THE CURRENT STATUS OF MEDICAL PHYSICS IN JAMAICA, RADIATION PROTECTION EDUCATION AND COMPLIANCE ACROSS RADIATION USER PROFESSIONALS

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Abstract— **Before 2015, the safe use of radiation had not been strongly enforced among radiation professionals in various sectors. However, by July 2015, the parliament of Jamaica, passed the Nuclear Safety and Radiation Protection Act (NSRPA) to formalize the use of all forms of radiation generators and radioactive materials. By September 2017, under this Act, an independent regulatory body was formulated to be the instrument for regulating the radiation landscape. This national radiation regulatory body is known as the Hazardous Substance Regulatory Authorities (HSRA). These two pivotal moments inadvertently made Jamaica the first English speaking Caricom Community (CARICOM) nation with radiation laws and an independent regulatory body.**

These events have propelled Jamaica's development through sectors such as radiation medicine, industry, and national security. However, 9 years later, there has still been resistance and slow assimilation of radiation compliance by some private radiation user professionals. To further elaborate, various gaps have been seen that compromise radiation safety in practices within dentistry to surgery.

This occurrence has revealed the need for further education and training for all professionals by certified radiation safety experts to improve the overall standards to an international reference level.

Keywords— **Jamaica, medical physics, radiation protection education, medical imaging, dentistry, interventional surgery, fluoroscopy.**

I. INTRODUCTION

Jamaica is a small island developing state (SIDs) of the Caribbean Community (CARICOM), with a population of 3 million people. Although a SID, Jamaica has not been unfamiliar with the use of nuclear science for peaceful purposes. Since 1984, Jamaica became the first English-speaking Caribbean country to host a 20KW research nuclear reactor, known as the SLOWPOKE - 2. This feature was supported by the European Union (EU) and the International Atomic Energy Agency (IAEA) and has paved the way for the future of nuclear science in Jamaica and the Caribbean. 40 years later, since the advent of this reactor, this has supported the progress of Jamaica through services related to academic research, personnel and environmental radiation monitoring, mineral exploration, environmental protection, climate change, agriculture water and food security, and nutrition and medicine.

Although the occurrence of a reactor highlighted the many values of nuclear science and scientific endeavour, there was a missing key element that would further unlock the potential of the atom for the Jamaican society. This has been a lack of radiation legislation and regulators. These shortcomings have restricted access for local entities to do business internationally to procure and import radioactive sources and other related services. The current international nuclear/radioactive materials supplier landscape demands a country have national nuclear regulations and laws to supply its goods and services. This is in keeping with the IAEA mandates to prevent the misuse of radioactive or nuclear materials to safeguard lives and the environment.

Over the period there has been a notable increase in the use of radiation-generating equipment and medical radioisotopes for the medical and dental sector, both privately and publicly. This increase is in response to the notable ongoing upward trends in Non - Communicable Diseases (NCDs), such as cancer and cardiovascular disease, and the purchasing power parity of both the service providers and consumers of these services. The same can be observed within the industrial and security sectors, as Jamaica increases industrialization via its manufacturing activities and ports that allow goods and people to flow through the country for business or leisure tourism.

II. MEDICAL PHYSICS AND RADIATION LEGISLATION

However, with all these beneficial uses, the safe use of radiation has not been strongly enforced among radiation professionals in various sectors. Radiation Safety officers (RSO) and education have been a limited and foreign concept. Exposure to radiation safety would have been either through the enrolment into a formal radiation-affiliated academic program at an introductory level or restricted to personnel who are privately employed and educated by an international supplier customer support team on the functionality and operation of equipment, devices, or materials.

Intermediate to advanced education and training is not widely exposed nor accessible and therefore there is a reflection of poor to barely acceptable radiation safety practices in some clinical practices. Furthermore, in a setting where radiation generators are present, all stakeholders within the operation would not be adequately aware of the dangers of radiation exposure vs the specialist who may be operating it. Stakeholders such as administration, sanitation staff, medical/ dental ancillary staff, and the temporarily visiting general public are at risk. This also can be extended to highly educated professionals such as clinical members of

a surgical team, dental hygienists, veterinary assistants, or engineers and technicians within a manufacturing environment.

In light of these challenges, in developing a culture of radiation safety, competent radiation safety professionals need to be within the public and private spaces to educate all professional stakeholders and the general public on the responsible and safe use of radiation and radioactive materials. This remedy came into fruition when the University of the West Indies (UWI) Mona Campus launched its Medical Physics BSc and MSc programs in 2009 and 2011 respectively. To date, this program has graduated approximately under 200 medical physicist graduates.

