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Seminars in
RADIATION
ONCOLOGY

Global Health in Radiation Oncology: The Emergence of a New Career Pathway

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The massive global shortfall in radiotherapy equipment and human resources in developing countries is an enormous challenge for international efforts in cancer control. This lack of access to treatment has been long-standing, but there is now a growing consensus about the urgent need to prioritize solutions to this problem and that a global strategy is required for them to be successful. An essential element of making radiotherapy universally accessible is a coordinated approach to clinical training and practice. This has been recently recognized by many university departments and clinical training programs. However, formalized training and career promotion tracks in global health within radiation oncology have been slow to emerge, thereby limiting the sustained involvement of students and faculty, and restricting opportunities for leadership in this space. We examine here potential structures and benefits of formalized global health training in radiation oncology. We explore how defining specific competencies in this area can help trainees and practitioners integrate their activities in global health within their existing roles as clinicians, educators, or scientists. This would also help create a new global health track for academic advancement, which could focus on such domains as implementation science, health service, and advocacy. We discuss how effective mentorship models, international partnerships, and institutional twinning arrangements support this work and explore how new resources and funding models might be used to further develop and expand radiation oncology services globally.
Semin Radiat Oncol 27:118-123

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Conflicts of interest: None.
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Introduction

Globalization is a modern phenomenon that is perhaps most evident in the interconnectedness of economies and in the global transmission of disease. The field of global health broadly refers to a perspective on health that extends beyond local and national boundaries and includes the goal of resolving problems that are beyond the capacity of any single nation to address.[1] This field implies a shared responsibility for human welfare and the recognition that the welfare and health of nations and individuals across the globe are inextricably linked.

Only recently has a global health perspective emerged in radiation oncology. In a 2006 article, the potential value of cross-national partnerships in introducing radiotherapy into lower income countries was recognized.[2] Since that time, there has been growing recognition of the need for radiotherapy to be available in these regions to combat the increasing burden of cancer mortality and morbidity in these populations, and of the

 http://dx.doi.org/10.1016/j.semradonc.2016.11.003
1053-4296/

potential power of international partnerships to make this happen. The Global Task Force on Radiotherapy for Cancer Control (GTFRCC) of the Union for International Cancer Control (UICC), made up of over 100 members from the fields of oncology, industry, global health, and economics, was created to develop an organized international response to this challenge.[3] The GTFRCC, which provided a roadmap for radiotherapy to be introduced into low- and middle-income countries (LMICs),[4] is a potential model for the global application of expertise in radiotherapy to the problem of cancer control. Inherent in this expansion is the need for a large number of skilled individuals to deliver radiotherapy treatments.

The efforts of the GTFRCC and the interest that it has generated are encouraging, but also points to the need for an enduring global health perspective in radiation oncology, an essential long-term component of overall cancer care. Sustained development of this focus in radiation oncology requires an organized approach to recruitment and training in this field. We will consider here current global health training and career opportunities in radiation oncology and what strategies are needed to enhance and formalize such opportunities.

A Formalized Competency Profile

Educational competencies measure the knowledge, skills, and attitudes that students must acquire to contribute effectively to the workforce upon graduation.[5] Within the field of radiation oncology, a formalized competency profile pertaining to global health knowledge and skills has been notably lacking for those completing specialty training. The lack of accepted core competencies and standardized global health curricula across health professional training in general reflects historical paternalistic perspectives on global health and hinders the development of well-defined global health career paths for students and trainees.[1] A globalized perspective on global health, which recognizes the interdependence of countries, economies, and health challenges, demands that physicians graduate with the competency to address the needs of diverse patients within diverse health systems.

The global health training experiences of residents in different radiation oncology programs have tended to be fragmented and inconsistent. In some programs, training is limited to an occasional conference or teaching session, or grand rounds on global health topics. In a survey assessing the global health interests of US radiation oncology residents, nearly 90% of respondents reported interest in participating in an international radiation oncology educational experience, but an equal proportion reported there were no global health education activities in their training program.[6]

Most commonly, additional exposure to global health is based on the motivation of, and opportunities made available to, individual trainees, who may participate in short-term clinical placements working in LMICs. These experiences allow trainees to define the degree of their interest in global health, to evaluate the effect on family and significant others of working abroad both within and beyond training, and to develop more long-term collaborative relationships with health service organizations in a particular region.[7] Trainees in both LMICs and HICs (high-income countries) may benefit from educational exchanges including learning about different practice patterns, clinical presentations, and treatment techniques in different settings.

