



Original Article

Transition to practice in radiation oncology: Mind the gap

Lara R. Best^{a,b,*}, Arpita Sengupta^{a,b}, René J.L. Murphy^c, Catherine de Metz^{d,e},
Theresa Trotter^f, Shaun K. Loewen^g, Paris-Ann Ingledew^h, Joan Sargeant^{b,c}

^a Department of Radiation Oncology, Nova Scotia Cancer Center, Halifax; ^b Dalhousie University, Halifax; ^c Acadia University, Wolfville; ^d Department of Radiation Oncology, Cancer Centre of Southeastern Ontario, Kingston; ^e Queen's University, Kingston; ^f University of Calgary, Calgary; ^g Division of Radiation Oncology, Tom Baker Cancer Centre, Calgary; and ^h Department of Radiation Oncology, Vancouver Centre, BC Cancer Agency, Vancouver, Canada



ARTICLE INFO

Article history:

Received 25 March 2019

Received in revised form 3 June 2019

Accepted 8 June 2019

Available online 25 June 2019

Keywords:

Medical education

Radiation oncology

Transition to practice

ABSTRACT

Introduction: Physicians entering independent practice often express apprehension in managing the non-clinical aspects of practice. This study examined the perceived preparedness of radiation oncology (RO) residents for independent practice, identified education gaps, and discussed how these deficiencies could be addressed.

Materials and methods: Focus groups with senior RO residents, fellows, new-to-practice radiation oncologists (ROs), and residency program directors were conducted. Data were coded using the Canadian Medical Education Directives for Specialists (CanMEDS) competencies using thematic analysis.

Results: Commonly reported gaps in the transition to practice (TtP) for ROs were lack of experience with: practice management, understanding the structure and function of the health care system and how it varies by jurisdiction, financial planning, effective communication and collaboration with other health care team members, creation of accurate and timely documentation, and radiotherapy problem-solving related to treatment planning and evaluation. Suggestions to address these challenges included use of mentorship, educational resources, courses, simulation-based medical education, improved graded responsibility, resident longitudinal clinics, and formal curricula in radiation therapy planning and evaluation.

Conclusion: There are gaps in TtP education for RO trainees with opportunities for enrichment through the forthcoming implementation of a competency-based medical education framework in 2019. The gap in perceived competency in physician-related radiotherapy tasks may be caused by the complex interaction of clinical workflow processes, people and technology that has led to ineffective integration of trainees. The data are informative to medical education leaders for the development of comprehensive TtP curricula.

Crown Copyright © 2019 Published by Elsevier B.V. All rights reserved. Radiotherapy and Oncology 138 (2019) 126–131

The transition from residency, a trainee role, to that of an independent medical specialist is referred to as the transition to practice (TtP) in medical education. The TtP represents a process rather than a single point in time, of moving from senior resident to independent specialist [1]. It involves a significant difference in the level of work and responsibility of the physician [2]. It is associated with feelings of both achievement for completing training, and apprehension especially regarding non-clinical skills (i.e. teaching, financial and business management, supervision of learners) which many report are not adequately addressed during residency [2–4]. This transition is also associated with emotive

distress, feelings of isolation, with up to 30% of new to practice specialists demonstrating symptoms of burnout [2,5,6].

Provision of optimal preparation can aid in coping with the transition [7]. Suggestions for addressing these concerns during residency include provision of increased responsibility to senior residents to more closely mirror a specialist's workload within an authentic workplace environment, provision of leadership training, increased health advocacy experience and use of mentoring [1–3,8–13]. However TtP curricula have not been a formal component of Canadian training programs, and thus were incorporated using diverse methods and lengths, when implemented at all.

Many societies including the European Board of Radiotherapy of the Union of European Medical Societies (UEMS) with the European Society for Radiotherapy and Oncology (ESTRO) have moved to medical education frameworks such as Competency Based medical Education (CBME), that incorporate non-clinical skills that

* Corresponding author at: Department of Radiation Oncology, Nova Scotia Cancer Center, 5820 University Ave, Halifax, NS B3H1V7, Canada.

