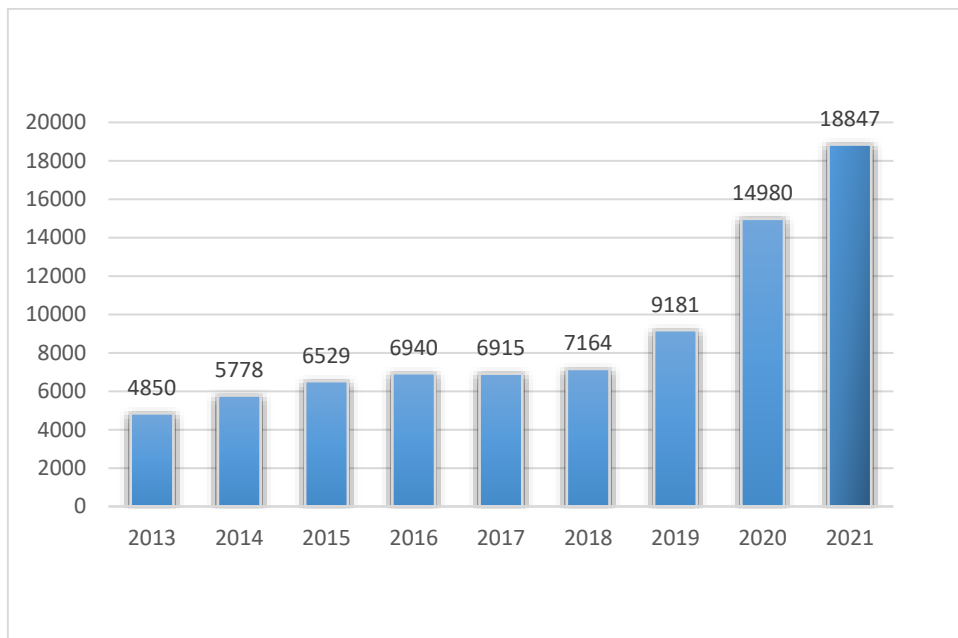


Fig. 1: Available annual fellowships in all Residency Schools

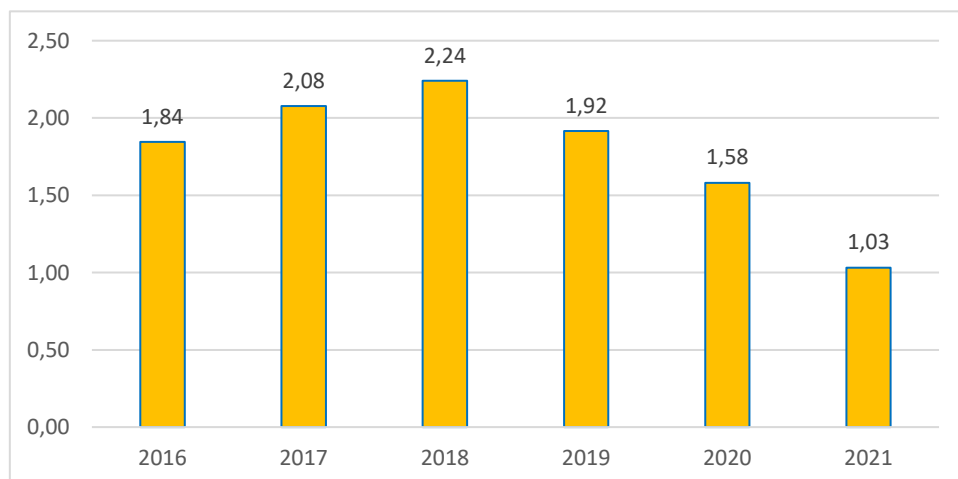


Fig. 2: Ratio total participants / total fellowships

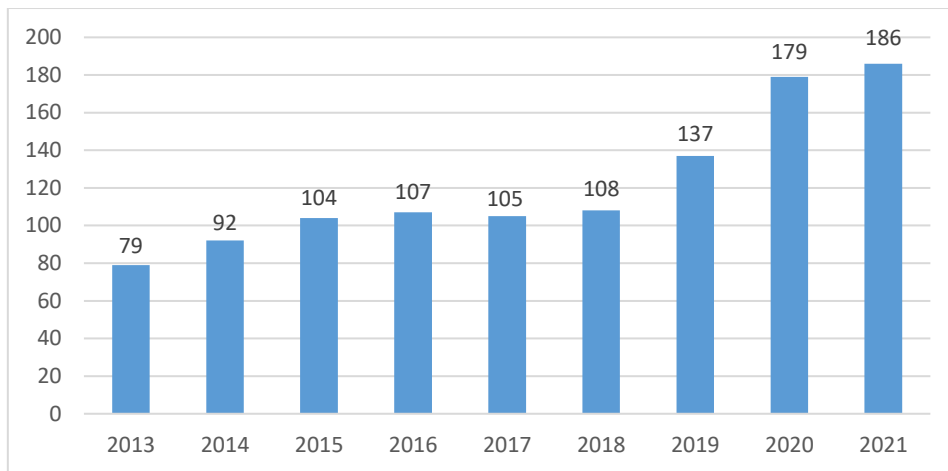


Fig. 3: Available annual fellowships in Radiotherapy

