MEDICAL PHYSICS EDUCATION AND TRAINING IN ZIMBABWE

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Abstract — **Medical Physics is a branch of applied of physics concerned with the application of the concepts and methods of physics to the diagnosis and treatment of human disease. It is allied with medical electronics and instrumentation, bioengineering. The term 'Medical Physics', as is used here, includes medical imaging physics, therapeutic medical physics, nuclear medical physics and medical health physics. The three areas of activity for a Medical Physics are research and development, clinical service and consultation and teaching. In Zimbabwe, Medical Physics training is offered by a group of institutions which includes two universities (National University of Science and Technology and University of Zimbabwe) and three central hospitals (Mpilo Central Hospital, United Bulawayo Hospitals and Parirenyatwa Group Hospitals)**

Keywords — **medical physicist, radiotherapy, nuclear medicine, Zimbabwe, NUST.**

I. Introduction

There is a growing incidence of cancer especially in the developing world as clearly outlined in the Lancet Oncology Commission Report [1] Based on the input data to the Lancet Oncology Commission Report, the estimated cancer incidence in Zimbabwe was 15,520 cases in 2012. This is expected to increase to 27,720 by 2035, i.e., an 80% increase. It was estimated that 41% of these cases will benefit from having radiation therapy thus at the present time at least 6,400 patients should be receiving radiation therapy.

For any expansion to take place to meet the growing needs to fight against cancer, trained professionals including medical physicists will be required. In order to address the shortage of medical physicists, the National University of Science and Technology (NUST) introduced a MSc Degree in Medical Physics to fulfil the academic requirements for training medical physicists which has been running since 2015. The curriculum for the programme was developed with support of the International Atomic Energy Agency (IAEA) in the form of funding for experts to come and teach and review the modules. At national level, the program has been approved by the Zimbabwe Council for Higher Education (ZIMCHE) and accepted by the Allied Health Practitioners Council of Zimbabwe (AHPCZ) as fulfilling the academic requirements of medical physicists. The initial enrolment to the program was 13 students in September 2015 and has been restricted to a maximum of 10 students for subsequent intakes to ensure adequate supervision for their projects and clinical placements. The program is structured to take two years with the second year dedicated to a research project and clinical placements. The taught modules include: basic physics and biology of radiation, anatomy and physiology, physics of non-ionising radiations, radiotherapy physics, medical imaging physics, nuclear medicine physics, medical electronic and instrumentation and safety and quality management.

Challenges that faced the program included lack of lecturers to cover teaching of all modules, limited funding to set up a medical physics laboratory, limited computing infrastructure to support computer simulations and image processing. The country had no capacity to bring in external lecturers to support the teaching. This was coupled with a government freeze on recruitment. We were able to get assistance from the IAEA through a National Project which was aimed at capacity building for medical physicists and other professionals involved in cancer management.

The government is fully supportive of the initiative to train medical physicists locally. When the program started, there were only three experienced Medical Physicists who had completed an MSc degree in medical physics and undergone supervised clinical training, working in the two cancer centres and could teach at the university. The program has now enrolled four intakes, the first intake graduated in 2017. The future of the program looks bright as the government plans to recruit more lecturers to teach on the program and is also investing in service contracts for equipment in the public institutions to ensure minimal downtime and reliable provision of clinical service as well as a good training environment for the students enrolled on the program.

All the centres have computerized treatment planning systems, a comprehensive information management system. The country has one functional nuclear medicine department equipped with a SPECT gamma camera. There are many conventional X-ray scanners in both public and private institutions as well as CT scanners, mammography units and interventional radiology units. A summary of medical equipment for medical imaging and radiation therapy is shown in Table 1.

II. INFRASTRUCTURE

Zimbabwe, with a population of approximately 15 million people, has three radiotherapy centres; two public and one private. One public institution is in Bulawayo while the other two centres are in Harare. The two public centres have five linear accelerators and three brachytherapy units while the private centre has one linear accelerator.

Table 1 Medical equipment for medical imaging and radiation therapy

Equipment	Total
SPECT	1
Dose calibrators	1
Accelerator	6
MRI	2
CT	23
Mammography	8
Standard Radiology	307
Interventional	15

III. REGULATION OF MEDICAL PHYSICS

In the regulatory framework of Zimbabwe, the presence of a medical physicist is mandatory for all Radiation therapy and Nuclear Medicine centres. The requirement is a bit relaxed for diagnostic radiology centres where the system only requires the services of a medical physicist. The Medical Physics professional is regulated by the Allied Health Practitioners Council of Zimbabwe (AHPCZ). The AHPCZ keeps a record of all practicing Medical Physicists and enforces the need for Medical Physics training. Practicing certificates are renewed annually. Distribution of Medical Physicists in the country is given in Table 2.

Table 2 Distribution of medical physicists in Zimbabwe

Medical Physicists	Total
Radiotherapy	8
Nuclear Medicine	1
Radiology	0
Total	9

IV. EDUCATION AND TRAINING

Medical physics education and training in Zimbabwe has traditionally been completion of a BSc degree in Physics or Applied Physics followed by a two-year internship. A full year Medical Physics clinical attachment, as part of the degree in Physics or Applied Physics was also required before was one could be considered for a position as a Medical Physicist. After completion of the degree program, one would be allowed to work as a Medical Physicist for two years under the supervision of a Clinically Qualified Medical Physicist, after which he/she would be allowed for independent clinical work as a Medical Physicist. The current set up is such that one completes a taught MSc Medical Physics Degree followed by a two-year internship. The taught MSc degree has a requirement for clinical placements in different areas of medical physics when students are in their second year.

V. CONCLUSION

Medical physics training and practice has seen steady progress over the past 4 years and to date we have had four intakes of students. We now follow a curriculum which is harmonized with the AFRA training syllabus for Medical Physicists which was derived from IAEA training publications [2-5]. We also use materials from Emerald [6]. Students are expected to gain competences in all areas where we have the equipment as specified in the IAEA documents. The remainder of the competences are usually acquired through IAEA or government funded fellowships. The second group of students is expected to graduate in November 2019.

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