MEDICAL PHYSICS EDUCATION AND TRAINING IN KENYA: CURRENT STATUS OVERVIEW

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Abstract—**Medical Physics as defined by several international bodies and organizations, amongst them International Organization of Medical Physics (IOMP), is the application of Physics principles and techniques both in diagnosis and treatment of diseases. Medical Physics encompasses allied areas in Medical engineering, electronic and instrumentation and biophysics techniques. The medical physics professionals practices in Radiation therapy, Diagnostic radiology, Nuclear Medicine and in Health physics. In Kenya Medical Physics education and training is young and only two years old, this makes the ratio of medical physicist to population all times high. In Kenya, the Medical Physics education started in 2021 at the Technical university of Kenya, with clinical training at the Kenyatta National Hospital..**

Keywords— **Medical Physicist, Radiotherapy, Diagnostic radiology Nuclear medicine, Technical university of Kenya**

I. Introduction

Cancer is the second leading cause of fatalities and deaths among the non-communicable diseases in Kenya. This trend is expected to increase unless proper mechanisms of detection and treatment are put in place. Kenya is an East African countries with the demography as shown in the Table 1.

Table 1: Kenya Demography

Area	GDP Growth	Per capita	Population	No: of MPs
582.646 km^2	5.1 % (As of January 2022)	1.76 USD (As of December 2021)	53.77 million (As of September 2020)	32 (As of July 2022)

The history of diagnostic radiology services in Kenya dates back to 1936 when the first X-ray facility was installed and subsequent examination performed on 827 people. This was followed with major expansion at the national hospital and four more hospitals outside the capital city. But in 1968 the first cobalt 60 machine was installed in Kenya with a visiting Medical Physicist training the local physicist on the job. It was not until 2020 that, with the assistance of International Atomic Energy Agency (IAEA), a formal training syllabus was drawn and effectively implemented in 2021. This was the genesis of Medical Physics education and training in Kenya.

The training of medical physicist takes place at the Technical University of Kenya for theoretical courses and clinical training takes place at the Kenyatta National Hospital (KNH). The training is divided in segments undertaken per semester. The duration is 2 calendar years. The first year is spent at the University for taught modules that includes: physics of radiotherapy, radiology and nuclear medicine, and radiobiology, anatomy and physiology, ionizing and non-ionizing radiations, electronic and instrumentation and safety and quality management. The second year is dedicated to research project and clinical placements. The Medical Physics program faced several challenges, among them is lack of enough staff and limited funding. These challenges have been addressed gradually.

The history of Kenya's radiation equipment and distribution of medical physicists are presented in Table 2 and Table 3 respectively.

Table 2: History of radiation equipment in Kenya.

Year	Equipment	Centre
1936	First X-ray	KNH
1948 - 1951	Second X-ray (4 Provincial Hospitals)	Kisumu, Mombasa, Nakuru, Nyeri
1958	First Mobile Fluoroscopy	KNH
1968	First Cobalt 60 EBRT, Rectilinear scanner	KNH
1970	First Radionuclide imaging	KNH
1980	Brachytherapy Equipment	KNH
2010	First LINAC in Kenya	Cancer Care Centre

Table 3: Distribution of MPs

Discipline	Total
Radiation Therapy	26
Diagnostic Radiology	2
Nuclear Medicine	2
Private/ Academic	2

II. Infrastructure

Kenyatta National Hospital, the centre for clinical training, there are computerized treatment planning systems for both radiation therapy external beam and brachytherapy, and hospital health information management system. The country has three functional nuclear medicine departments, two private and one Government equipped with a SPECT gamma camera and PET/CT. The country has several diagnostic radiology equipment conventional X-rays machines both public and private institutions as well as CT scanners, mammography units, fluoroscopy units and interventional radiology units. Table 4 presents radiation and imaging equipment in Kenya as of July 2022.

The development has seen Kenya with approximate population of 54 million persons having 8 radiotherapy centers, 3 being government-owned and five privately-owned. All the centers are both in the capital city Nairobi and outside Nairobi with various facilities as below table.

Table 4: Radiation and Imaging Equipment in Kenya

Equipment	Total	Population (million) per Equipment
Cobalt 60	2	26.885
Linear Accelerator	12	4.481
HDR Brachytherapy	8	6.721
X-ray	2000+	≤ 0.027
CT Scanner/CT Simulator	3000+	≤ 0.018
MRI	50+	≤ 1.075
Mammography	40+	≤ 1.344
Gamma camera	3	17.923
PECT/CTs	1	53.77
Cyclotron	2	26.885

III. Regulatory framework for medical physics

Medical physics as a profession has never had any regulatory framework in Kenya, this was occasioned by the huge deficit in number of trained Medical Physicist. There is no proper regulatory framework and the registration of Association of Medical Physicist of Kenya (AMPKen) is underway (Table 5). Currently, all medical physicist are cooperated in Eastern Africa Association of Radiation Protection as members, although in voluntary basis. There is also a requirement from Kenya Nuclear Regulatory Authority to license all radiation workers of which Medical Physicist subscribe to.

Table 5: Professional Society (AMPKen)

Year	First President	First Sec Gen	Members
2022 (Registration year)	Mr. Wakhule Aggrey (Interim Chairman)	Mr. Bernard Ochieng (Interim Sec Gen)	Male: - 18 Female: - 12

IV. Way forward

2021 has been the turning point for Medical Physics training in Kenya, both academic and clinical. The country has developed structured clinical training programme. Once the first batch of trainees are out, the country will have a pool of trained medical physicists. With more and more people showing interest in Medical Physics, the roles and responsibilities of Medical Physics are now becoming clearer with the government and private centers urged to draft schemes of service for the profession. The IAEA technical cooperation (TC) projects have also assisted with awareness and variety of responsibilities of medical physicists practicing in various specialty. Medical physicists are expected to play key roles in projects that touch on the development of this profession.

IV. Conclusion

With the current development, both in the expansion of radiotherapy and diagnostic centers, there has been a need to have medical physicist in every institution with radiation equipment. Interest in establishment of medical physics education and training programme in Kenya has seen tremendous rise over the last decade. The country has as of 2021 successfully established one academic and clinical programme, with a promising future for more training centres to be established in the near future. The IAEA syllabus has formed the basis of training within the second cohort of trainees in the first year of study.

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REFERENCES

1. International Atomic Energy Agency. Postgraduate Medical Physics Academic Programmes, Training Course Series No. 56. Vienna: International Atomic Energy Agency; 2013.
2. International Atomic Energy Agency. Clinical Training of Medical Physicists Specializing in Radiation Oncology, Training Course Series No. 37. Vienna: International Atomic Energy Agency; 2009.
3. International Atomic Energy Agency. Clinical Training of Medical Physicists Specializing in Diagnostic Radiology, Training Course Series No. 47. Vienna: International Atomic Energy Agency; 2010.
4. International Atomic Energy Agency. Clinical Training of Medical Physicists specializing in nuclear Medicine,
5. Training Course Series No. 50. Vienna: International Atomic Energy Agency; 2011 Prevalence and Capacity of Cancer Diagnostics and Treatment: A Demand and Supply Survey of Health-Care Facilities in Kenya

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