12-9-2016

Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care.

D Rodin

J Longo

T Sherertz

M M Shah

O Balagun

See next page for additional authors

Authors
D Rodin, J Longo, T Sherertz, M M Shah, O Balagun, N Wendling, Jacob Van Dyk, C N Coleman, M J Xu, and S Grover

Clinical Oncology xxx (2016) 1–6

Contents lists available at ScienceDirect

Clinical Oncology

journal homepage: www.clinicaloncologyonline.net

Overview

Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care

D. Rodin [*†], J. Longo [*‡], T. Sherertz [*§], M.M. Shah [*¶], O. Balagun [*||], N. Wendling [*], J. Van Dyk [***††], C.N. Coleman [*], M.J. Xu [§], S. Grover [*‡‡]

[*] *International Cancer Expert Corps (ICEC), New York, New York, USA*
[†] *Department of Radiation Oncology, University of Toronto, Toronto, Canada*
[‡] *Department of Radiation Oncology, Medical College of Wisconsin, Milwaukee, Wisconsin, USA*
[§] *Department of Radiation Oncology, University of California, San Francisco, California, USA*
[¶] *Department of Radiation Oncology, Henry Ford Hospital, Detroit, Michigan, USA*
[||] *Department of Radiation Oncology, Cornell University Medical School, New York, New York, USA*
[**] *Departments of Oncology and Medical Biophysics, Western University, London, Ontario, Canada*
[††] *Medical Physics for World Benefit (MPWB), Canada*
[‡‡] *Department of Radiation Oncology, University of Pennsylvania, Philadelphia, Pennsylvania, USA*

Received 27 October 2016; accepted 15 November 2016

Abstract

Closing the gap in cancer care within low- and middle-income countries and in indigenous and geographically isolated populations in high-income countries requires investment and innovation. This is particularly true for radiotherapy, for which the global disparity is one of the largest in healthcare today. New models and paradigms and non-traditional collaborations have been proposed to improve global equity in cancer control. We describe recent initiatives from within the radiation oncology community to increase access to treatment, build the low- and middle-income countries' radiation oncology workforce, mobilise more professionals from within high-income countries and raise awareness of the global need for equitable cancer care.

Key words: Cancer care; global health; health disparities; radiation oncology

Statement of Search Strategies Used and Sources of Information

This article was written in collaboration with radiation oncologists working within global health settings and reflect expert opinion. No formal search strategy was employed.

Introduction

Low- and middle-income countries (LMICs) are estimated to have only 5% of cancer care resources, yet account for 80% of the disability-adjusted life-years lost to cancer [1]. Although radiotherapy is one of the essential cancer treatment modalities used in more than half of all cancer cases in high-income countries (HICs), over 90% of individuals in low-income countries have no access to radiotherapy [2,3]. Even in resource-rich countries, radiotherapy and other specialised oncological services are typically concentrated in large urban settings, leaving populations living in rural or remote settings vulnerable to cancer disparities [4–7].

As we begin to develop evidence to support long-term investment in radiotherapy for LMICs [8], we must also carefully consider the long-term sustainability of physical and human capital required by radiotherapy programmes in resource-limited regions. This includes developing and supporting global initiatives that have been created to engage with non-governmental organisations (NGOs), governments, industry partners and academic institutions. Here we describe current efforts to sustainably foster

Author for correspondence: S. Grover, Department of Radiation Oncology, University of Pennsylvania, 3400 Civic Center Blvd, Philadelphia, 19104 PA, USA. Tel: +1-215-615-3714; Fax: +1-215-349-8975.
E-mail address: Surbhi.grover@uphs.upenn.edu (S. Grover).

http://dx.doi.org/10.1016/j.clon.2016.11.008
0936-6555/

medical expertise and robust radiotherapy centres in LMICs and remote areas of HICs. We review the existing challenges to mobilising expertise and resources to these regions and highlight potential innovative solutions.