E-mail address: Lara.Best@nshealth.ca (L.R. Best).

have been highlighted by the TtP literature, skills perceived as necessary to function within complex collaborative health care systems [14–20]. Canada has adopted a hybrid CBME model that incorporates some time-based elements with Canadian Medical Education Directives for Specialists (CanMEDS)-mapped work-based assessments and a competency-based framework [21]. One of the most notable changes with the CBME education model in Canada is the introduction of a final phase of residency training specifically focused on the TtP [22]. The TtP phase is designed to refine the skills of a Radiation Oncology (RO) resident with the goal of demonstrating competence in managing a RO practice at a consultant level [23].

There is limited literature available to guide selection of skills and competencies to be included in RO specific TtP curricula as multi-speciality studies excluded RO [1,4,6,24,25]. There also remains a lack of consensus as to how a TtP curriculum should be integrated into residency training, how it should be evaluated, and how much time should be devoted to it [1]. Given the deficit in knowledge about TtP specific to RO, the objective of this qualitative study was to examine the perceived preparedness for independent practice that the current residency training programs provide RO residents and to understand the competencies perceived as lacking. This study also examined how perceived gaps in competencies could be addressed with the implementation of a TtP curriculum.

Materials and methods

Qualitative research methods using focus groups, were employed [26,27]. Four stakeholder groups were identified, including residents in the last two years of residency training, fellowship trainees (period of medical training after successful completion of residency), new-to-practice (≤ 3 years from training) ROs, and residency program directors. A separate focus group was conducted with each stakeholder group to avoid influence of other stakeholders' opinions and to provide peer support [28–30]. A pilot test was conducted prior to the first focus group to provide feedback and to fine-tune survey questions. This study obtained research ethics approval.

RO fellowship trainees and residency program directors focus groups were conducted via tele-conference, while the other two (new-to-practice ROs and senior residents) occurred in a face-to-face format. Mixed formats were used to maximize study participation. All groups were invited to participate via email. Those who were interested were given an information pamphlet that contained the study questions one week in advance. Senior RO residents were not given the information ahead of time due to time constraints. The information pamphlet as well as information provided at each focus group session defined TtP as the process of transitioning from the role of senior resident to independent consultant, realizing that this occurred over time.

The focus groups occurred between June 2017 and March 2018. Participants were asked to: (1) Describe the current state of transition to practice for Radiation Oncology at your center; (2) Identify gaps in the current transition to practice phase for Radiation Oncology; (3) Strategize how these gaps in transition to practice can be addressed; (4) Discuss what competencies, skills, knowledge and attitudes should be included in a TtP curriculum; and (5) Discuss how residents can best acquire these competencies. Focus groups continued until no new comments were being generated.

Focus groups were audio recorded and transcribed. The transcripts were analyzed for key themes using thematic analysis and were categorized into two groups: articulated, and emergent [31]. Articulated data specifically addressed the questions posed during

an interview. Emergent data contained unanticipated comments that are often linked to unspoken cultural perspectives or group values. For this study, articulated data were grouped as: details about any current TtP practices, perceived TtP gaps, and suggestions to address the TtP gaps. Data were coded using CanMEDS competencies based on the Royal College Objectives of Training in Radiation Oncology [32]. Coding was completed by the primary investigator and was cross-checked by four of the co-authors.

Results

There were twenty-six participants in the study including 6 senior RO residents (45 invited), 3 RO fellows (12 invited), 5 new to practice ROs (new ROs attending the Canadian Association of Radiation Oncology (CARO) annual scientific meeting (ASM) in 2017 were invited by the CARO ASM committee, with the absolute number invited not divulged by the ASM committee), and 12 RO program directors (16 invited, one participant was a member of a regional RO department but not a RO program director). 11 of the 13 RO training programs in Canada were represented. Six of 11 programs reported having a TtP curriculum that occurred in the final year of training, but TtP content was highly variable and the length ranged from 1 to 12 months.

