

# Situation of young radiation oncologists, medical physicists and radiation biologists in German-speaking countries

## Results from a web-based survey of the Young DEGRO working group

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Received: 9 December 2015 / Accepted: 18 May 2016 / Published online: 24 June 2016  
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### Abstract

**Background and purpose** The working group “Young DEGRO” (yDEGRO) was established in 2014 by the German Society of Radiation Oncology (DEGRO). We aimed to assess the current situation of young radiation oncologists, medical physicists and radiation biologists.

**Methods** An online survey that included 52 questions or statements was designed to evaluate topics related to training, clinical duties and research opportunities. Using the electronic mailing list of the DEGRO and contact persons at university hospitals in Germany as well as at four hospitals

in Switzerland and Austria, young professionals employed in the field of radiation oncology were invited to participate in the survey.

**Results** A total of 260 responses were eligible for analysis. Of the respondents 69 % had a professional background in medicine, 23 % in medical physics and 9 % in radiation biology. Median age was 33 years. There was a strong interest in research among the participants; however a clear separation between research, teaching and routine clinical duties was rarely present for radiation oncologists and medical physicists. Likewise, allocated time for research and teaching during regular working hours was often not available. For radiation biologists, a lack of training in clinical and translational research was stated.

**Conclusion** This survey details the current state of education and research opportunities in young radiation oncologists, medical physicists and radiation biologists. These results will form the basis for the future working program of the yDEGRO.

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**Keywords** yDEGRO · Residency · Education · Research · Survey

### Situation junger Mediziner, Physiker und Biologen in der Radioonkologie im deutschsprachigen Raum

Ergebnisse einer webbasierten Umfrage der Arbeitsgruppe „Junge DEGRO“

### Zusammenfassung

**Hintergrund** Die Arbeitsgruppe „Junge DEGRO“ (yDEGRO) wurde 2014 innerhalb der Deutschen Gesellschaft für Radioonkologie (DEGRO) gegründet. Ziel dieser Arbeit ist die Statuserhebung der aktuellen Situation von jun-

gen Ärzten, Physikern und Biologen in der Radioonkologie in Deutschland.

**Methoden** Es wurde eine Onlineumfrage mit 52 Fragen zu den Themen Aus- und Weiterbildung, klinische Tätigkeit und Forschung entwickelt. Mithilfe der elektronischen DEGRO-Mitgliedskartei und Kontaktpersonen an den deutschen Universitätskliniken sowie an 4 Kliniken in Österreich und der Schweiz wurde die Einladung zur Teilnahme an dieser Umfrage per E-Mail an junge Mediziner, Physiker und Biologen in der Strahlentherapie verschickt.

**Ergebnisse** Insgesamt wurden 260 Antworten ausgewertet; 69 % der Teilnehmer waren Mediziner, 23 % Physiker und 9 % Biologen. Das mediane Alter betrug 33 Jahre. Unter den Teilnehmern bestand ein großes Interesse an Forschung, doch eine klare Trennung zwischen Forschung, Lehre und klinischen Routinetätigkeiten war für Mediziner und Physiker selten gegeben. Ebenso waren dezidierte Zeitfenster für Forschung und Lehre selten vorhanden. Im Bereich der Biologie zeichnete sich ein Bedarf in der Aus- und Weiterbildung bezüglich klinischer und translationaler Forschung ab.

**Schlussfolgerung** Diese Umfrage gibt detaillierte Einblicke in die aktuelle Situation junger Ärzte, Physiker, und Biologen bezüglich Aus- und Weiterbildung, klinischer Routine und Forschung in der deutschen Radioonkologie. Die Ergebnisse dieser Umfrage bilden die Grundlage für das zukünftige Arbeitsprogramm der yDEGRO.