Mobilising the Radiation Oncology Community

Unsubstantiated assumptions about the affordability and feasibility of radiotherapy in low resource settings have severely limited efforts to improve access. For this reason, the Board of the Union for International Cancer Control convened the Global Task Force on Radiotherapy for Cancer Control (GTFRCC) in 2013 to raise awareness about the dramatic inequalities in radiotherapy access and to develop an economic platform to support national and international investment. The GTFRCC published a report in *Lancet Oncology* in 2015 that detailed the demand for radiotherapy, the cost of building infrastructure and training professionals to deliver radiotherapy, and the financial return on investment at a macroeconomic level [8]. This report was the culmination of a collaborative effort of over 100 experts from around the world across radiotherapy, industry, cancer control and economics. Building on the momentum generated by the report, the European Society for Radiation Oncology (ESTRO) is developing a global partnership of organisations to continue to work on improving radiotherapy investment in LMICs.

One of the Calls to Action in the GTFRCC report was for 7500 radiation oncologists, 20 000 radiation therapists and 6000 medical physicists to be trained for LMICs by the year 2025. Accomplishing this will require a creative and substantial multipronged effort, a research and implementation challenge as significant as that of the more classical academic research tracks. At present, many LMICs lack appropriate education and training programmes and do not have the expertise, resources or personnel to provide practical on-the-job training. Success in the creation of an educational programme to develop a trained workforce will require collaboration among international, national, regional, local and NGOs [9].

Global Health as a Career Path in Radiation Oncology

It is yet unclear how LMICs will find educators to train more radiation oncologists, physicists and radiation therapists to fill this important need. Although many retiring oncologists have devoted their post-practice years to this calling, the clinical and financial demands on those who are still in practice often preclude dedicated global health work. Furthermore, despite growing interest among oncologists, global oncology is still not well recognised and supported as a career path [10]. As a result, the engagement of trainees and early career faculty in resource-poor settings has often been limited to self-funded, small-scale projects. This model of global health work in largely uncoordinated single-person silos during 'free time' is minimally effective and not sustainable.

'Value' in HIC oncology departments has traditionally been quantified by revenue and research generation. Yet, growing recognition of the global inequities in cancer care resources has led many to reconsider how to support and assign 'value' to radiation oncologists addressing this important problem. Academic centres with global health departments are now beginning to pursue multidisciplinary partnerships to make sustainable and impactful contributions. One such example is University of Pennsylvania's commitment to support one of their staff radiation oncologists to work full-time with the local team at Princess Marina Hospital in Botswana to develop oncology research, teaching and clinical care infrastructure.

Academic careers in global oncology have expanded to fields such as implementation science, care coordination, epidemiology, cancer biology and the development of low cost and point-of-care interventions. This work can be partially carried out on the ground in LMICs or may take place remotely when personal or professional commitments do not allow such time away from the home base. Faculty members who are on the ground in locations distant from their home site require professional support, which may occur through telemedicine access, case review, data management and statistical resources, remote didactic lectures, and multidisciplinary input on training plan protocols and care guidelines. A more robust academic approach, with quantification and publication of findings, will help build an evidence base that can be more broadly appreciated.

Opportunities for trainees to engage in global health are also expanding. The Global Health Rotation Initiative was launched in 2015 by US and Canadian radiation oncology residents to facilitate international educational exchanges for trainees [11]. A database of global radiation oncology organisations with resident elective opportunities is hosted on the online radiotherapy community website, www.globalrt.org [30]. Radiation oncology residents can rotate at diverse sites. For example, the Christie NHS Foundation Trust in Manchester, UK, the Cancer Diseases Hospital in Lusaka, Zambia and Walking Forward, which works with indigenous populations in the USA.