Twenty gaps identified during the focus group sessions are presented in Table 1 by CanMEDS domain. Five of these are not included in the current objectives of training for Radiation Oncology [32]. The most frequently described gaps, which were discussed by all focus groups, were in the Leader domain (practice management, business management, understanding institutional differences, and implementing strategies to ensure personal practice improvement), the Medical Expert domain (lack of resident involvement in the radiotherapy planning workflow) and the collaborator domain (interaction with, and inclusion of, members of the multi-disciplinary team). None of the groups discussed gaps within the Health Advocate competency domain.

For resident involvement in the radiotherapy planning workflow a residency program director commented that they had 'gotten a lot of feedback about residents' onboard imaging assessments being weak,' while another commented 'assessment of plans; they're [senior residents] not involved with enough.' One new to practice RO commented that 'I'm really having to think about how do I want to simulate patients, how do I want them set up, how do I want them treated, what imaging do I want... during training, it was already basically set up for me and I never had to think about those things.' A fellow commented 'something that I needed to focus on a little bit better was plan approval and plan evaluation,' to which another followed-up with 'we barely did any of that in residency.'

Table 2 shows stakeholders' suggestions on how to improve the educational experience for TtP. All groups discussed personalized mentorship and coaching during TtP, incorporating all CanMEDS domains, and addressing areas not directly covered by the formal curriculum. Other suggestions included use of both formal (i.e. dedicated curricular time such as workshops) and informal (i.e. discussions with staff) teaching, and creation of educational resources such as a handbook to help navigate the intricacies of starting an independent practice.

Suggestions specific to gaps in the Medical Expert domain included increased practice exposure through a resident-driven longitudinal clinic (RLC), managing individual staff clinics with minimal oversight, improved graded responsibility with demonstrated competency, and completing a rotation at a peripheral cancer center. The RLC should include new patient consultations, treatment planning tasks, and ongoing patient follow-up over time with post-clinic review with staff preceptors. Two novel sugges-

Table 1
Perceived gaps discussed by stakeholder groups.

CanMEDS	Competency	Discussed by
Collaborator	Interaction with, and inclusion of, members of the multi-disciplinary team	All groups
Communicator	Accurate and timely documentation of clinical encounters, brachytherapy procedures, and radiotherapy summaries	New ROs, PDs
Leader	Administration related to running an independent practice	Residents, PDs
	Leadership: chairing and participating in rounds, tumor boards, and committees	Residents, PDs
	Understanding physician remuneration, budgeting and financial planning	All groups
	Recognize one's own limits	PDs
	Practice management: setting up & efficiently running a clinical practice	All groups
	Institutional differences: understanding the structure and function of the health care system when a resident started practice in a center outside of that where they trained	All groups
	Implementing strategies to ensure personal practice improvement: contract negotiation and career planning	All groups
	Enacting change	New ROs
	Ultimate responsibility: providing independent care for patients	Fellows, PDs
	Continuity of care: longitudinal practice and patient management	Fellows, new ROs
Medical Expert	Radiotherapy planning workflow: contour review, plan evaluation, quality assurance review, on-treatment or post-treatment imaging assessment, and trouble-shooting issues that arise on the treatment units (i.e. poor soft-tissue match, immobilization concerns, etc)	All groups
	Triaging cases	New ROs
	Completing forms (insurance, completion notes)	New ROs
Professional	Work-life balance, culture in medicine	New ROs, PDs
Scholar	Teaching medical learners	Residents
	Maintenance of certification	PDs
	Processes and requirements for academic promotion	PDs
Other - Mentorship	Lack of provision of mentorship for senior residents and new Radiation Oncologists	Fellows, new ROs

^Topics that are not included in the objectives of training for Radiation Oncology.
New ROs: new to practice ROs.
PDs: RO residency program directors.
*Topics discussed by all stakeholders

tions included the use of simulation-based medical education, especially to improve exposure to radiotherapy plan evaluation and trouble-shoot treatment related issues, and use of a radiotherapy planning curricular block. The radiotherapy planning curricular block could incorporate protected time in which a resident's responsibilities would focus on peer review, addressing issues at the simulator and treatment units, and radiation therapy plan review. Other suggestions to improve the TtP included provision for on-boarding or orientation packages for new-to-faculty individuals, use of peer support for new staff, and a list of 'success tips' that could be provided to senior residents.

