Advancing Global Radiological Services: An Academic Medical Center Offers 5 Core Strategies

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It is estimated that between one-half and two-thirds of the world's population lack access to basic imaging services,[1] reflecting one of the most marked disparities in global healthcare. Nowhere is this more evident than in many low- and middle-income countries (LMICs), where radiology infrastructure and human resources remain critically limited. In Tanzania, for example, the number of practicing interventional radiologists was recently reported as zero, underscoring the depth of the workforce gap. By contrast, in high-income nations, radiologist-to-population ratios can exceed 100 per million people.[2] This disparity illustrates the scale of the global radiology divide and the urgent need for sustainable strategies to expand access.

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Compounding these shortages are barriers such as inadequate infrastructure, limited imaging equipment, and insufficient training.[3] These gaps can delay critical diagnoses, exacerbate preventable illnesses, and contribute to avoidable deaths.

Similar challenges face radiation oncology. Cancer remains the second leading cause of death worldwide.[4] By 2030, most cancer deaths are expected to occur in LMICs,[5] where access to radiation therapy remains severely limited. Indeed, more than 90% of low-income country populations lack basic radiation therapy services.[6]

Addressing these inequities requires a global commitment and coordinated strategies across multiple organizations and disciplines. They include governments, intergovernmental organizations such as the World Health Organization and the International Atomic Energy Agency, nongovernmental organizations (NGOs) like RAD-AID International, and medical societies such as the Radiological Society of North America (RSNA) and the American Society for Radiation Oncology (ASTRO).

Five Core Strategies

Recognizing the urgency of this challenge, Dartmouth Health has established the Division of Global Radiation Oncology (DGRO). An initiative dedicated to the principle that all nations deserve high-quality radiological services, the DGRO leverages 5 core pillars: implementation science, clinical training, virtual education, community engagement, and analysis of determinants of global health (Figure 1).

Implementation Science

Leveraging evidence-based strategies to introduce and optimize advanced technologies and practices in resource-limited settings is foundational to the DGRO's efforts. As fundamentally technology-driven fields, Radiology and Radiation Oncology rely on sophisticated equipment and expertise to deliver effective care. The goal, however, is not merely

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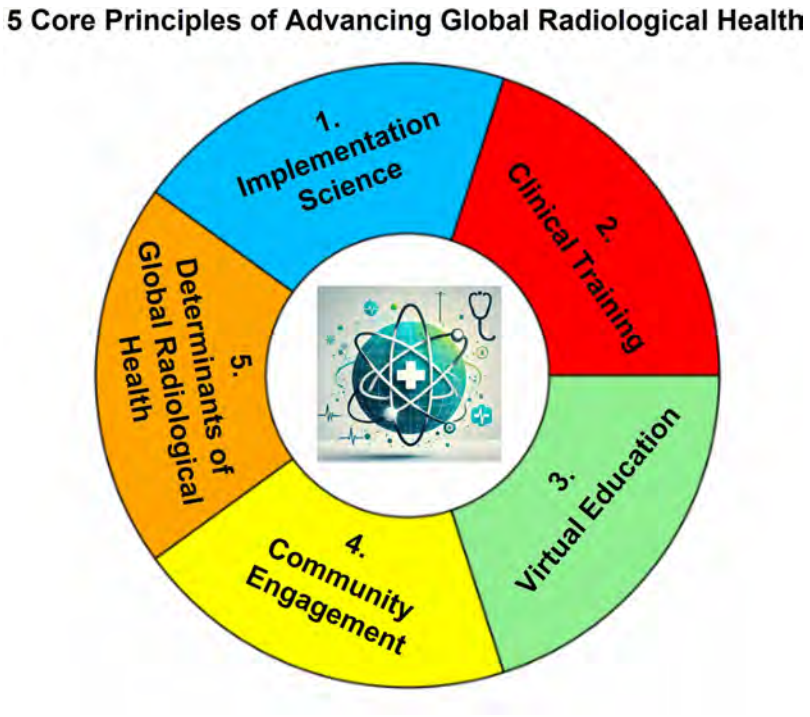
Figure 1. Schematic drawing illustrating a 5-pronged framework for advancing global radiological services by leveraging 5 key pillars: implementation science, on-site clinical training outreach, virtual didactic education, community engagement, and the study of determinants shaping global health.



to bring technology to LMICs but to develop sustainable systems that enhance care and empower local healthcare providers. This helps ensure that technologies are appropriately integrated to meet the unique needs of each setting.