Partnerships to Improve Training within Low- and Middle-income Countries

The development of educational initiatives within LMICs has also been gaining momentum. For many years, the International Education Subcommittee of the American Society for Radiation Oncology (ASTRO) has run an eContouring Ambassador Initiative programme in which designated experts coach others on how to delineate organs and tumours on three-dimensional images [12]. Varian's educational programme, 'Access to Care', prepares staff to operate the equipment that their respective centres have acquired [13]. Varian is now establishing multiple training sites throughout the African continent and individual projects have been implemented with the goal of training the workforce in LMICs. A pilot curriculum for institutions transitioning from two-dimensional to three-dimensional breast conformal

Please cite this article in press as: Rodin D, et al., Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care, Clinical Oncology (2016), http://dx.doi.org/10.1016/j.clon.2016.11.008

radiation therapy has been successfully implemented in Armenia and will also be launched in Gabon [14]. The Global Radiation Oncology Collaboration in Education (GRaCE) is another example of an international collaboration to formally establish basic competency goals for radiation oncology training that may one day include LMICs [15].

Although much of the focus has been on increasing the physician and radiation technician training, Medical Physics for World Benefit (MPWB, formerly called Medical Physicists Without Borders) is an altruistic NGO established to support the effective and safe use of physics and technologies in medicine [16,17]. This is accomplished through advising, training, demonstrating and/or participating in medical physics-related activities and developing partnerships and relationships to support specific individual cancer programmes in LMICs. For example, MPWB may offer on-the-job training or help to support medical physics masters degree programmes in LMICs. MPWB is a young organisation incorporated in Canada in 2015 and in the USA in 2016, with its recent activities outlined in Appendix Table A1.

Mentorship: the International Cancer Expert Corps

One of the largest concerted efforts to establish sustainable training and mentorship relationships between HICs and LMICs is the International Cancer Expert Corps (ICEC). The ICEC is a not-for-profit NGO whose goal is to implement a sustainable global health career path from trainee to retiree, working with academic institutions, professional societies and dedicated individuals [18]. To expand global network capacity, ICEC accesses human resources that might otherwise be lost. This includes altruistic, globally oriented young leaders, senior retirees with decades of experience, private practitioners and mid-career academicians.

The ICEC model builds on existing global health programmes by providing sustainable mentorship from experts in hubs to associates in ICEC centres in LMICs and in underserved regions in HICs [19]. Hubs are academic cancer centres, practices and professional organisations that provide expertise and infrastructure. The initial expert/hub to associate/centre pairings are built from pre-existing 'twinning' relationships. Each ICEC centre in the LMICs has a principal investigator whose team is mentored by a multinational cadre of experts. Mentorship is based on formal guideline and protocol-based care. When an ICEC centre passes a quality assurance review, which may take years, it will have the skills to manage cancer by internationally acceptable standards and become regional and global centres of excellence. In addition to mentor–mentee in-country on-site visits, consistent mentoring is accomplished through recurring weekly teleconferences. This avoids the pattern of periodic visits with big gaps in between and allows a global health career to fit within a typical workweek. By encouraging individual programmes to maintain their identity while working together as part of a global team with standardised policies, procedures and metrics, the model is self-propagating and could fill the enormous personnel gap noted above.

Although only a newly formed NGO, ICEC has helped to establish unique partnerships among experts involved with the security of nuclear material and those interested in cancer care. Concern by the US Interagency Working Group on Alternatives to High-Activity Radioactive Sources (GARS) about the safety of radiation resources for cancer in politically unstable regions has led the James Martin Center for Non-Proliferation to develop a new paradigm entitled 'Treatment, not Terror' [20,21]. This includes recognising (i) the need for cancer care to be the primary goal rather than the removal of radiation sources (particularly cobalt-60, (ii) the need for training personnel in the safe use of linear accelerators, and (iii) the opportunity to develop high-quality linear accelerators that are tailored for challenging environments.