Such variability in global health education across many medical disciplines prompted Martimianakis and Hafferty[8] to identify 3 dimensions of a globally competent physician. The first, termed the "universal global physician," represents universal and transferrable standards of medical competency that can be applied in any setting. The "culturally versed global physician" refers to cultural sensitivity in patient interactions and the "global physician advocate" refers to the responsibility of physicians to understand the social determinants of health and advocate for marginalized patients.[8] Similar aims are now being included in the development of global health competencies in many undergraduate and graduate medical curricula.[9]

Within radiation oncology, educational leaders from around the world recently formed the Global Radiation Oncology Collaboration in Education (GRaCE). This group was created to develop modern competency-based radiation or clinical oncology curricula that reflect practice patterns across different jurisdictions.[10] However, the specific global health competencies that should be acquired within radiation oncology training programs have not yet been specified. Such competencies could be seamlessly integrated into existing curriculum frameworks such as the Canadian Medical Education Directives for Specialists (CanMEDS) (Table). CanMEDS is the most commonly applied framework for physician training worldwide consisting of 7 broad core competency domains. Developed in Canada,[11] it has also been applied to radiation oncology professional training in Australia, New Zealand,[12] and European countries[13] among others.[14]

Beyond Specialty Training

A career in global health may be focused in such diverse areas as patient care, basic science, clinical research, education, health services, and advocacy, reflecting the full spectrum of practice within the discipline of radiation oncology. For example, in the area of clinical trials, international collaborations between HICs and LMICs are growing. The Cervix Cancer Research Network within the Gynecologic Cancer Intergroup (GCIG) was established to extend enrollment to countries with the largest disease burden.[15] This partnership enhanced trial accrual and the power of the outcome evidence, but also benefited LMICs through investment in their machines, recordkeeping, and quality assurance.[15] It also established ongoing relationships between oncology centers in HICs and LMICs and enduring collaborations and mentorship relationships between investigators at different centers.

Research into technological advances in the delivery of radiation therapy also has enormous global implications. Novel applications and technology designs, such as cloud-based computing for treatment planning, could help solve many

Table Global Health Educational Competencies using the CanMEDS Framework

CanMEDS Role	Global Health Competency
Medical Expert	(1) Describe the epidemiology of cancer in LMIC setting. (2) Apply common radiation technologies available in LMICs, including cobalt-60 and 2D, to radiotherapy planning.
Professional	(3) Describe the ethical issues associated with collaborating with private enterprise and philanthropic groups in LMIC settings. (4) Demonstrates insight into his or her limitations and how these may differ in LMIC settings.
Leader	(5) Demonstrate effective team leadership in a low-resource setting. (6) Describe the principles of implementation science. (7) Engages others in partnerships and networks to promote improvement in LMICs.
Communicator	(8) Describes the principles of effectively disclosing a diagnosis of cancer to a patient and family members using culturally appropriate communication principles. (9) Describe the differences in patient and family communication strategies in a specific global setting compared with their country of training.
Scholar	(10) Identify the challenges in applying current guideline-based treatment in low-resource countries. (11) Develop an educational program for a high-impact topic in a low-resource setting.
Health advocate	(12) Articulate a process improvement plan to address community health with respect to cancer care in LMICs. (13) Intervene on behalf of patients or the community with respect to the social, economic, and biologic factors that may effect on their health.
Collaborator	(14) Integrate successfully into a clinical care team in a LMIC setting. (15) Describe differences in the roles of other professions in LMIC settings compared with their country of training.

physical infrastructure limitations.[4] Within education, the growing global demand for radiotherapy has created a need for educators and education researchers to support the development of a well-trained global workforce. The GTFRCC has estimated that 22,100 medical physicists and 30,000 radiation oncologists must be trained to meet estimated demand in 2035. The nature of this training will likely be unique to the specific environments in the LMIC settings with the need to explore the scopes of practice across all professional groups in this new setting.

