3 Education and Training

Sandra Turner, Zvi Symon, and Jesper Grau Eriksen

3.1 Introduction

The links between health professional education and training, patient outcomes and organisational quality and safety within health systems are well established [1–3]. Consequently, ensuring high-quality evidence-based education for all radiation oncology professionals is crucial in optimising cancer patient care, particularly for those undergoing radiation therapy.

Supplementary Information The online version contains supplementary material available at [https://doi.org/10.1007/978-3-030-91170-6_3].

S. Turner (✉)
Western Sydney Radiation Oncology Network, Westmead Hospital, Westmead, NSW, Australia
e-mail: sandra.turner1@optusnet.com.au

Z. Symon
Chair Radiation Oncology, Sheba Medical Center, Tel Hashomer, Ramat Gan, Israel
e-mail: symonz@sheba.health.gov.il

J. Grau Eriksen
Department of Experimental Clinical Oncology, Aarhus University Hospital, Aarhus N, Denmark

Department of Oncology, Research 2, Aarhus University Hospital, Aarhus N, Denmark
e-mail: jesper@oncology.au.dk

3.2 Theoretical Background

Explicit competency- (or learning outcome-) based curricula are a recognised requirement for effective health professional learning [4, 5]. Such curricula must be supported by structured training programmes providing the full scope of opportunities for learning, appropriate supervision and assessment of progression and competence. Curriculum frameworks such as CanMEDS (Canadian Medical Education Directives for Specialists) support the design of such curricula [6], including for radiation oncology training [7, 8]. Modern curriculum frameworks serve to highlight the multiple overlapping roles of health professionals in addition to their core expertise, e.g. medical expertise for doctors, physics knowledge and skills for medical physicists, and so on (Fig. 3.1).

By way of example, some skills to be mastered by training radiation oncologists in managing breast cancer and the links to the CanMEDS Medical Expert and other ('Intrinsic') roles are shown in Table 3.1.

It is important to recognise that education is an on-going commitment for all health professionals in order to maintain currency and expertise. Life-long learning is of utmost relevance to the field of radiation oncology due to its rapid and continual evolution.

O. Kaidar-Person et al. (eds.), *Breast Cancer Radiation Therapy*,
https://doi.org/10.1007/978-3-030-91170-6_3

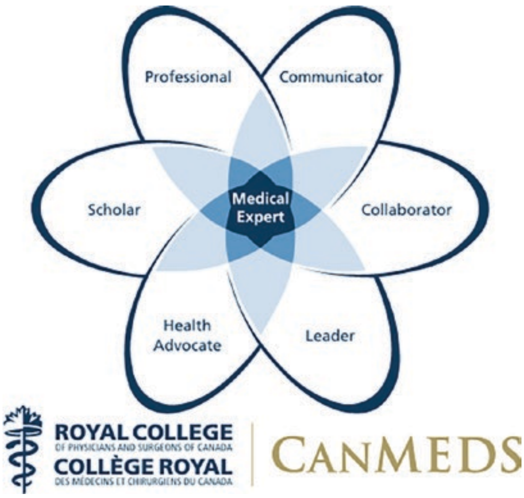

Fig. 3.1 CanMEDS diagram showing the multiple roles of the medical specialist. (Copyright © 2015 The Royal College of Physicians and Surgeons of Canada. http://www.royalcollege.ca/rcsite/canmeds/canmeds-framework-e. Reproduced with permission)

Table 3.1 Example radiation oncologist competencies and corresponding CanMEDS roles

Competence	CanMEDS role/s
Assessing a new patient for breast radiation therapy	Medical expert, communicator
Presenting a patient & actively participating in a breast cancer multidisciplinary meeting	Medical expert, collaborator, advocate, scholar
Contouring target volumes & organs/structures at risk for a course of breast radiation therapy	Medical expert
Recruiting & consenting a woman with breast cancer to a clinical trial	Medical expert, communicator, scholar
Managing psychosocial/sexual &/or cultural issues relating to change in body image following breast cancer treatment	Medical expert, communicator, professional
Participating in a quality improvement project (e.g. to streamline bookings for breast radiation therapy at your centre)	Collaborator, leader

3.3 Foundational Oncology Sciences

All radiation oncology professionals require education in the sciences underlying the safe practice of oncology including planning and delivery of radiation therapy. The different radiation oncology professional team members need varying levels of expertise across the subjects of cancer/radiation biology, radiation physics, oncological anatomy including imaging techniques and pathology.