**Schlüsselwörter** yDEGRO · Facharztausbildung · Ausbildung · Forschung · Befragung

## Background and purpose

Radiation oncology a cornerstone in the treatment of malignant diseases. The majority of cancer patients receive radiotherapy during their course of disease, either as a part of a uni- or multimodal curative concept [1, 2] or as a palliative measure to reduce the symptomatic burden of advanced disease [3]. Using guidelines for infrastructure and human resources published by the European Society for Radiotherapy and Oncology (ESTRO) and the International Atomic Energy Agency (IAEA), Datta et al. [4] showed that there is a current deficit of 26, 18, 23 and 11 % regarding teletherapy units, radiation oncologists, medical physicists and radiotherapy technologists in 39 European countries, respectively. They estimated the increase of cancer incidence and calculated that by 2020, an additional 1698 teletherapy units, 2429 radiation oncologists, 1563 medical physicists and 2956 radiotherapy technicians would be needed in these countries to meet the increasing patient number [4].

Smith et al. [5] projected that the absolute number of cancer patients receiving radiotherapy during their initial

treatment would increase by 22 % between 2010 and 2020 for the United States population, creating a considerable demand for qualified radiation oncologists, medical physicists, radiotherapy technicians and radiation biologists.

The German Society of Radiation Oncology (DEGRO) was founded in 1995 and originated from a section within the German Röntgen Society. In 2014, the DEGRO had 2,167 members. The largest member group were physicians (73 %), followed by technicians/dosimetrists (14 %), medical physicists (8 %) and biologists (2 %). Of the society members, 111 (5 %) were aged 20–29 years and 359 (17 %) were 30–39 years old [Personal communication from Heide Müller, DEGRO Office].

The DEGRO has performed two prior surveys regarding the situation of radiation oncology residents in Germany in 2006 and 2008, respectively [6, 7]. While the first mainly dealt with recruitment challenges and radiation oncology training in general [6], the second survey focused on residency itself as well as important advantages and drawbacks [7]. While most residents were satisfied with their residency, the majority of respondents stated that training in special techniques, such as stereotactic radiotherapy or intensity-modulated radiotherapy at that time were under-represented in the curriculum and that the organization of the curriculum was suboptimal [7]. Only 41 % felt that they were provided with adequate support and time for academic research [7].

In February 2014, the DEGRO working group Young DEGRO (yDEGRO) was established within the DEGRO. The goal was to establish a representation of the young physicians, physicists and biologists in the field of radiation oncology. As a first step, a survey was generated to gather opinions on the current state of education and training among young radiation oncologists, medical physicists and radiation biologists in Germany.

## Methods

An online survey was developed regarding (1) the future projects of the yDEGRO, (2) participation in activities of the yDEGRO and the DEGRO and (3) the current status of education/training, clinical duties, teaching and research activities for radiation oncologists, medical physicists and radiation biologists. The survey comprised a total of 52 questions or statements, respectively. Of those questions and statements, 22 were general, whereas the rest were specific to the professional background of the participants (13 for medicine, 7 for medical physics and 10 for radiation biology). The survey questions and statements are listed in Table A 1.

An open source software (LimeSurvey GmbH, Hamburg, Germany) was used to generate an online survey. The invi-

**Table 1** Baseline characteristics of the study population

Characteristic	<i>n</i>	%
Median age: 33 years		
<i>Gender</i>	260	100
Female	143	55.0
Male	117	45.0
<i>Professional background</i>	260	100
Medicine	181	69.6
Medical physics	52	20.0
Radiation biology	27	10.4
<i>Membership in professional societies (multiple answers were allowed)</i>	260	100
DEGRO	171	65.8
ESTRO	82	31.5
Other	71	27.3
<i>Employment</i>	260	100
University hospital	190	73.1
Non-university tertiary care center	28	10.8
Non-university primary/secondary care center	5	1.9
Practice	37	14.2
<i>Duration of employment</i>	260	100
0–12 months	45	15.2
13–24 months	34	12.5
25–36 months	50	18.2
27–60 months	101	36.9

tation to participate in the survey was distributed via e-mail. Members of the DEGRO were contacted using the DEGRO electronic mailing list. Furthermore, contact persons were identified at University hospitals in Germany as well as in four hospitals in Austria and Switzerland (Aarau, Vienna, St. Gallen and Zurich) to improve display advertising and enhance the target audience of the survey. These contact persons were instructed to invite all young professionals of their respective departments as well as those from other hospitals and private practices to participate in the survey. Despite younger professionals being the primary target audience, there was no age limit for participation. The survey was open from 3 September 2014 until 31 December 2014.