Optimizing imaging protocols is one example of how implementation science can help achieve these goals in both specialties. Tailoring workflows to a given institution's needs can enhance image quality, mitigate geometric uncertainties, and ensure more accurate diagnoses and treatment planning. Another example is customizing hypofractionated radiation therapy protocols to reduce the number of treatment sessions, thereby improving patient throughput without compromising care quality.

Together, these efforts illustrate how implementation science can harmonize radiology and radiation oncology to deliver meaningful, worldwide reductions in radiological disparities.

Clinical Training

Improving clinical training is a second important strategy. Building radiological capacity in LMICs depends not just on the availability of technology but also on the expertise of the professionals using it. During our trips to underserved LMICs, we have witnessed how much sophisticated equipment goes unused or abandoned due to inadequate clinical training.

Training can take many forms. Theseinclude sending clinical teams to provide hands-on training with partner institutions in LMICs and, in our case, hosting observerships at Dartmouth Health. By focusing on practical techniques and workflows, these initiatives foster skills development for radiologists, radiation oncologists, medical physicists, and other support personnel.

For example, technologists can be taught how to optimize protocols to improve diagnostic accuracy; medical physicists can be taught to refine their quality assurance practices to ensure safe equipment operation. These exchanges enhance individual expertise, strengthen institutional capacity, and help local teams sustain high-quality patient care.

We believe that clinical training outreach achieves its greatest impact when it goes beyond one-time, short-term engagements and focuses on building long-term relationships. Dartmouth Health, for example, collaborates with local institutions to hold regularly scheduled case discussions, conduct technical troubleshooting, exchange ideas, and even develop mentorship programs.

These measures offer local practitioners a trusted resource for guidance and support as they navigate complex cases or implement new practices. Equally valuable, ongoing relationships like this help cultivate a sense of community and alleviate the isolation that many clinicians in LMICs feel because of the reduced availability of peer networks in their regions.

Virtual Education

Offering virtual didactic education comprises the third of DRGO's strategies. LMICs face critical deficits in radiology and radiation oncology personnel. According to some estimates, the number of radiation oncologists must increase more than 20-fold to meet global radiation

therapy needs by 2030.[7] Similarly, the demand for radiologists, medical physicists, and imaging technologists far exceeds the capacity of current training programs, leaving resource-limited regions struggling to sustain essential medical imaging services. As it allows for the delivery of high-quality training without requiring travel or costly infrastructure, virtual education offers a promising and accessible solution.

To this end, Dartmouth faculty are leading web-based initiatives tailored to the educational needs of radiology and radiation oncology professionals. These include a continuing lecture series on topics ranging from the principles of imaging modalities to advanced radiation therapy techniques.

Other online initiatives have included an MRI course for medical physicists in Turkey, a curriculum for radiation oncology residents in Kenya, and a lecture series for radiology residents in Guyana. Our faculty have also directed practical treatment planning workshops for physicists and dosimetrists and taught online courses on hypofractionated radiation therapy for specialists across sub-Saharan Africa.

Community Engagement

This fourth of the 5 core pillars emphasizes integrating radiology professionals into the broader healthcare community. Methods for achieving this goal include conference presentations, publishing research focused on global healthcare issues, and hosting forums for professionals to share their experiences at the international level.

The importance of global community engagement cannot be overstated. The wider healthcare community has already developed innovative frameworks for building clinical capacity, expanding infrastructure, delivering education, and scaling care in resource-limited settings. For example, collaborations between governments and NGOs have supported the deployment of radiation therapy equipment, the establishment of national cancer treatment guidelines, and the training of technologists and clinicians to implement those services safely. These kinds of interventions can inform radiology's efforts[2] and help prevent duplication by offering tested models for equitable partnership, locally adapted solutions, and long-term sustainability.