The adaptation of radiation oncology curricula to the diverse environments of LMICs is an important challenge. Curriculum development can be influenced by the needs of multiple institutional, student, and professional interests. Standard-setting in education that is appropriate for countries of vastly differing resources is difficult. The blanket application of an educational structure developed in HICs to LMIC settings has been criticized for failing to address the health professional shortfall.[16] To address this issue, the International Atomic Energy Agency (IAEA) published a syllabus in 2009 for the training of radiation oncologists in LMICs to assist Member States in the development of their training programs.[17] However, the LMIC educational system is affected by rapid fluctuations in investment, technology and global priorities, necessitating a flexible modular approach to training. Leveraging alternative pedagogical models and education technology may allow the realization of the goals of globally focused curricula. The Commission on the Education of Health Professionals for the 21st Century has recently advocated for global instructional reforms that are competency-driven, adaptive to changing local conditions and resources, and promote interprofessional and transprofessional education.[18] Such educational reforms reflect a crucial area for future global health research within radiation oncology.

Within HICs, the integration of global health into well-established clinician-scientist, clinician-investigator, or clinician-educator career tracks, can allow faculty to enter existing institutional tracks for performance evaluations and academic advancement. However, much valuable work within global health may not fit squarely within these existing tracks. It may involve advocacy, program development or other forms of knowledge translation locally or internationally. Implementation science, which evaluates the process of translating high-level research findings into meaningful change and daily clinical practice, has also emerged within global health study as a critically important area of study. This is particularly relevant in LMICs, where clinical presentations and resources are often markedly different to the controlled environments within which randomized trials and other high-level studies have traditionally been conducted.[19]

The lack of specified core global health competencies in radiation oncology limits the development of global health expertise among faculty and the appropriate recognition of their achievements. Radiation oncologists working in global health might benefit from a formalized "global radiation oncology career pathway" that is aligned with existing promotional pathways. The development of such a track may require lobbying for recognition of global health–related activities that do not meet the traditional promotion criteria of educational or research activities. An example of this type of activity is the

GlobalRT.org project, which is an online platform developed by radiation oncology trainees and junior faculty, advocating for equitable access to radiotherapy globally.[20] Encouragingly, the University of Toronto Faculty of Medicine recently introduced the criterion of Creative Professional Activity to reward staff who undertake these types of endeavors that do not necessarily result in grants, publications or teaching awards, but that advance the practice of medicine.[21]

Supporting a Career in Global Health

Participation in global health activities may also involve support of clinical positions in radiation oncology in LMICs, either through direct employment in an area of interest or through participation in institutional partnerships between LMICs and HICs. Supporting international service has become a challenging issue for department chairs in the recruitment of radiation oncology faculty interested in international work, but several institutions are currently committed to exploring sustainable solutions. The University of Pennsylvania is supporting a radiation oncologist based fulltime in Botswana to work closely with local stakeholders in strengthening oncology clinical programs, research, and education.[22] Other institutions, such as University of San Diego, have provided support to residents for global health experiences and are actively evaluating options to support faculty on the ground who are engaging in global health activities. Institutions will need to find solutions to back-fill positions when trainees or faculty are engaged elsewhere.

Currently, most global health endeavors are only partially funded, typically through a combination of departmental and institutional discretionary funds, scholarships, and grants. Some are performed on a fully voluntary basis.[23] As a result, physicians and other providers often accept lower salaries, to ensure protected time to participate in global health work.[24] In turn, this may translate to some global health efforts being ad hoc rather than strategic. The International Cancer Expert Corps (ICEC), a nongovernmental organization focused on developing career pathways for young clinicians (oncologists, pathologists, and radiologists) in global health,[25,26] is bringing together several academic and nonacademic institutions to pool resources to develop a sustainable program. ICEC calls for broader recognition of health care service within academic medicine and aims to create a career path for radiation oncologists and others committed to global oncology by providing compensation for time spent away. Through this effort, the ICEC aims to bridge the chasm between the enthusiasm and willingness to lead that many trainees exude and careers that offer little support for such activities in oncology practice.[27]