For statistical analyses, we used Microsoft Excel for Mac 2016 (version 15.14) and SPSS (version 22, IBM SPSS Statistics). To enhance the clarity of the data, we grouped the positive answers “strongly agree” and “agree” unless otherwise stated.

## Results

### Baseline characteristics

There were a total of 387 responses to the survey. After elimination of incomplete responses that included only answers to the general questions (Table A 1), 260 participations were included in this analysis. Baseline characteristics are listed in Table 1. Of respondents 69 % had

a professional background in medicine, 23 % in medical physics and 9 % in radiation biology. Most of the participants (67 %) were employed at university hospitals. Median age was 33 years.

### Scope of yDEGRO activities

Of the respondents 89 % voted that the yDEGRO should be the lobby for the young professionals inside the DEGRO. Promoting the participation of young members in committees and panels of the DEGRO was approved by 82 % of respondents. Additionally, 83 % were in favor of establishing a research network for scientists and clinicians. Building a platform for professional communication and exchange, improvement of working conditions for scientists as well as clinicians and enhancement of continuing education was advocated by 80, 79 and 89 %, respectively.

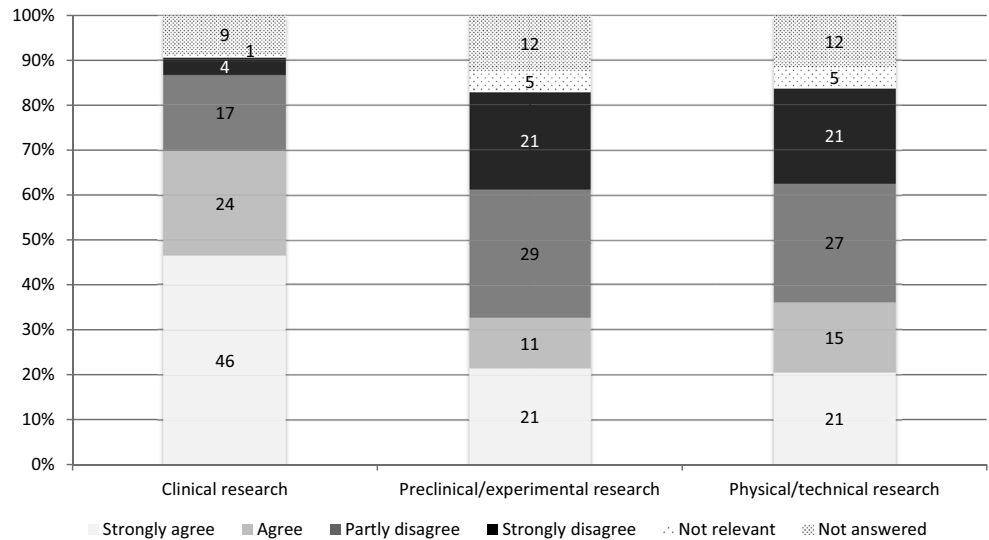
In all, 44 % stated that they were very interested or mostly interested in joining the activities of yDEGRO. The majority (60 %) was willing to contribute to the organization of conferences (e.g. designing and drafting the scientific program, selection of posters and abstracts), while 45 and 33 % were interested in working with the committees and panels within the DEGRO or external guideline committees. Finally 43 % took an interest in establishing a research network, while 39 % cared about founding regional groups within the yDEGRO.