Discussion

The highest numbers of perceived gaps per CanMEDS domain were within the Leader and Medical Expert domains. There was less discussion within Collaborator, Communicator, Scholar, and Professional domains and there was none regarding the Health Advocate role. Our findings are similar to previously published

Table 2
Suggestions to address the perceived gaps in the TtP.

Area for Improvement	Suggestions
<i>Leader</i>	
Practice management	Formal & informal teaching, RLC, manage a staff's practice, mentorship
Business and financial management	Formal and informal teaching, educational resources, mentorship
<i>Medical Expert</i>	
Radiation planning process	More exposure, graded responsibility, simulation, informal teaching, formal teaching, mentorship, self-directed, dedicated curricular block
Ultimate responsibility, longitudinal patient management	RLC, graded responsibility, manage a staff's practice, simulation, informal teaching, self-directed, rotation at a community/peripheral center
Contract negotiation & career planning	Formal teaching, mentorship
<i>Scholar</i>	
Academic promotion	Formal teaching
Teaching medical learners	Graded responsibility, formal teaching experience
<i>Other</i>	
Other suggestions to improve the TtP process	On-boarding/orientation packages for new hires, mentorship for residents and new staff physicians, peer support, resident business cards, list of 'success tips'

reports, which tended to exclude radiation oncology, where the Leader domain, and to a lesser extent Collaborator, Scholar and Professional domains are heavily represented [2-4,6,9,11,24,33-35]. Radiation oncology TtP specific articles are lacking, although the 2017 survey of Canadian RO residents found that 43% felt unprepared to be competitive in the job market, with 79% planning to pursue a post-residency fellowship [36]. Likewise a survey of radiation oncology trainees and junior faculty and related disciplines from 34 European countries found that 26% felt that their national education program was insufficient [37].

There was significant overlap in the perceived gaps voiced by the stakeholder groups, but the perspectives differed, as were the topics that were most discussed (Table 3). For each stakeholder group, the five most discussed topics are listed in descending order. Similarities were noted in the groups that were in the 'pre-practice' position (residents, fellows) versus the 'post-practice' position (new ROs, program directors). The pre-practice group spent a longer period discussing perceived gaps linked to concerns foreseen for the immediacy of transitioning such as understanding physician remuneration, budgeting, financial planning, contract negotiation and career planning, concerns around the nuances of the initial process of setting-up a practice and concerns around institutional differences. In contrast, the post-practice group also discussed more novel perceived gaps, including communication with other health care providers, physician wellness and sustainable practice, creation and maintenance of professional curriculum vitae, and maintenance of specialty certification. The differences seen between these two groups reaffirms the need to include all stakeholders in the decision making process when considering a TtP curriculum, as each provides a different perspective and suggestions for improvement that may not otherwise be considered.

Taken together this aligns with adult learning theory, as each stakeholder group discussed gaps from the lens of their current experiences [38]. This is most evident from the discussion of the new ROs who have experienced the spectrum of TtP, and are the closest to the process. Many of their comments focused on their

Table 3
Most discussed perceived gaps in the TtP.