Engaging with RSNA, ASTRO, and other professional groups is equally important. These groups provide platforms for advocacy, collaboration, and education to help integrate the priorities of the radiology and radiation oncology communities with those of global healthcare organizations.[8] Non-governmental organizations such as RAD-AID International, Radiating Hope, and Rayos Contra Cancer can help translate these priorities into action through capacity-building programs and sustainable interventions in which technology or expertise is introduced into clinics in LMICs. Indeed, fostering community engagement underscores the importance of replacing professional and specialty silos with collaboration to ensure that improving the health of people around the world becomes an integral part of the mission of the radiology community.

Determinants of Global Health

The goal of examining the determinants of global health, our fifth core pillar, is to direct more effective and sustainable outreach initiatives. Inequities in access to radiological services are shaped by a web of economic, geographic, historical, political, and cultural factors.[9] Although they fall outside the scope of radiology professionals, these factors directly influence the success of healthcare efforts. Broadening their understanding of these determinants allows institutions to move beyond surface-level solutions to address the deeper causes of inequities.[10]

However, this requires a willingness to engage with specialists outside of radiology and radiation oncology, including experts in the social sciences, public policy, health diplomacy, and international development. By embracing this multidisciplinary approach, institutions can create more informed strategies to drive meaningful, lasting access to medical imaging and radiation oncology services.

Conclusion

Nearly 4 billion people currently lack access to basic imaging services.[1] The magnitude of this disparity represents an opportunity for the radiology community not just to greatly expand the reach of its services but also to help improve healthcare equity on a potentially unprecedented scale.

We believe the strategic framework outlined here, based on the principle that people of every nation deserve equal access to high-quality healthcare, can help achieve both of these goals.

Ultimately, this is not just about meeting a challenge. It is a moral imperative—one that demands vision, collaboration, and sustained action by the entire healthcare community. Through

commitment and innovation, the radiology community has the capacity to profoundly reshape global healthcare and create a future where equitable access to care is a reality for all.

REFERENCES

1) Ngoya PS, Muhogora WE, Pitcher RD. Defining the diagnostic divide: an analysis of registered radiological equipment resources in a low-income African Country. *Pan Afr Med J*. 2016;25:99. doi:10.11604/pamj.2016.25.99.9736

2) McKenney AS, Garg T, Kim E, Kesselman A. Addressing global radiology disparities: increasing access to interventional radiology education. *Radiographics*. 2021;41(5):E142-E144. doi:10.1148/rg.2021210176

3) Jalloul M, Miranda-Schaeubinger M, Noor AM, et al. MRI scarcity in low- and middle-income countries. *NMR Biomed*. 2023;36(12):e5022. doi:10.1002/nbm.5022

4) Wang H, Naghavi M, Allen C. Global, regional, and national life expectancy, all-cause mortality, and cause-specific mortality for 249 causes of death, 1980-2015: a systematic analysis for the global burden of disease study 2015. *Lancet*. 2016;388(10053):1459-1544. doi:10.1016/S0140-6736(16)31012-1

5) Bray F, Jemal A, Grey N, Ferlay J, Forman D. Global cancer transitions according to the human development index (2008-2030): a population-based study. *Lancet Oncol*. 2012;13(8):790-801. doi:10.1016/S1470-2045(12)70211-5

6) 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(2):107-114. doi:10.1016/j.clon.2014.10.006

7) Elmore SNC, Prajogi GB, Rubio JAP, Zubizarreta E. The global radiation oncology workforce in 2030: estimating physician training needs and proposing solutions to scale up capacity in low- and middle-income countries. *ARO*. 2019;8:10-16. doi:10.37549/ARO1193

8) Lief E, Weygand J, Parker SA, et al. Global representatives' initiative of the American Association of Physicists in Medicine. *Med Phys Int*. 2023;11:16.

9) Parker SA, Weygand J, Bernat BG, et al. Assessing radiology and radiation therapy needs for cancer care in low-and-middle-income countries: insight from a global survey of departmental and institutional leaders. *Adv Radiat Oncol*. 2024;9(11):101615. doi:10.1016/j.adro.2024.101615

10) Acemoglu D, Johnson S, Robinson JA. The colonial origins of comparative development: an empirical investigation. *Am Econ Rev*. 2001;91(5):1369-1401. doi:10.1257/aer.91.5.1369