### Research and teaching (radiation oncologists and medical physicists only)

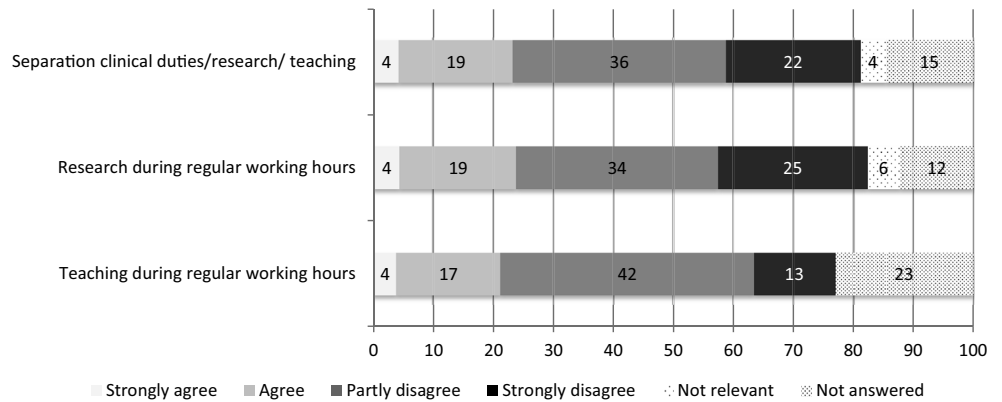
There was a broad interest in research both among employees at university hospitals as well as among those working in other hospitals or private practices (Fig. 1). Overall, 70 % of respondents were interested in clinical research, while 32 % were interested in preclinical/experimental research and 36 % in research relating to physical or technical topics.

As shown in Fig. 2, only 4 % of respondents strongly agreed that there was a complete separation between clinical duties and research or teaching activities, while 22 % strongly disagreed with this statement (25 % of physicians and 14 % of medical physicists). Only 23 % agreed that conducting research was possible during normal working hours on a regular basis (9 % for physicians and 22 % for medical physicists). Similar results were found for teaching activities (21 % agreement overall). Administrative duties were considered a major burden by 55 % of participants (62 % of physicians and 31 % of medical physicists). Only 42 % stated that fees for professional education events or conferences were always or mostly covered by their employer (38 % for physicians vs. 56 % for medical physicists).

**Fig. 1** Question 12 – “Are you interested in clinical research?”; “Are you interested in preclinical/experimental research?”; and “Are you interested in physical/technical research?” for physicians and medical physicists



**Fig. 2** Questions/statements 11, 13 and 14 – “There is a clear separation between clinical duties and research/teaching activities”; “There is an opportunity to perform research during regular working hours”; and “There is an opportunity to perform teaching during regular working hours” for physicians and medical physicists