	CanMEDS core competency	5 most commonly discussed competencies
Program directors and CBD committee	Communicator	Creation/provision of clear, precise, appropriate records of clinical encounters and treatment plans
	Leader	Practice management – setting up & efficiently running a clinical practice
	Medical Expert	Ultimate responsibility – providing independent care for patients, time management
	Leader	Understanding physician remuneration, budgeting and financial planning
	Medical Expert	Radiation planning process
New ROs	Leader	Understanding physician remuneration, budgeting and financial planning
	Leader	Institutional differences – understanding the structure and function of the health care system, and how it varies by jurisdiction
	Leader	Practice management – setting up & efficiently running a clinical practice, time management
	Collaboration	Working with other health professionals to work as part of an effective team
	Medical Expert	Radiation planning process
RO fellows	Medical Expert	Radiation planning process
	Leader	Practice management – setting up & efficiently running a clinical practice
	Leader	Contract negotiation and career planning
	Leader	Institutional differences – understanding the structure and function of the health care system, and how it varies by jurisdiction
	Leader	Practice management – setting up & efficiently running a clinical practice
Senior RO residents	Leader	Understanding physician remuneration, budgeting and financial planning
	Leader	Contract negotiation and career planning
	Leader	Institutional differences – understanding the structure and function of the health care system, and how it varies by jurisdiction
	Leader	Radiation planning process
	Medical Expert	Radiation planning process

current lived-in experiences, instead of the challenges they perceived while a resident. This provides support for the concept of transition as a process, and not a moment in time [1].

A notable finding in this study was the reported gap in the Medical Expert domain, with all stakeholders reporting a lack of resident involvement in the radiotherapy planning workflow, a core competency of independent practice (this included radiotherapy simulation details, plan evaluation, and on-treatment assessments). These are also listed as competencies in the ESTRO core curricula [19]. This perceived gap may arise from operational challenges with integrating residents into the radiotherapy planning processes. The radiotherapy treatment planning system (TPS) enables planning tasks within an electronic task-based clinical workflow scheduler to be assigned to key personnel so that as each task is completed, the next task is automatically assigned to the

appropriate person. Tasks are usually assigned at the time of radiotherapy simulation and imaging acquisition with all RO tasks (contouring, plan review, on-board imaging review and at some centers peer review) being allocated to the primary RO. Residents may not be directly integrated into physician tasks but do have access to the primary RO's task list. This process often leads to completion of tasks by the staff RO without a resident knowing it was available, which can unintentionally limit opportunities for resident case-based learning and treatment decision-making. The challenges with assigning residents to RO workflow tasks can also lead associated health professions to preferentially contact staff ROs for treatment related questions or concerns instead of involving residents. The problems with technology suggest it may interfere with resident integration and learning opportunities during the radiotherapy planning process, but it is not felt to represent a deficiency in understanding the principles of planning and delivery. Improved trainee integration, and graded responsibility opportunities can help address some of these concerns, although one must still consider clinical workflow efficiency.

One suggestion to improve resident exposure to radiation therapy planning decision making and direct patient care was to establish a resident longitudinal clinic (RLC), a clinic structure which is more common in medical oncology [39]. Two Canadian programs discussed the successful implementation of an RLC in their residency programs that was well received by residents. However, there are potential roadblocks to implementation including logistical (clinic space, nursing and administrative support), and medico-legal concerns (ensuring a most responsible specialist is assigned to each patient).

Two other suggestions included a dedicated radiation planning block and use of simulation-based teaching methods. Simulation-based medical education provides learners with opportunities to practice skills and acquire knowledge in realistic settings, increase exposure to less frequently encountered experiences, learn from structured feedback, and enhance reflection [40]. One Canadian center created a database of treatment plan evaluation cases for resident learning, for which data regarding impact on learning is pending [41]. Both simulation and a dedicated radiation planning block put the radiation planning process at the center of the learning experience, thus promoting educational experiences around the nuances of radiation treatment decision-making. Since both are novel education components, implementation would require creation of new curricula with competency-mapped objectives and evaluations that are contextual, valid and reliable [42,43].

Many of the suggestions put forth by the study participants to address perceived competency gaps have similar themes to the reported literature. These include increased responsibility for senior residents to allow for learning conditions that more closely mirror a specialist workload, provision of leadership or teaching training, and mentoring [1–3,8–13,39,44]. Another common suggestion was the use of workshops or formal courses, especially for increasing exposure to practice management, physician remuneration, budgeting and financial planning [8,9,12]. Participants suggested that many of these topics could also be incorporated into learning opportunities that already exist for senior RO residents including annual refresher/review courses, educational events at annual scientific meetings, and through workshops held by medical education departments.