International Efforts to Address the Radiation Machine Shortfall

In addition to education and workforce capacity building, important and creative partnerships have also been developed to enable delivery and commissioning of new radiotherapy equipment. There is considerable variability in governmental regulations, medical infrastructure and ability to accommodate radiation therapy equipment across LMICs. In 2009, the International Atomic Energy Agency (IAEA) established the Advisory Group on Increasing Access to Radiotherapy (AGaRT) under the Programme of Action for Cancer Therapy (PACT). AGaRT was created to help countries acquire radiotherapy machines, negotiate appropriate service contracts and to help design sustainable facilities [22].

Some organisations and institutions in HICs have been willing to donate machines that are no longer in use to LMICs. However, the process that must be followed for such donations to occur has often been a barrier to timely equipment transfer. The initial steps include identification of a donor site for equipment and the engagement with industry to assist in evaluation and disassembly. Before shipment, a recipient site must be evaluated for the ability to safely house the donor unit, the feasibility of retrofitting current bunkers for donated machines (shielding, physical facilities, etc.), access to treatment personnel (physicians, physicists, radiation therapists), current medical facilities, coordination/collaboration of local government/health ministries, and adaptations required for local electrical/technological infrastructure. If all of these criteria are met, a machine can be shipped, re-assembled and installed. Commissioning the machines and creating a self-sustaining educational/treatment infrastructure with limited resources (monetary, technological, trained personnel) is a substantial ongoing challenge.

Radiating Hope is a non-profit organisation that aims to assist with safe, effective use of equipment, supporting onsite training of personnel, sustained remote technical support, partnerships with medical professionals and industry, and education of local communities through global partnerships [23]. It has also provided funds to assist with training of personnel and assistance with creating a self-sustaining infrastructure, in the context of limited

Please cite this article in press as: Rodin D, et al., Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care, Clinical Oncology (2016), http://dx.doi.org/10.1016/j.clon.2016.11.008

resources. Over the past 6 years, Radiating Hope has collaborated with industry and has facilitated the donation of nine radiation teletherapy units (used/refurbished) and one high dose rate afterloader in Guatemala, Honduras, Madagascar, Peru, Ukraine, Senegal, Tanzania. Further details of these initiatives are outlined in Appendix Table A2. Radiating Hope currently has one linear accelerator in storage and is searching for a qualified recipient.

The International Organization for Medical Physics (IOMP) also coordinates donations of treatment-related equipment and supplies, such as treatment planning systems, imaging systems, immobilisation devices, multileaf collimators and ion chambers. Nearly 20 countries have received these donations (www.radiatinghope.org and www.iomp.org). Individual institutions have also supported machine donation. For example, Istituto Scientifico Romagnolo per lo Studio e la Cura dei Tumori (IRST) in Italy donated a linear accelerator to Bugando Medical Centre in Mwanza, Tanzania. They have also collaborated with the hospital and local policy makers to advance comprehensive cancer care, including prevention, screening and education in that region [24].

'Global Health' Needed within High-income Countries

In light of the growing enthusiasm to expand radiotherapy capacity to LMICs, it is important to remember that 'global health' needs still exist within HICs themselves. Stark cancer disparities are observed between the general population and indigenous and other resource-limited communities within HICs. Indigenous groups present with more advanced-stage cancers and have higher rates of cancer mortality when compared with non-indigenous people in the same country [4–6]. Indeed, cancer is the leading cause of premature death among the American Inuit [25]. They are the only racial group in the USA for which cancer death rates have not declined over the past 20 years; instead, cancer mortality rates have increased [25]. As global oncology works in parallel to address LMICs and these vulnerable communities within HICs, we hope there will be many opportunities for solution sharing and mutual benefit.

Indigenous people face barriers to optimal cancer care that are similar to those faced by cancer patients in LMICs. In resource-rich countries, radiation therapy and other specialised oncological services are typically concentrated in large urban settings, while greater proportions of indigenous people live in rural or remote settings [4–7]. First Nations People, Métit and Inuit living in Nunavut must travel a minimum of 2000 km by air to receive specialty care [26]. This geographical barrier and the requirements of transportation and temporary housing fall are analogous to that in LMICs [27].