**Questions specific to radiation oncologists**

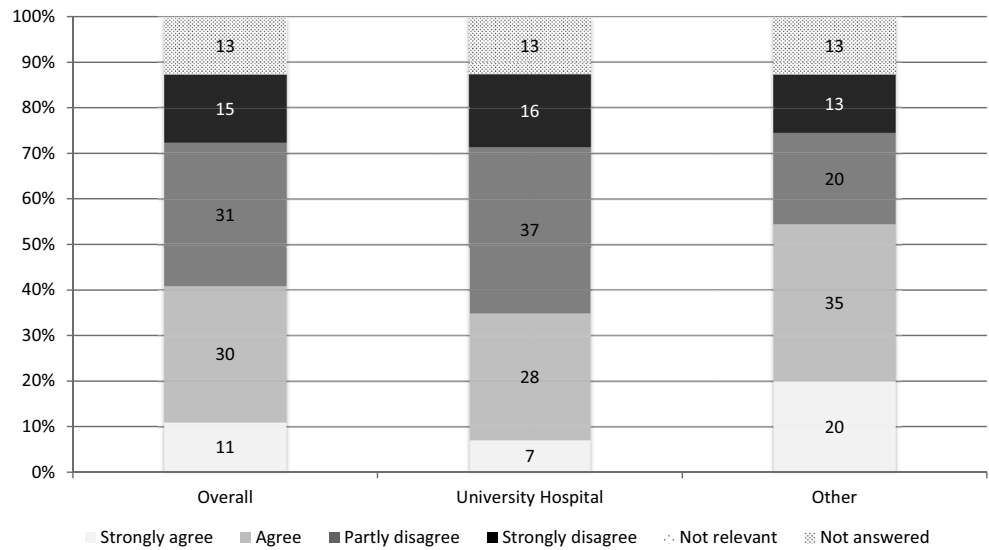
Clinical duties took up most of the working time, only 41 % of respondents felt that these responsibilities taken alone could usually be handled in the regular working hours (35 % for university hospitals vs. 55 % for other employers, Fig. 3). Of the respondents 65 % thought that the required case numbers for board certification could be obtained during the five-year residency without major difficulties. External rotations (i. e. radiology, medical oncology) were rarely feasible with 55 % declaring that there was no regular option to perform such rotations. The mean number of night or weekend shifts per month was 2.3 (range 0–8) with 123 responses (32 %) and 56 % of respondents being satisfied with the number of night/weekend shifts. Regular personal performance/progress meetings were available for 41 % of respondents. General consideration of employee’s suggestions for improvement in the hospital/practice was reported by 8 % of participants, while 16 % stated lack of consideration. The working atmosphere was found mostly positive by 77 %. However, only 34 % felt that there was

an acceptable work–life balance during residency (31 % for university hospitals vs. 43 % for other employers, Fig. 4).

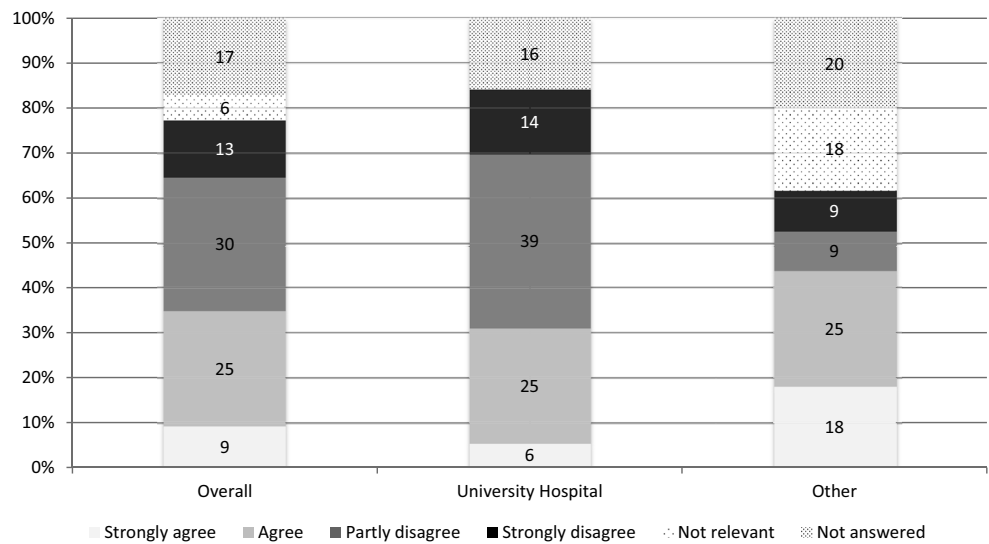
**Questions specific to physicists**

A dedicated program for education and training of medical physicists in radiation oncology at the individual institutions was available in 44 % of the respondents (41 % for university hospitals vs. 47 % for other employers). About half of the participants were satisfied with their education (51 % for university hospitals vs. 40 % for other employers). Handling the daily clinical work during regular working hours was judged as completely or mostly feasible by 44 % of participants (38 % for university hospitals vs. 53 % for other employers), while 40 % stated that this was only occasionally possible. Regular team meetings or individual feedback discussions were held in 68 % of cases and 52 % stated that their ideas for improvement were mostly taken up for discussion.