Some suggestions could be easily implemented without requiring specific curricular time, such as providing transitioning residents with a compilation of 'success tips' and informal discussions with specialists and other health professionals around radiation specific topics, practice management and business management. Maximizing elective resident rotations at other centers may increase exposure to institutional differences, variations in clinical management, and different treatment methods and tech-

niques. Currently residency programs allow for this, although the uptake among residents and residency programs is variable.

Support for new-to-practice ROs was also discussed. Onboarding programs, and peer mentorship have been reported previously, with perceived benefit [12,13,45]. Mentorship is linked to improved care quality, patient safety, and increased confidence, job satisfaction, working relationships, while decreasing stress and burnout [1,12,13,45].

We acknowledge that the study has inherent weaknesses. Canada has a public healthcare system of which 70% of radiation oncologists work within an academic health sciences center (AHSC), 14% within a non-AHSC teaching hospital, with the remainder in administrative or blended roles [46]. Given this is a Canadian study aimed at TtP education to guide curricular development for CBME, the applicability to other locales could be questioned. Following the ESTRO core curriculum release in 2011, many European countries have transitioned to CBME already, and may have already grappled with and overcome some of these concerns [19,37]. However, from the results of the European questionnaire published by Bibault et al. there remain areas that could be improved, although the details of what deficiencies were perceived in the European radiotherapy curricula remains unclear, especially if the perceived gaps fall within the transition to practice [37].

The study employed a representative sample of key stakeholders and may not have generated a comprehensive list of ideas. The medium to conduct the focus groups varied with face-to-face or tele-conference interactions due to logistical, financial, and time constraints of the study. Also, the senior residents did not receive the questions in advance which may have reduced the time for deliberation of ideas prior to the focus group. Given this is qualitative research, it is challenging to quantify responses into what is deemed most important as all responses are perceived as having value.

This study identified key areas, particularly in the Medical Expert and Leader CanMEDS domains that could be improved during TtP experiences, and uncovered possible innovative methods to address them. Many of these competencies could be introduced on a spectrum of graded responsibility, with introduction in earlier phases of competency based medical education with scaffolding of learning leading to full competence by the time a trainee completes the TtP. The information should serve as a valuable resource for educators to address specific needs and enable future graduates to start their careers more confidently as independent practitioners in radiation oncology.

Declaration of Competing Interest

None.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.radonc.2019.06.012>.