The ICEC's approach is not entirely new. In 2010, Paul Farmer and his colleagues described a vision of an international health service program that would allow health care workers to accept overseas placements in exchange for health-related graduate school scholarships and loan forgiveness.[28] This type of service and education design has been successfully implemented in the context of HIV/AIDS. The Pediatric AIDS Corps recruits residents from pediatrics, family medicine, and internal medicine for placements of at least 1 year in Africa.[29] Participants are employees of the Baylor College of Medicine, which is linked to the Baylor's Children's Clinical Centers of Excellence in Botswana, Lesotho, Malawi, and Burkino Faso. Participants receive a living stipend of US$40,000/year, a full benefits package, a housing allowance of $1200/month, and a student loan debt relief of $40,000/year for each year of service.[29]

There are also several current grant opportunities available to support training in global health. For example, the UICC and the American Society of Clinical Oncology offer pilot grants for residents and junior faculty that could help to establish research in a global setting and to generate pilot data to support subsequent grant applications. Several opportunities for career development exist through the National Cancer Institute at the National Institutes of Health (NIH), such as the NIH K-01 early career development grant, which is geared toward global health researchers. Other sources of funding such as the American Society of Radiation Oncology early career award or Fogarty International fellowship could also be applied to support training in global oncology.

Industry stakeholders in radiation oncology, in particular the manufacturers of treatment machines and planning systems, have expressed growing interest in contributing to solving the problem of access to quality (often, to any) radiotherapy services on a global scale. Several models for research collaborations with industry have led to development of new and more sophisticated technologies, although such models have not yet been applied to health care delivery and research as it might apply to LMICs. Varian has established training programs in Vietnam, South Africa and India focusing on clinical and administrative aspects of radiation oncology taught by international experts. Similarly, Elekta is developing training programs in LMICs, such as the advanced Elekta Training Center in Cape Town, South Africa.[30] This center, a collaboration between Elekta and Tygerberg Hospital and Cape Peninsula University of Technology in Cape Town, are intended to address the need for skilled technology experts in South Africa and other parts of the continent as older systems are phased out and the latest technology is introduced.

The Effect of Role Models

Mentoring has been recognized as an important component of global health capacity strengthening within education programs[31,32] and as a key contributor to successful academic career development in all disciplines of medicine.[33] In a 2012 survey of radiation oncology faculty conducted by the Radiation Oncology Academic Development and Mentorship Assessment Project (ROADMAP) survey, those who reported having a mentor involved in their career had higher academic productivity, with more publications, citations, and funding.[34] Strong mentorship in domestic institutions and in international settings can provide essential expertise, support, and stimulate academic development.[31]

Unfortunately, more than half of American radiation oncology residents surveyed reported that they lacked sufficient faculty guidance to pursue international educational experiences during their residency training.[6] The decentralized nature of global health—away from major universities and medical centers, across time zones, and within diverse geographical, cultural, and economic settings—requires strong interpersonal mentorship relationships to ensure a successful outcome. Further, faculty with the ability to become global health mentors may be different from those who are able to provide career mentorship in other domains. It may be that a multiple mentorship model is needed to support different areas of development among trainees. Global health mentors may need to be drawn both from within and from outside the field of radiation oncology, and from institutions or countries other than those where the mentee performs their clinical duties.

There are several established and reported models for mentorship that extend beyond individual institutions to support trainees and early career faculty. At the University of Toronto, a group mentoring experience for new global health researchers was created in response to a needs assessment, which indicated that these individuals often felt isolated from their peers and were struggling to connect with a global health research community.[35] This group mentorship program for postdoctoral fellows, and faculty at all career stages included regular in-person and online meetings that focused on such activities as networking, grant writing, research implementation and management, writing, and career planning.[35] An organized group-based approach to mentorship of this kind can cultivate and sustain clinicians and researchers committed to global health careers.[36]

Effective mentorship may also transpire and provide guidance in the clinical global health setting. Utilizing the International Training and Education Centre on HIV (I-TECH) clinical mentoring approach as a starting point, Shah et al[31] proposed a list of key elements for successful mentorship of trainees and faculty in clinical global health research. These include clarifying respective responsibilities in the mentor-trainee relationship, ensuring adequate on-site supervision, training in local customs, and monitoring of progress through regular mentoring evaluations. Shah et al supply in their publication a detailed checklist of expectations for US-based mentors, local mentors, and visiting trainees.