Efforts to better understand and address cancer disparity within indigenous populations can serve as a model for adapting cancer education programmes for other underserved populations. Walking Forward is a superb example of a multifaceted programme that was developed through funding from the National Cancer Institute's Cancer Disparities Research Partnership. Through an emphasis on cancer education, patient navigation and clinical trial participation, Walking Forward addresses the barriers that prevent Lakota Sioux in the region surrounding Rapid City, South Dakota from being diagnosed with cancer at earlier stages and achieving optimal cancer outcomes [27,28]. To overcome deeply engrained mistrust of clinical trials, Walking Forward works with tribal councils, develops culturally sensitive consents, translates trial information into Lakota, and has created local employment opportunities for culturally competent staff members, many of whom grew up and still live on the reservations. Over 2500 American Inuit had enrolled on Walking Forward research studies [29].

Conclusion

The increased discourse on global oncological disparities, specifically in radiotherapy, has brought a welcomed demand for action. Addressing the disparities in cancer treatment will require oncology leaders to identify better ways to coordinate and support existing efforts and innovate to fulfil unmet needs. Sustainable investment in education, mentorship and global radiation oncology career paths will serve to greatly improve the radiation oncology workforce in LMICs. Multidisciplinary collaborations are needed to provide the machines and expertise needed to commission and maintain radiotherapy units. Advances in cancer capacity within LMICs and resource-limited regions in HICs will hopefully serve to benefit both populations. Given the many efforts to answer the demand for action in oncological care and radiotherapy, collaboration and mutual support among multiple concerted efforts is necessary.

Appendix

Table A1
Recent Medical Physics for World Benefit (MPWB) activities

- Zimbabwe is seeking additional expertise in support of a new medical physics masters degree programme.
- MPWB is in discussion with University of Toronto about the possibility of supporting an MSc project in medical physics in Ethiopia. Ethiopia is planning to open five new cancer centres in the next few years.
- One of our board members (Yakov Pipman) presented at the Harvard Global Health Summit on behalf of MPWB.
- Two board members of MPWB received invitations to participate in discussions at CERN about the development of a low cost, modular linear accelerator.
- Discussions have been initiated with major vendors to develop partnerships in practical 'on-the-job' training programmes.
- Close communications are in progress with the International Atomic Energy Agency regarding projects in Zimbabwe and Jamaica.
- MPWB has been invited to be a non-government cooperating organisation for ICARO2 (International Conference on Advances in Radiation Oncology) in 2017.

Please cite this article in press as: Rodin D, et al., Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care, Clinical Oncology (2016), http://dx.doi.org/10.1016/j.clon.2016.11.008

- Communications are in progress regarding a collaboration between MPWB and Radiating Hope to provide short-term on-the-job training in Ghana.
- Various other requests have been made. For example, some Rotarians in Canada would like to donate a cobalt machine to Uganda and they are seeking training support from MPWB.