References

- [1] Yardley S, Westerman M, Bartlett M, Walton JM, Smith J, Peile E. The do's, don't and don't knows of supporting transition to more independent practice. *Perspect Med Educ* 2018;7:8–22.
- [2] Westerman M, Teunissen PW, van der Vleuten CP, Scherpbier AJ, Siegert CE, van der Lee N, et al. Understanding the transition from resident to attending physician: a transdisciplinary, qualitative study. *Acad Med* 2010;85:1914–9.
- [3] Beckett M, Hulbert D, Brown R. The new consultant survey 2005. *Emerg Med J* 2006;23:461–3.
- [4] Morrow G, Burford B, Redfern N, Briel R, Illing J. Does specialty training prepare doctors for senior roles? A questionnaire study of new UK consultants. *Postgrad Med J* 2012;88:558–65.
- [5] Westerman M, Teunissen PW, Fokkema JP, van der Vleuten CP, Scherpbier AJ, Siegert CE, et al. The transition to hospital consultant and the influence of preparedness, social support, and perception: a structural equation modelling approach. *Med Teach* 2013;35:320–7.
- [6] Dijkstra IS, Pols J, Remmelts P, Brand PL. Preparedness for practice: a systematic cross-specialty evaluation of the alignment between postgraduate medical education and independent practice. *Med Teach* 2015;37:153–61.
- [7] Teunissen PW, Westerman M. Opportunity or threat: the ambiguity of the consequences of transitions in medical education. *Med Educ* 2011;45:51–9.
- [8] Blumenthal DM, Bernard K, Bohnen J, Bohmer R. Addressing the leadership gap in medicine: residents' need for systematic leadership development training. *Acad Med* 2012;87:513–22.
- [9] Brouns JW, Berkenbosch L, Ploemen-Suijker FD, Heyligers I, Busari JO. Medical residents perceptions of the need for management education in the postgraduate curriculum: a preliminary study. *Int J Med Educ* 2010;1:76–82.
- [10] Busari JO, Berkenbosch L, Brouns JW. Physicians as managers of health care delivery and the implications for postgraduate medical training: a literature review. *Teach Learn Med* 2011;23:186–96.
- [11] Card SE, Snell L, O'Brien B. Are Canadian General Internal Medicine training program graduates well prepared for their future careers? *BMC Med Educ* 2006;6:56.
- [12] Higgins R, Gallen D, Whiteman S. Meeting the non-clinical education and training needs of new consultants. *Postgrad Med J* 2005;81:519–23.
- [13] Sachdeva AK, Flynn TC, Brigham TP, Dacey Jr RC, Napolitano LM, Bass BL, et al. Interventions to address challenges associated with the transition from residency training to independent surgical practice. *Surgery* 2014;155:867–82.
- [14] Al Bu Ali WH, Balaha MH, Kaliyadan F, Bahgat M, Aboulmagd E. A framework for a competency based medical curriculum in Saudi Arabia. *Mater Sociomed* 2013;25:148–52.
- [15] NHS Institute for Innovation and Improvement, Academy of medical Royal Colleges. Medical Leadership Competency Framework. 3rd ed. University of Warwick Campus, Coventry, UK: NHS Institute for Innovation and Improvement, Coventry House; 2010.
- [16] Frank JR, Danoff D. The CanMEDS initiative: implementing an outcomes-based framework of physician competencies. *Med Teach* 2007;29:642–7.
- [17] Frank JR, Snell L, Sherbino J. CanMEDS 2015 Physician Competency Framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.
- [18] Accreditation Council for Graduate Medical Education. ACGME Common Program Requirements. USA: Accreditation Council for Graduate Medical Education; 2016.
- [19] Eriksen JG, Beavis AW, Coffey MA, Leer JW, Magrini SM, Benstead K, et al. The updated ESTRO core curricula 2011 for clinicians, medical physicists and RTTs in radiotherapy/radiation oncology. *Radiother Oncol* 2012;103:103–8.
- [20] ten Cate O, Scheele F. Competency-based postgraduate training: can we bridge the gap between theory and clinical practice? *Acad Med* 2007;82:542–7.
- [21] Royal College of Physicians and Surgeons of Canada. Competence by Design: Reshaping Canadian Medical Education. Ottawa 2014. <http://www.royalcollege.ca/rcsite/documents/educational-strategy-accreditation/royal-college-competency-by-design-ebook-e.pdf>.
- [22] Royal College of Physicians and Surgeons of Canada. CanMEDS 2015 CBD competence continuum 2015. <http://www.royalcollege.ca/rcsite/documents/cbd/cbd-competence-continuum-diagram-legal-e.pdf>.
- [23] Royal College of Physicians and Surgeons of Canada. Radiation oncology training experiences. <http://www.royalcollege.ca/rcsite/documents/ibd/radiation-oncology-rte-training-experiences-e.pdf>.
- [24] Crosson FJ, Leu J, Roemer BM, Ross MN. Gaps in residency training should be addressed to better prepare doctors for a twenty-first-century delivery system. *Health Aff (Millwood)* 2011;30:2142–8.
- [25] Morrow G, Illing J, Redfern N, Burford B, Kergon C. Are specialist registrars fully prepared for the role of consultant? *Clin Teach* 2009;6:87–90.
- [26] Sim J. Collecting and analysing qualitative data: issues raised by the focus group. *J Adv Nurs* 1998;28:345–52.
- [27] Yazan B. Three approaches to case study methods in education: Yin, Merriam, and Stake. *Qual Rep* 2015;20:134–52.
- [28] Barbour RS. Making sense of focus groups. *Med Educ* 2005;39:742–50.
- [29] Diccio-Bloom B, Crabtree BF. The qualitative research interview. *Med Educ* 2006;40:314–21.
- [30] Stalmeijer RE, McNaughton N, Van Mook WN. Using focus groups in medical education research: AMEE Guide No. 91. *Med Teach* 2014;36:923–39.
- [31] Massey OT. A proposed model for the analysis and interpretation of focus groups in evaluation research. *Eval Program Plann* 2011;34:21–8.
- [32] Royal College of Physicians and Surgeons of Canada. Objectives of Training in the Specialty of Radiation Oncology. <http://www.royalcollege.ca/cs/groups/public/documents/document/ltaw/mtyx/-edisp/rcp-00161417.pdf>.
- [33] Li ST, Tancredi DJ, Schwartz A, Guillot AP, Burke AE, Trimm RF, et al. Competent for unsupervised practice: use of pediatric residency training milestones to assess readiness. *Acad Med* 2017;92:385–93.
- [34] Lynch DC, Pugno P, Beebe DK, Cullison SW, Lin JJ. Family practice graduate preparedness in the six ACGME competency areas: prequel. *Family Med* 2003;35:324–9.
- [35] McDonnell PJ, Kirwan TJ, Brinton GS, Golnik KC, Melendez RF, Parke 2nd DW, et al. Perceptions of recent ophthalmology residency graduates regarding preparation for practice. *Ophthalmology* 2007;114:387–91.

