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Expansion of a Multinational Medical Physics Course for Radiation Oncology Residents in East Africa as a Collaborative Model for Education in Low- and Middle-Income Countries

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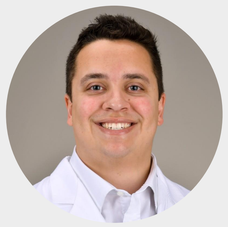
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ABSTRACT

Purpose:
Stark global inequities persist in access to radiological health services, with low- and middle-income countries (LMICs) bearing an increasing cancer burden while facing critical shortages in trained medical physicists and radiation oncologists. Virtual education models have demonstrated effectiveness in addressing workforce gaps in global health settings. This work describes the expansion of a medical physics course for radiation oncology residents from a single-institution pilot to a multinational program across East Africa.

Methods:
Building upon a successful pilot at the University of Nairobi Medical School in Kenya, the course expanded to include radiation oncology residents at Muhimbili University of Health and Allied Sciences in Tanzania and the National Cancer Centre in Lilongwe, Malawi. An international teaching faculty of 15 lecturers from 11 institutions across three continents began a year-long curriculum of 25 biweekly lectures via Zoom. Topics span foundational physics, imaging modalities, and radiation therapy techniques including treatment planning, IMRT, stereotactic procedures, brachytherapy, and quality assurance.

Results:
The expanded course enrolled 45 radiation oncology residents across the three participating institutions. Faculty represented academic medical centers, cancer centers, and global health organizations from the United States, Germany, and Kenya, including UC San Diego, UCLA Health, Cedars-Sinai, Moffitt Cancer Center, Mayo Clinic, UT Health Houston, UAB, CU Anschutz Medical Campus, RAD-AID International, University of Würzburg, and University of Nairobi.

Conclusion:
This multi-country collaboration demonstrates a scalable, replicable framework for medical physics education in LMICs. By leveraging international expertise and virtual delivery, this model addresses workforce shortages while providing radiation oncology trainees with essential physics knowledge for safe and effective clinical practice.

INTRODUCTION

Expanding access to medical physics education in sub-Saharan Africa requires scalable, collaborative models that leverage international expertise while addressing regional workforce needs. This work describes the successful expansion of a medical physics course for radiation oncology residents from a single-institution pilot at the University of Nairobi Medical School to a multinational program now serving trainees at Muhimbili University of Health and Allied Sciences in Tanzania and the National Cancer Centre in Lilongwe, Malawi.

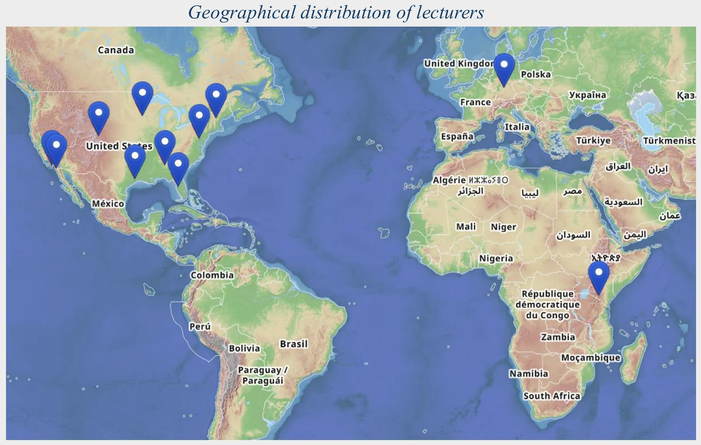
MATERIALS AND METHODS

	Topics
1	Radioactive Decay
2	Radiation Production
3	Interactions of Radiation with Matter
4	Radiation Detection
5	Radiation Measurement Quantities
6	Radiation Safety
7	X-Ray Imaging
8	CT Imaging
9	Nuclear Medicine
10	Ultrasound 1
11	Ultrasound 2
12	MV Units
13	Calibration
14	Electron Beam Therapy
15	Dose Distribution and Scatter Analysis
16	MU Calculations
17	Treatment Planning 1
18	Treatment Planning 2
19	Intensity-Modulated RT
20	Stereotactic Procedures
21	Magnetic Resonance Imaging 1
22	Magnetic Resonance Imaging 2
23	Brachytherapy 1
24	Brachytherapy 2
25	Quality Assurance

- An international teaching faculty drawn from 11 institutions across three continents, to include academic medical centers, cancer centers, and global health organizations.
- A comprehensive year-long curriculum of 25 lectures covering foundational physics, imaging modalities, quality assurance, and radiation therapy techniques.

Course information:
- Lectures are held virtually on a bi-weekly basis.
- Lectures occur over the course of 1-hour with time for a question-and-answer session at the end.
- Recordings of the lectures and copies of the slides are stored in a cloud service and are made available to the students for future use.

Geographical distribution of lecturers



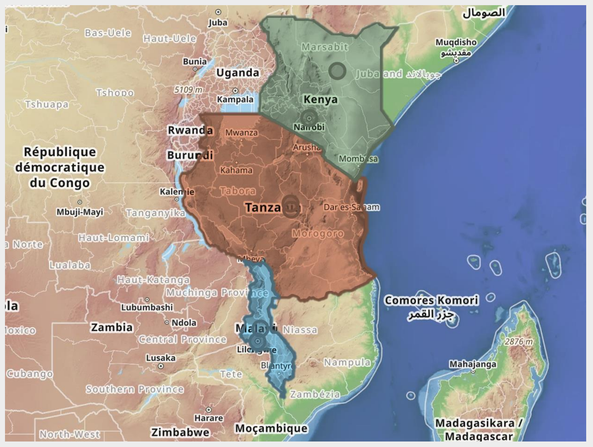
DISCUSSION

This expansion demonstrates that a single-institution virtual physics curriculum can be extended across national borders without new infrastructure at participating sites, relying instead on a distributed volunteer faculty and existing Zoom access. A formal assessment of knowledge gain is ongoing and will be reported at course completion.

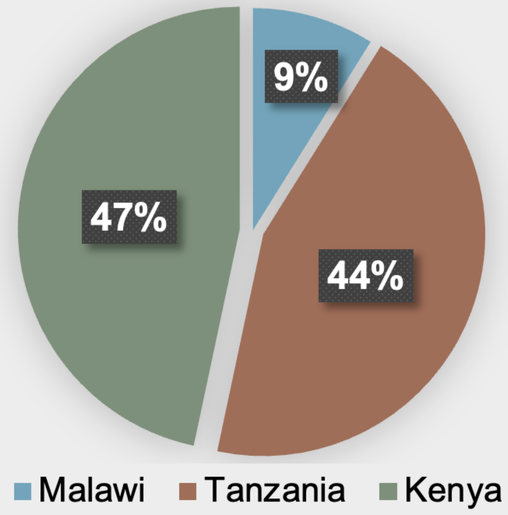
RESULTS

- 45 radiation oncology residents were enrolled in the course from three participating institutions in Kenya (47%), Tanzania (44%), and Malawi (9%).
- Course is currently in progress.

Map of East African countries' participation in the multinational medical physics course for radiation oncology residents. Highlighted regions indicate the three participating countries: Kenya, Tanzania, and Malawi



Geographical distribution of residents



CONCLUSIONS

This multi-country collaboration establishes a replicable framework for medical physics education that can be adapted to other regions facing similar workforce challenges, ultimately supporting the safe and effective delivery of radiation therapy to underserved populations.

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