**Fig. 3** Question/statement 25 – “It is possible to handle the clinical responsibilities during the regular working hours” shown separately for physicians at university hospitals and at other hospitals or private practices



**Fig. 4** Question/statement 24 – “The work–life balance is acceptable” divided by the type of employer for physicians



**Questions specific to biologists**

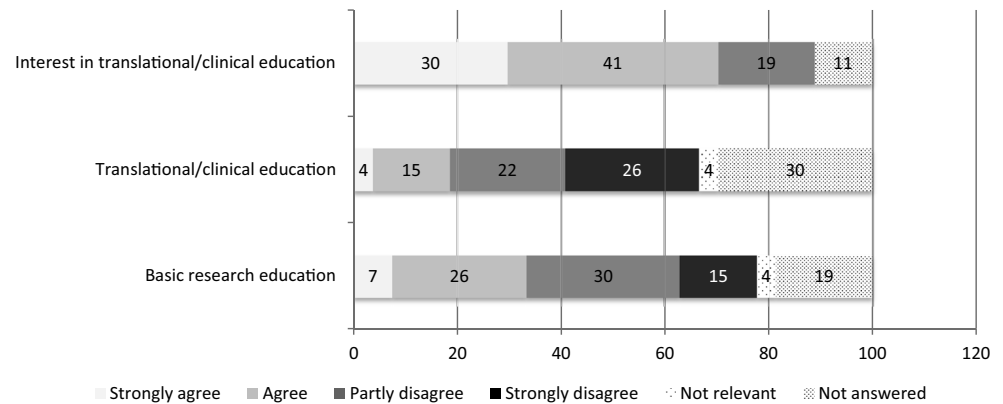
A striking finding in the radiation biology section was a clear discrepancy between the interest of radiation biologists in education related to translational or clinical work and the opportunities available (Fig. 5). While 71 % of participants stated an interest in this area, only 19 % rated their respective education as good and only 33 % were mostly satisfied with the cooperation between scientists and clinicians. With 33 % of positive ratings, the score for education in basic research was better than in the translational/clinical field. In addition, 30 % of participants saw their interests in translational rather than in basic research and in free text questions the majority of answers stated that the cooperation between clinicians and scientists needed to be improved at the institutions and that the DEGRO confer-

ence should cover more radiobiological research to become more attractive for radiation biologists.

**Discussion**

The increasing incidence and prevalence of malignant diseases due to the growing life expectancy in the developed world creates a demand for qualified experts in all oncologic disciplines including radiation oncology [4, 5]. However, there is evidence from both Europe and the United States that suggests that the supply of radiation oncologists might not keep pace with these trends [4, 5]. Similarly, a German survey conducted by the DEGRO showed that 47.1 % of potential providers of residency training in radiation oncology had difficulties in recruiting new personnel [6].

**Fig. 5** Questions/statements 38–40 – “I have a basic interest in translational/clinical training”; “The education and training in the translational/clinical field is satisfactory” and “The education and training in basic research is satisfactory” for radiation biologists



There is a lack of data projecting the need for medical physicists in radiation oncology. A survey performed by the ASTRO in 2007 raised concerns in terms of education in radiation biology because there was a significant decline in teaching experts in radiation biology educators who had received graduate training in radiation biology themselves. Furthermore, the mean age of experts in charge of radiation biology education for residents in radiation biology was 52 years [8].

Previous surveys from Germany and other countries have demonstrated that the satisfaction with the residency and the profession itself is high among radiation oncologists [6, 7, 9]. However, allocation of working time to research and teaching activities was suboptimal.