Reciprocal Benefits of Global Partnerships

Over the last decade, a number of partnerships between health care institutions in HICs and those in LMICs have developed. Institutions benefit in multiple ways from student and faculty exchange in the domains of clinical care, training, and research. These interactions afford all entities the opportunity for cross-pollination of ideas, understanding of cancer on a global scale and investigation of cancer across diverse populations that may yield unprecedented insights.[37] In Kenya, Moi University School of Medicine and Moi Teaching and Referral Hospital have a long-standing partnership with the Academic Model Providing Access to Healthcare (AMPATH) consortium of US and Canadian medical schools. This partnership has led to tremendous clinical success across several disciplines, including oncology, and has generated mutual knowledge, resulting in more than 100 peer-reviewed articles that have published with investigators from both HICs and LMICs.

Another collaboration between Dana-Farber, Brigham and Women's Cancer Center, Partners in Health and the Rwandan Ministry of Health has led to the construction of the Butaro Cancer Center of Excellence.[38] This is the country's first comprehensive cancer center and the region's first rural cancer center. Despite this partnership, however, and other similar collaborations, radiotherapy services have been slow to develop in LMICs relative to other treatments. For instance, in Rwanda, the radiotherapy treatment machine to person ratio of 1:1.75 million people grossly exceeds the Inter-Society Council of Radiation Oncology's recommendation of 1 machine per 120,000 population or 1 per 300 cancer patients. A select group of patients, determined by the Ministry of Health, are sent to neighboring countries for treatment, where resources are also strained.[38]

Despite these challenges, the feasibility of incorporating radiotherapy into international oncology partnerships has been demonstrated. In 2000, the Bugando Medical Center in Mwanza, Tanzania, Tanzanian health and governmental bodies, and a group of Italian cancer organizations designed a long-term plan for radiotherapy development.[39] The initial focus was on establishing a pathology service, and inpatient and outpatient oncology units in Bugando Medical Center. The next stage aimed to equip the cancer center with radiotherapy, other consultation services, and a stronger workforce. In 2011, the Tanzanian Central Government committed to the construction of a $7 million radiotherapy facility that would house 6 bunkers, a treatment planning room, consultation rooms, a molecular biology laboratory and an operating theater. They also obtained 2 cobalt-60 radiotherapy machines funded by the Tanzanian government and a donated linear accelerator. The center was inaugurated in November 2013 and the plan is to begin treating their first radiotherapy patients before the end of 2016. At present, the staff includes a radiation oncologist, a medical physicist, three radiation technologists and four oncology nurses.[39]

These partnerships hold significant promise for improving cancer care in LMICs, but ongoing evaluation and improvement is essential to prevent power imbalances, create transparency, assess engagement, and ensure that objectives are met. To be effective, such processes will require additional training for the health professionals involved. A number of frameworks have been published for evaluating processes and outcomes of international partnerships,[40] although in the context of radiation oncology, a clear structure has not yet been developed. Efstathiou et al[41] shared their experience of reviewing a new clinical radiotherapy program in Botswana, in which they propose that programs evaluate and measure machine resource use and throughput, adherence to guidelines, health outcomes, and the cost of care delivery. However, specific recommendations around the timing of evaluations and quality standards for measurement were not articulated.[41]

Conclusion

The rising global need for cancer care in general, and more specifically the global shortfall in radiotherapy services, coincides fortuitously with the current medical community and political interest in global health. There is now an opportunity to build capacity in global radiation oncology while responding to the unmet need for cancer care in LMICs. However, the requisite growth in education and training program development, and educational research specific to the field of global radiation oncology will necessitate significant investments of both human and financial resources. In addition, it will demand a systematic approach to implementation. These projects must be developed through partnerships between academic and medical institutions, and industry across both HICs and LMICs. We have elaborated here some potential strategies for the establishment of a career pathway in global radiation oncology, for its academic and professional recognition, and for its application to global cancer care. Further advocacy and study is needed to explore and ensure the feasibility of such approaches.

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