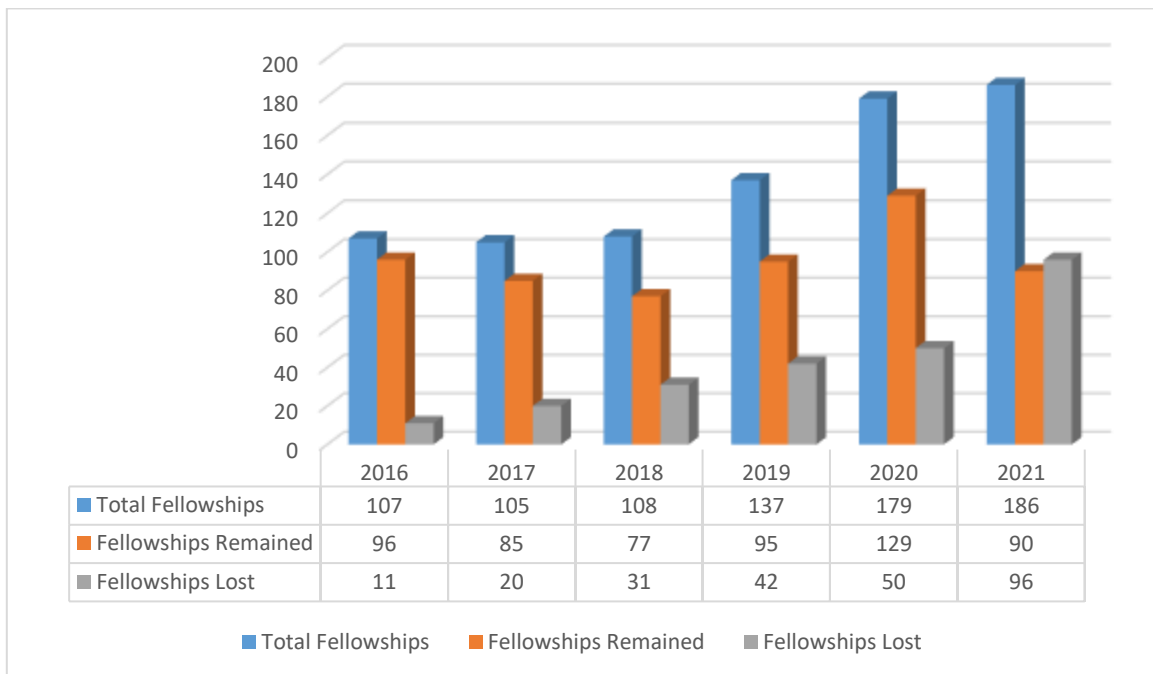


Fig. 4: Summary of fellowships in Radiotherapy from 2016 to 2021

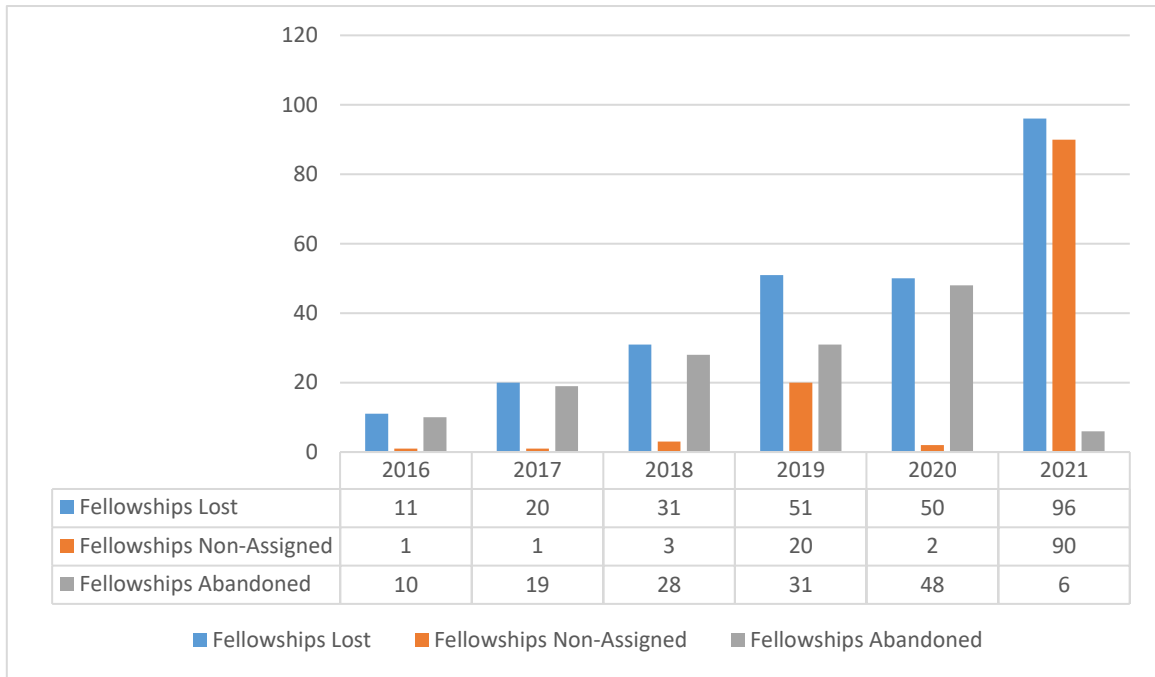


Fig. 5: Fellowships Non-Assigned vs Fellowships Abandoned

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