The results of our survey confirm that there is a high interest in research activities among the respondents. Nevertheless, there is a lack of integration of research and also teaching activities into clinical routine. Several publications suggest that this represents an important obstacle for residents to pursue an academic career in radiation oncology. While results from an American survey among radiation oncologists state that the baseline interest in research may be the most important driver towards an academic career versus private practice, research opportunities during residency and academic pressure and obligations were ranked among the top criteria influencing the career choice [10]. Jagsi et al. [11] presented similar findings, which showed that academic pressures, declining support for research, and bureaucracy were important reasons not to pursue an academic career. The residents' first choice of an academic career varied from 14 to 33 % between 2000 and 2002, while 38 to 54 % stated that they wish to join a private practice [11]. Our survey also shows that the financial support for attending professional education events or conferences is suboptimal as 43.4 % reported minimal or lack of compensation for registration fees or travel costs. This is in line with the findings of a survey conducted among the young members of the Italian Association of Radiation Oncology (AIRO) [12].

Regarding the contents of the residency and training in medical physics, national and international guidelines have been published [13–15]. In one of the previous DEGRO surveys, 71 % of participants stated that there was no designated person in charge of the residency curriculum at their institution [7]. Correspondence of the institutional residency program with the ESTRO recommendations was rated as insufficient by 61.9 % of the respondents in the Italian survey [12]. As shown in our survey, there is room for improvement regarding the professional development of physicians, physicists and radiation biologists including regular individual progress meetings, financial support for professional education and conferences, facilitation of clinical rotations and implementation of educational and teaching programs for physicists.

To our knowledge, there are no specific guidelines for the training of future radiation biologists. Our survey strongly suggests that there are deficits especially in training regarding clinical and translational research. It needs to be mentioned, however, that the total number of participating radiobiologists was comparably low and there may also be a selection bias towards biologists with stronger interest in translational research taking part in our survey. In the AIRO survey, knowledge of radiation biology was described as moderate or poor by 72.1 % of participating physicians [12].

There are some limitations to this survey. The distribution of the invitation through the DEGRO mailing list and contacts at university hospitals has likely lead to an underrepresentation of young professionals employed at nonacademic hospitals and private practices. The interests and demands of this collective might differ from the one included in our analysis, e.g. regarding interest in research. Furthermore, there was no age limit for participation, thus creating heterogeneity in age and stage of professional education. This was, however, a deliberate decision of the yDEGRO to allow maximum inclusion of subjects willing to contribute to the program of the yDEGRO.

In summary, our survey provides important insight into the current situation of training and education in radiation

oncology, medical physics and radiation biology. These findings should be employed to further improve the training and research perspectives of young radiation oncologists, physicists and radiation biologists and will form the basis for the future working program of the yDEGRO.

## Conclusion

Based on the results of this survey, the yDEGRO has proposed a list of activities for the upcoming years. This includes

- improving access to technical information and professional education regarding the residency as well as education for medical physicists and radiation biologists,
- enhancing the interdisciplinary knowledge exchange between physicians, medical physicists and radiation biologists through clinical and research mobility grants,
- establishing a research network (yTrialists) providing the infrastructure to perform clinical and translational studies in conjunction with the Arbeitsgemeinschaft Radio-logische Onkologie and
- facilitating active participation of young physicians, physicists and biologists in committees, working groups, conferences and other relevant activities of the DEGRO.

The feasibility and success of these measures will be determined by performing follow-up surveys on the subject matter.

**Acknowledgements** We would like to thank the DEGRO board for providing financial support for several group meetings as well as for the great general support and trust in the yDEGRO. Furthermore, we would like to thank Heide Müller (DEGRO office) for providing the DEGRO membership characteristics. We thank all members of the yDEGRO as well as all participants to this survey.

## Compliance with ethical guidelines

**Conflict of interest** D. Krug, Rene Baumann, T. Rieckmann, E. Fokas, T. Gauer and M. Niyazi declare that they have no competing interests.

**Ethical standards** The accompanying manuscript does not include any studies on humans or animals performed by any of the authors.