3.4 Core Requirements for Training Institutions/Departments

Training institutions should be accredited in accordance with national and/or international regulations. The training institution, either alone or in cooperation with other regional departments, must be adequately equipped to support both the workload and range of radiation oncology services required for training professionals in state-of-the-art breast radiation oncology. If such minimum requirements cannot be met by a single institution, several training institutions should offer an integrated programme that meet the minimum requirements.

For standardising work-place-based training and ensuring that minimum competences are reached, the programme should be founded on a nationally or internationally recognised core curriculum (or both). Training departments must also facilitate access to a formal programme of theoretical learning and provide resources to ensure trainees gain the knowledge they require. International courses dealing with clinical and/or technical skills in the management of breast cancer may add value to the local radiation oncology breast cancer curriculum [9].

The human resources necessary for high-quality education are vitally important. Qualified trainers (radiation oncologists, radiation physicists and radiation therapists) that educate trainees should be sufficient in number to provide continuous training and easy access to supervision. It is advised that medical trainees are exposed to several radiation/clinical oncologists that have different perspectives on the content being learned. Furthermore, it is recommended that trainers themselves undergo ongoing training in supervision and teaching methods in order to maintain a high pedagogical level of training delivery [9].

3.5 Requirements for Work-Place-Based Clinical and Technical Education

In order to receive comprehensive training, the radiation oncology trainee should be exposed to an adequate case-mix and a sufficient number of breast cancer patients to mirror the full spectrum of disease. Thus, trainees must have access to patients at all stages of cancer—from early diagnosis to completion of follow-up as well as in terminal care. It is important that the trainee requires the hands-on experience in all practical procedures that is required to work independently as a future specialist. Such skills are wide-ranging, for example, the ability to lead a breast cancer multidisciplinary team conference, mastering difficult conversations with patients, being aware of acute and late morbidities and how to manage these, as well as having the appropriate technical skills in delineation and planning of breast cancer radiation therapy. Preferably, training should take place in departments that actively participate in breast cancer research in order that trainees be exposed to practical challenges of acquiring scientific data and to facilitate skills in critical appraisal of the scientific literature [9].

3.6 Assessment of Learning

Although summative evaluation (e.g. formal examinations) has value in driving learning, it cannot stand alone in modern work-place-based education. Formative assessment that evaluates progression in line with curriculum competencies (knowledge, skills and attitudes) is even more important and allows timely and repeated feedback to the trainee. In addition, formative assessments help determine if the trainee can be granted additional responsibility in their daily work. Milestones and Entrusted Professional Activities (EPAs) have developed as useful tools to ascertain such progress, i.e. does the trainee have the required competencies to be entrusted to work more independently or to aim at acquiring higher level skills? [10]. An example of an EPA for breast cancer radiation oncology is shown in Table 3.2.

Formative evaluation can be achieved in a variety of ways, for instance direct observation during a work procedure with structured feedback from a supervisor, audit of learning portfolios and applying multisource feedback tools. These assessment methods are very reliable for testing practical skills and other competencies. Such evaluations need to be performed regularly throughout training in order to be most effective. Formative work-place-based evaluation and summative assessment are complementary and can supplement each other when applied in a balanced way [11].

3.7 Effective Educational Methods

A central challenge in educating members of any team is to address both the lack of knowledge and skill of the novice and the, sometimes misguided, assuredness of the experienced mem-

Table 3.2 Example of an entrusted professional activity (EPA) for breast cancer management

Milestone: The trainee can independently evaluate a radiation treatment plan for breast cancer
EPA: Independent plan evaluation
Assessed by direct structured observation by a supervisor including discussion of (but not limited to): • Indication for radiation therapy, dose and fractionation • Previous radiotherapy or contraindications • Is positioning appropriate for the target in question? • Evaluation of target volumes (TV) and organs at risk (OAR) delineation. Sufficient number of OARs? • Evaluation of dose levels, homogeneity and dose distribution • Evaluation of constraints met or not met—median doses vs. max dose and use of dose–volume histograms (DVH) • Discuss the balance between TV coverage and OAR involvement • If compromises are made—why, where and possible consequences

bers. Team-based education initiatives are highly valuable as they improve understanding of how, if performed incorrectly, steps of a process can cascade into a sequence of errors that could otherwise go unrecognised and have major consequences. For example, a tense painful shoulder girdle during the planning CT in a woman who has recently undergone breast and axillary surgery, compounded by a cold bunker and a non-empathic caregiver, can result in an unreproducible set-up for treatment delivery which if uncorrected, could under-dose the target or deposit unnecessary dose in normal tissues.