Table A2
Projects conducted by Radiating Hope

Year	Nation	Project/donation
Since 2010		• Global cancer advocacy via mountain climbing, runs, annual medical missions, symposiums
	Madagascar	• Cobalt unit
	Peru	• Linear accelerator
2011	Panama City, Panama	• Brachytherapy equipment
	International Cancer Center	• Treatment planning guidance/assistance
		• Trained medical professionals and local healthcare staff to perform cancer screenings
2012	Dakar, Senegal	• High dose rate afterloader, source changed as needed
	L'Institut Jolio-Curie Dctantec	• In-person training visits for technical support, self-sustaining infrastructure with library of plans with fixed geometry, financial support, weekly physics technical support
		• Volunteer visits to adapt brachytherapy to a low-resource, limited trained personnel setting
2013	Tegucigalpa, Honduras	• 2 teletherapy units
	Centro Oncologico Hondureno	• Multileaf collimator currently being installed
2014	Kharkiv, Ukraine	• Linear accelerator donated from University of Minnesota
	Kharkiv Institute of Physics and Technology	
2014	Moshi, Tanzania	• First Kilimanjaro Climb and Greater Horn Oncology Symposium (GHOS) for fundraising and to increase awareness
	Kilimanjaro Christian Medical Center	
2015	Guatemala City, Guatemala	• 3 orthovoltage teletherapy machines
2015	Mwanza, Tanzania	• Linear accelerator donated from Mayo Clinic
	Bugando Medical Center	• Second Kilimanjaro fundraising climb
2016	Mwanza, Tanzania	• High dose rate afterloader
	Bugando Medical Center	• Second GHOS
		• Partnering with MD Anderson to calibrate donated physics equipment and send to developing nations
2016	Kenya	• Training and travel grants to physicist to receive training in Ghana
2016	Senegal	• Sending radiation treatment staff from Dakar for training at the American Society for Radiation Oncology (ASTRO) annual meeting

References

[1] Farmer P, Frenk J, Knaul FM, *et al*. Expansion of cancer care and control in countries of low and middle income: a call to action. *Lancet* 2010;376:1186–1193.
[2] Barton MB, Jacob S, Shafiq J, *et al*. Estimating the demand for radiotherapy from the evidence: a review of changes from 2003 to 2012. *Radiother Oncol* 2014;112:140–144.
[3] Zubizarreta EH, Fidarova E, Healy B, Rosenblatt E. Need for radiotherapy in low and middle income countries - the silent crisis continues. *Clin Oncol* 2015;27:107–114.
[4] Javid SH, Varghese TK, Morris AM, *et al*. Guideline-concordant cancer care and survival among American Indian/Alaskan Native patients. *Cancer* 2014;120:2183–2190.
[5] Moore SP, Green AC, Bray F, *et al*. Survival disparities in Australia: an analysis of patterns of care and comorbidities among indigenous and non-indigenous cancer patients. *BMC Cancer* 2014;14:517.
[6] Seneviratne S, Campbell I, Scott N, Kuper-Hommel M, Round G, Lawrenson R. Ethnic differences in timely adjuvant chemotherapy and radiation therapy for breast cancer in New Zealand: a cohort study. *BMC Cancer* 2014;14:839.
[7] Coleman CN, Love RR. Transforming science, service, and society. *Sci Transl Med* 2014;6:259fs42.
[8] Atun R, Jaffray DA, Barton MB, *et al*. Expanding global access to radiotherapy. *Lancet Oncol* 2015;16:1153–1186.
[9] Abdel-Wahab M, Bourque JM, Pynda Y, *et al*. Status of radiotherapy resources in Africa: an International Atomic Energy Agency analysis. *Lancet Oncol* 2013;14:e168–e175.
[10] Rodin D, Yap ML, Grover S, *et al*. Global health in radiation oncology: the emergence of a new career pathway. *Semin Radiat Oncol* 2016 (in press).

Please cite this article in press as: Rodin D, et al., Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care, Clinical Oncology (2016), http://dx.doi.org/10.1016/j.clon.2016.11.008