## Appendix

**Table A 1** Survey questions/statements

### General questions

1. How old are you?	
2. What's your gender?	Male, female
3. In what professional setting do you work?	University hospital, tertiary hospital, community hospital, private practice
4. What's your professional background?	Medicine, Medical physics, Biology
5. Do you hold a membership of a professional society?	DEGRO, ESTRO, other (free text)
6. How long have you been working for your current employer?	0–12 months, 13–24 months, 25–36 months, 37–60 months

### Young DEGRO initiative

7. Which activities should the Young DEGRO address in your opinion?	Strongly agree
a) Representation of young member within the DEGRO	Agree
b) Promotion of young member involvement in DEGRO committees and working groups	Partly disagree
c) Establishment of a research network for young scientists and physicians	Strongly disagree
d) Platform for professional communication and knowledge exchange	Not relevant
e) Improvement of working conditions of young physicians and scientists	
f) Improvement of education and training, e. g. specific training opportunities	
8. I would like to actively participate in the activities of the Young DEGRO	
9. Which activities would be of interest to you?	
a) Participation in DEGRO committees and working groups	
b) Participation in external guideline committees	
c) Establishment of a research network	
d) Active participation in programme organization of annual conferences	
e) Establishment of regional groups within the Young DEGRO	
f) Other suggestions (free text)	
10. General comments (free text)	

### Research and teaching

11. There is a clear separation between clinical work, teaching and research.	Strongly agree
12. Are you interested in research?	Agree
a) Clinical research	Partly disagree
b) Preclinical and experimental research	Strongly disagree
c) Physical and technical research	Not relevant
13. There is an opportunity for research during regular working hours	
14. There is an opportunity for teaching during regular working hours	
15. Fees for education events or conferences are covered by the employer	
16. Administrative duties are a major burden	

### Medical profession (physicians only)

17. There is a dedicated education and training programme at the institution	Strongly agree
18. The number of night/weekend duties is acceptable	Agree
19. How many night/weekend duties do you complete per month on average?	Partly disagree
20. The working atmosphere at the institution is good	Strongly disagree
21. The required case numbers for board certification can be obtained during the five-year residency	Not relevant
22. There are possibilities of rotation in related departments (e. g. radiology)	
23. The accessibility and the training quality by senior physicians is satisfactory	
24. The work–life balance is acceptable	
25. It is possible to handle the clinical responsibilities during the regular working hours	
26. There are regular staff meetings	
27. Your suggestions for improvement are addressed	
28. What do you consider particularly positive in your hospital? (free text)	
29. What would you like to change in your hospital and how? (free text)	



**Table A 1** Survey questions/statements (Continued)

<i>Physics profession (physicists only)</i>	
30. There is dedicated education and training programme in your hospital	Strongly agree
31. The education and training programme is satisfactory	Agree
32. The clinical work can be accomplished in the regular working time	Partly disagree
33. There are regular staff meetings held	Strongly disagree
34. Your suggestions for improvement are addressed	Not relevant
35. What do you consider particularly positive in your hospital? (free text)	
36. What would you like to change in your hospital and how? (free text)	
<i>Biology profession (biologists only)</i>	
37. My main interest lies more in translational than in basic research	Strongly agree
38. The education and training in the translational/clinical field is satisfactory	Agree
39. The education and training in basic research is satisfactory	Partly disagree
40. I have a basic interest in translational/clinical training	Strongly disagree
41. The cooperation of clinicians and researchers at our institute is good	Not relevant
42. There are regular staff meetings held	
43. Your suggestions for improvement in the institute are addressed	
44. Participation in the DEGRO conference vs. general scientific conference is more attractive and why? (free text)	
45. What do you consider particularly positive in your institute? (free text)	
46. What would you like to change in your institute and how? (free text)	
<i>DEGRO association (not reported in this publication)</i>	
47. I consider myself well informed regarding the tasks and activities of the DEGRO	Strongly agree
48. The DEGRO education programme is attractive	Agree
49. The DEGRO membership provides an acceptable cost–benefit ratio	Partly disagree
50. Would you be interested in a cost-reduced combined membership of DEGRO and ESTRO?	Strongly disagree
51. What do you consider particularly positive within the DEGRO? (free text)	Not relevant
52. What would you like to change within the DEGRO and how? (free text)	

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