Some useful approaches to engage learners include:

- *Peer-Based Comparisons*. For example, a peer-based comparison of how different radiation therapists/technologists deal empathetically with an anxious patient [12], or how different radiation oncologists contour treatment volumes, or how different dosimetrists deal with hotspots, are helpful platforms on which the trainer can build their discussion and teaching.
- *Blended Learning*. Combining interactive live (or virtual) learning with computer-assisted learning (including exercises, quizzes and videos) such as for contouring workshops, is an engaging approach to learning. National and international societies (e.g. ASTRO, ESTRO, IAEA) hold contouring and treatment planning workshops and refresher courses. It is especially enriching to connect with professionals at other centres to learn how they approach the same challenges. For example, ESTRO's FALCON programme (Fellowship in Anatomic Delineation and Contouring) is an online multifunctional Educase® platform for contouring and delineation. FALCON workshops are held for different disease sites and/or organs at risk contouring. The workshops are aimed at all radiation oncology professionals and trainees wanting to improve their contouring skills or to refresh knowledge. Workshops provide direct participant feedback and contouring comparisons under supervision from FALCON teaching faculty.
- *Simulation-Based Training*. To err is human. Virtual breast cancer RT environments allow trainees to make mistakes safely. The Virtual Education in Radiation Therapy (VERT) platform (www.vertual.co.uk) [13] is a sophisticated RT simulation system used mainly for radiation therapist technical training. Another example of simulation in training radiation oncology professionals is the use of role-playing actors for building communication skills. Audio-visual recording, debriefing and constructive feedback are central components of simulation-based training. Collaboration with experienced existing medical simulation and training facilities and the IAEA "Train the Trainers" initiative are useful in establishing a tailored programme [14].
- *Error-Based Learning*. Identifying and learning from common mistakes is a useful approach and easily implemented without sophisticated equipment. The inability to recognise an error is associated with a complete gap or an incomplete understanding of necessary core knowledge components comprising the entirety of the process. For example, in Fig. 3.2, the knowledge necessary to detect and correct the error includes an understanding of isodose plots, hotspots, the impact of varying separations, depth dose curves of different photon energies, wedges and the use of segments or the "field within field" concept.

3.8 Summary

In summary, there is a wealth of evidence-based techniques and tools for effective learning in radiation oncology as it applies to the treatment of breast cancer, as well as other tumour sites. These methods are not only valuable to novice learners in the field but should be used as part of life-long learning for all our professionals. It is the responsibility of the individual (regardless of seniority) as well as training institutions and treatment departments to ensure that knowledge

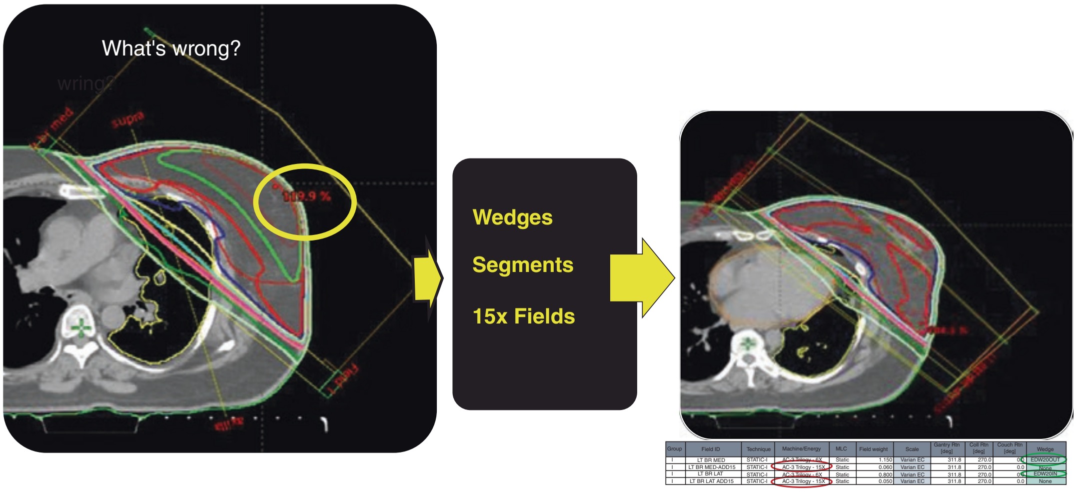

Fig. 3.2 Summary figure demonstrating error-based learning. Supervisor notes: Ask the trainee to review the plan and identify the error. Note the high hotspot (119.9%). Discuss the cause of the hotspot including the large separation and use of 6MV beams only. Discuss how to correct the plan with the use of higher energy photons, wedges and/or segments (field within field). Discuss the corrected plan. For the full teaching slide set, go to link: https//etc

and skills are up to date, and "old ways" are constantly challenged. These goals could not be more important in our rapidly evolving discipline. Finally, compliance with the known evidence supporting high-quality education programmes should underpin all radiation oncology professional training, not be considered an optional extra. Optimal education is thus a foundation to optimal care for patients undergoing RT for breast cancer.