- [36] Wang M, Loewen SK, Giuliani ME, Fairchild AM, Yee D, Debenham BJ. Results from the 2017 survey of radiation oncology residents in Canada. *Int J Radiat Oncol Biol Phys* 2018;102:e398–9.
- [37] Bibault JE, Franco P, Borst GR, Van Elmpt W, Thorwhart D, Schmid MP, et al. Learning radiation oncology in Europe: Results of the ESTRO multidisciplinary survey. *Clin Transl Radiat Oncol* 2018;9:61–7.
- [38] Kaufman DM, Mann KV. Teaching and learning in medical education: how theory can inform practice. In: *Understanding Medical Education: evidence, theory and practice*. Malden MA: Wiley Blackwell; 2014. p. 7–29.
- [39] Croke JM, Vickers MM, E C, Heng DY, Reaume MN, Song X, et al. Continuity clinics in oncology training programs in Canada. *Curr Oncol* 2012;19:e329–42.
- [40] Younan HC. Simulation-based medical education to improve intrinsic motivation in medical students. *Adv Med Educ Pract* 2017;8:31–2.
- [41] Adleman J, Winter J, Purdie TG, McNiven AL, Croke JM. Creation and implementation of high-fidelity computer-based simulation to improve resident competency in radiation therapy treatment plan evaluation. *Int J Radiat Oncol Biol Phys* 2018;102:e383–4.
- [42] Bordage G, Harris I. Making a difference in curriculum reform and decision-making processes. *Med Educ* 2011;45:87–94.
- [43] Palaganas JC, Rock LK. Simulation-enhanced interprofessional education: a framework for development. In: Palaganas JC, Maxworthy JC, Epps CA, Mancini ME, editors. *Defining excellent in simulation programmes*. China: Wolters Kluwer; 2015. p. 108–19.
- [44] Lister JR, Friedman WA, Murad GJ, Dow J, Lombard GJ. Evaluation of a transition to practice program for neurosurgery residents: creating a safe transition from resident to independent practitioner. *J Grad Med Educ* 2010;2:366–72.
- [45] Griffin A, Abouharb T, Etherington C, Bandura I. Transitional to independent practice: a national enquiry into the educational support for newly qualified GPs. *Educ Primary Care* 2010;21:299–307.
- [46] Canadian Medical Association. *Radiation Oncology Profile. CMA Specialty Profiles* 2018. <https://www.cma.ca/sites/default/files/2019-01/radiation-oncology-e.pdf>.