Further development came in 2015 and 2019 the Government of Jamaica, created the Nuclear Safety and Radiation Protection Act (NSRPA) and the Hazardous Substance Regulatory Authorities (HSRA) respectively, to formalize the use of all forms of radiation generators and radioactive materials. These two pivotal moments made Jamaica the first Caricom Community (CARICOM) nation with radiation laws and an independent regulatory body.

By 2021 to boost the representation and profile of medical physics locally and regionally, the Jamaica Association for Physics in Medicine (JAPM) was incorporated in October of that year. This not-for-profit organization is dedicated to representing and advancing medical physics science and its affiliated professionals.

By 2022, the government, with the support of the IAEA, established its first public nuclear medicine centre. These historical moments had inadvertently led to the development and improvement of the medical sector capacity for diagnosing and treating of cancer and other non-communicable diseases (NCDs).

In the last quarter of 2023, in putting the spotlight on medical physics in Jamaica publicly and across the Caribbean, JAPM hosted its inaugural scientific conference on November 13 -17,2023 in Kingston. This historical conference titled "*Quality Assurance in Radiation Medicine for Sustainable Healthcare*" was a collaborative effort of the JAPM and Ministry of Health & Wellness (MOHW) with heavy support from international organizations such as IAEA, Pan American Health Organization (PAHO), and the International Organization of Medical Physicist (IOMP).

III. CHALLENGES

These events have propelled Jamaica's radiation medicine sector and also stimulated the public discussion about nuclear power generation. These interventions have been appreciated by a burgeoning medical physics community, whose presence predates the laws and regulations. The radiation user landscape for an island is quite sizeable, compared to its Caricom counterparts, with over 1000 personnel, across the professions of dentistry, veterinary, surgery, diagnostic, and interventional radiology. Meanwhile, the medical physics fraternity has under 25 physicists in qualified posts. Furthermore, the treatment and diagnostic capacity has increased significantly. Within each specialism, there have been progressive strides in the development of medical physics resources both publicly and privately. In the Radiotherapy landscape, there are four (4) linear accelerators, one (1) cobalt teletherapy unit, and one (1) LDR Brachytherapy unit (Cs^{137}). In the Diagnostic and Interventional Radiology, there is a minimum of 100 units ranging from X-ray, CT scanner, Fluoroscopy, MRI, and Ultrasound. In nuclear medicine, there is one PET CT, one SPECT unit and few gamma cameras.

However, in light of this, nine (9) years after the law and regulations passed, there is still low radiation compliance by some private radiation user professionals. This occurrence has sparked an identifiable gap in the need for further education and training for all professionals. Firstly, in medical physics, there is a need for a holistic residency program, and a professional refresher course locally is required. The former is underway, and the latter eventually will make headway as resources and professional capacity increase.

Within the dental community, through public lecture engagements, identifiable knowledge gaps found were a preconceived notion that low doses are considered negligible doses due to using digital X-ray systems, lack of the need for personnel radiation monitoring, poor shielding materials, and facility layout configuration. A similar conclusion could be inferred from the observation of general and specialist surgeons who utilize fluoroscopy to conduct diagnostic/ interventional radiology studies/ procedures on patients. Gaps related to lax or non-existent enforcement of the wearing of personal dosimetry badges, full body PPE (especially for the head and eyes) wearing and frequent integrity testing, the consistent use of fixed or mobile architectural shielding, quality control testing of fluoroscopy units, diagnostic reference levels and annual general radiation protection education for the surgical team around the unit. There are currently unknowns about the position of radiation protection practices within veterinary radiology. Further investigation is needed to understand the current status of this sector. This is especially apparent with the introduction of mobile veterinary radiology service vehicles to the public.

Importantly, the general public is a key stakeholder that requires education about radiation usage and protection. This is especially the case where many of the general public are within all these sectors working in close contact with the medical staff. With only 15% of the workforce in Jamaica with a tertiary degree, a high level of ignorance would greatly increase the risk of radiation-related incidents among non-radiation workers. As such, this vulnerable group cannot be overlooked.

In conclusion, continual education in the public domain is deeply required to dispel ignorance related to radiation phobia and apathy toward safety in the presence of an ionizing source. Clinical and dental fraternities need current

and advanced knowledge about every changing landscape of radiation equipment functionalities and radiation protection principles in their practices. However, to assess the depth of the knowledge gap and then rectify issues, surveys need to be implemented on a local to national scale to establish the current education baseline. In the interim, in addressing the gap, activities are underway to engage with these radiation professional communities to assess the current status and then implement remediation actions to boost to a satisfactory level.

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