References

1. Asch D, et al. Evaluating obstetrical residency programs using patient outcomes. JAMA. 2009;302:1277–83.
2. Kerfoot B, et al. Durable improvements in prostate cancer screening from online spaced education. Am J Prev Med. 2010;39(5):472–8.
3. Barker J. Error reduction through team leadership: what surgeons can learn from the airline industry. Clin Neurosurg. 2007;54:195.
4. Iobst WF, Sherbino J, Cate OT, Richardson DL, Dath D, Swing SR, Harris P, Mungroo R, Holmboe ES, Frank JR. Competency-based medical education in postgraduate medical education. Med Teach. 2010;32(8):651–6. https://doi.org/10.3109/0142159X.2010.500709. PMID: 20662576.
5. Rosenblatt E, Prajogi G, Barton M, Fidarova E, Eriksen J, Hafty B, et al. Need for competency-based radiation oncology in developing countries. Creat Educ. 2017;8:66–80.
6. Frank J, Snell L, Sherbono J. CanMEDS 2015 physican competency framework. Ottawa: Royal College of Physicians and Surgeons of Canada; 2015.
7. Benstead K, Lara PC, Andreopoulos D, Bibault JE, Dix A, Eller YG, Franco P, Guiliani M, Jaal J, Juretic A, Kozma E, Lumsden G, Maddalo M, Magrini S, Mjaaland I, Pfeffer R, de Sousa de Sa Pinto OMT, Spalek M, Vozenin MC, Verfaillie C, Van Egten V, Eriksen JG. Recommended ESTRO core curriculum for radiation oncology/radiotherapy 4th edition. Radiother Oncol. 2019;141:1–4. https://doi.org/10.1016/j.radonc.2019.08.013. Epub 2019 Sep 5. PMID: 31495514
8. Turner S, Seel M, Berry M. Radiation Oncology Training Program Curriculum developments in Australia and New Zealand: design, implementation and evaluation—what next? J Med Imaging Radiat Oncol. 2015;59:728–35.
9. Eriksen JG, Beavis AW, Coffey MA, Leer JW, Magrini SM, Benstead K, Boelling T, Hjälm-Eriksson M, Kantor G, Maciejewski B, Mezeckis M, Oliveira A, Thirion P, Vitek P, Olsen DR, Eudaldo T, Enghardt W, François P, Garibaldi C, Heijmen B, Josipovic M, Major T, Nikoletopoulos S, Rijnders A, Waligorski M, Wasilewska-Radwanska M, Mullaney L, Boejen A, Vaandering A, Vandevelde G, Verfaillie C, Pötter R. The updated ESTRO core curricula 2011 for clinicians, medical physicists and RTTs in radiotherapy/radiation oncology. Radiother

Oncol. 2012;103(1):103–8. https://doi.org/10.1016/j.radonc.2012.02.007. Epub 2012 Mar 21. PMID: 22444243.
10. Dewey CM, Jonker G, Ten Cate O, Turner TL. Entrustable professional activities (EPAs) for teachers in medical education: has the time come? Med Teach. 2017;39(8):894–6. https://doi.org/10.1080/0142159X.2016.1270447. Epub 2016 Dec 27. PMID: 28027689.
11. Hawkins RE, Welcher CM, Holmboe ES, Kirk LM, Norcini JJ, Simons KB, Skochelak SE. Implementation of competency-based medical education: are we addressing the concerns and challenges? Med Educ. 2015;49(11):1086–102. https://doi.org/10.1111/medu.12831. PMID: 26494062.
12. Riess H, Kraft-Todd G. E.M.P.A.T.H.Y.: a tool to enhance nonverbal communication between clinicians and their patients. Acad Med. 2014;89(8):1108–12. https://doi.org/10.1097/ACM.0000000000000287. PMID: 24826853.
13. Leong A, Herst P, Kane P. VERT, a virtual clinical environment, enhances understanding of radiation therapy planning concepts. J Med Radiat Sci. 2018;65(2):97–105. https://doi.org/10.1002/jmrs.272. Epub 2018 Mar 8. PMID: 29516649; PMCID: PMC5986053.
14. Katzman T, Symon Z, Shelly E, Luxenburg O. Case report: a novel model for educating radiation therapists in small countries: case study of the "Train the Trainer" initiative in Israel. Tech Innov Patient Support Radiat Oncol. 2018;8:10–2. https://doi.org/10.1016/j.tipsro.2018.09.004. PMID: 32095582; PMCID: PMC703379.