[11] Association of Residents in Radiation Oncology. Global Health Initiative. Available at: https://www.astro.org/Affiliate/ARRO/Global-Health-Initiatives/Global-Health-Initiative/ (accessed 22 October 2016).
[12] American Society for Radiation Oncology. eContouring Ambassador Initiative. Available at: https://www.astro.org/Affiliate/International/eContouring-Ambassador-Initiative/ (accessed 22 October 2016).
[13] Cancer Control 2014. *Bridging the radiotherapy education gap*. Available at: http://www.cancercontrol.info/cc2014/bridging-the-radiotherapy-education-gap/; 2014 (accessed 22 October 2016).
[14] Balogun O, Karamyan N, Antonyan P, *et al*. A pilot curriculum for the implementation of 3-D conformal breast radiation therapy (3D-CRT) in a developing country. *Int J Rad Oncol Biol Phys* 2015;93:E360–E361.
[15] Turner S, Eriksen JG, Trotter T, *et al*. Establishing a Global Radiation Oncology Collaboration in Education (GRaCE): objectives and priorities. *Radiother Oncol* 2015;117:188–192.
[16] Van Dyk J. *Medical physicists without borders addresses the burgeoning need for medical physicists globally*. Available at: http://globalrt.org/medical-physicists-without-borders-addresses-the-burgeoning-need-for-medical-physicists-globally/; 2016 (accessed 22 October 2016).
[17] Medical Physics for World Benefit. Available at: http://www.mpwb.org/ (accessed 22 October 2016).
[18] International Cancer Expert Corps. Available at: www.iceccancer.org (accessed 22 October 2016).
[19] Coleman CN, Formenti SC, Williams TR, *et al*. The international cancer expert corps: a unique approach for sustainable cancer care in low and lower-middle income countries. *Front Oncol* 2014;4:333.
[20] Ribaudo C. Federal efforts to identify alternatives to high activity sources. Available at: http://science.energy.gov/~/media/np/pdf/workshops/workshop-on-isotope-federal-supply-and-demand-2015/Ribaudo_GARS_Presentation_to_DOE_Workshop.pdf (accessed 22 October 2016).
[21] Pomper M, Dalnoki-Veress F, Moore G. *Treatment, not terror: strategies to enhance external beam therapy in developing countries while permanently reducing the risk of radiological terrorism*. Available at: http://www.stanleyfoundation.org/publications/report/TreatmentNotTerror212.pdf; 2016 (accessed 22 October 2016).
[22] International Atomic Energy Agency. *AGaRT: The Advisory Group on increasing access to Radiotherapy Technology in low and middle income countries*. Available at: http://cancer.iaea.org/documents/AGaRTBrochure.pdf; 2013 (accessed 22 October 2016).
[23] Radiating Hope. Available at: http://www.radiatinghope.org/ (accessed 22 October 2016).
[24] Amadori D, Serra P, Bucchi L, *et al*. The Mwanza Cancer Project. *Lancet Oncol* 2016;17:146–148.
[25] White MC, Espey DK, Swan J, Wiggins CL, Eheman C, Kaur JS. Disparities in cancer mortality and incidence among American Indians and Alaska Natives in the United States. *Am J Public Health* 2014;104(Suppl. 3):S377–S387.
[26] Asmis TR, Febbraro M, Alvarez GG, *et al*. A retrospective review of cancer treatments and outcomes among Inuit referred from Nunavut, Canada. *Curr Oncol* 2015;22:246–251.
[27] Petereit DG, Molloy K, Reiner ML, *et al*. Establishing a patient navigator program to reduce cancer disparities in the American Indian communities of Western South Dakota: initial observations and results. *Cancer Control* 2008;15:254–259.
[28] Petereit DG, Burhansstipanov L. Establishing trusting partnerships for successful recruitment of American Indians to clinical trials. *Cancer Control* 2008;15:260–268.
[29] Petereit DG, Guadagnolo BA, Wong R, Coleman CN. Addressing cancer disparities among American Indians through innovative technologies and patient navigation: the Walking Forward experience. *Front Oncol* 2011;1:11.
[30] Rodin D, Yap ML, Hanna TP. GlobalRT: building a new radiotherapy community. *Lancet Oncol* 2014;15:926.

Please cite this article in press as: Rodin D, et al., Mobilising Expertise and Resources to Close the Radiotherapy Gap in Cancer Care, Clinical Oncology (2016), http://dx.doi.org/10.1016/j.clon.2016.11.008