

## Original Article

## Trends in the utilization of nuclear medicine technology in Jamaica: Audit of a private facility

## ABSTRACT

This study sought to evaluate the types and frequencies of nuclear medicine studies that were carried out at a privately-run nuclear medicine facility in Kingston, Jamaica. Previous studies of this nature have not been done among this population, therefore the researchers sought to gather data which may prove to be useful for the growth of nuclear medicine practice in Jamaica. The study was a nonexperimental, retrospective study which involved an assessment of the records of all nuclear medicine patients who received a radiopharmaceutical during January 01, 2017, to December 31, 2018. The data extracted included age, gender, radiopharmaceutical administered, indication for study, and impression from scan. The total number of nuclear medicine scans that were carried out at the facility for the 2-year period was 3756. Of this number, 1889 (50.3%) were male and 1866 (49.7%) were female, with the age ranging from 3 months to 100 years. The types and frequencies of the most frequently occurring studies conducted were bone (2116, 56.3%), renal (867, 23.1%), thyroid (307, 8.2%), and lung (254, 6.8%). Patients aged 60 years and over accounted for the majority of the bone scans (1353/2116). The age group 26–59 years accounted for most of the scans of the lung (123/254), thyroid (209/307), parathyroid (34/65), and whole body (26/34). Patients under 12 years of age accounted for the majority of the renal (596/867), gastrointestinal (22/26), and hepatobiliary (16/28) scans. The audit of this private facility reflects the documented demand on the International Atomic Energy Agency database for Latin America and the Caribbean, and demonstrates the need for continuity of this specialized service in our population.

**Keywords:** International Atomic Energy Agency, Jamaica, nuclear medicine, radiopharmaceuticals, trends

## INTRODUCTION

Nuclear Medicine (NM) is an essential technology of medicine globally in the management of both communicable and noncommunicable diseases. Evaluated trends have indicated growth in both diagnostic and therapeutic applications across different regions.<sup>[1,2]</sup> In spite of this growth, there exists variations in the provision of NM services across territories due to differences in factors such as qualified personnel, instrumentation, radiopharmaceuticals,<sup>[1]</sup> and financial resources. For example, Canada, in 2017, recorded 330 single-photon emission computed tomography (SPECT), 261 SPECT/computed tomography (SPECT/CT), and 51 positron emission tomography/CT (PET/CT) units,<sup>[3]</sup> averaging 17.6/million people, while reports obtained up to April 2016 from Member States of the International Atomic Energy Agency (IAEA) for Latin America and the Caribbean

have documented that the region possesses a total of 1348 gamma cameras, averaging 2.25/million inhabitants.<sup>[4]</sup> With a population of approximately 2.8 million, Jamaica

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currently has two SPECT and one PET units available at private institutions.

As a Member State of the IAEA, Jamaica has been a participant of a number of national and regional projects aimed at developing nuclear technologies. The IAEA Technical Cooperation Project JAM6012 geared at re-establishing NM capacity in the public health system in Jamaica,<sup>[5]</sup> has resulted in the training of a NM physician, a technologist, a physicist, and a radiopharmacist. The project will boost NM services with the addition of a SPECT/CT gamma camera at the University Hospital of the West Indies (UHWI), which is the largest hospital in Jamaica and the largest teaching hospital in the region.

This partnership between Jamaica and the IAEA is geared at increasing access to NM technology for all citizens of the country. While private institutions require full payment from all patients for services rendered, the offering of NM services by the UHWI will facilitate a reduction in out-of-pocket expense for patients, and therefore increase the availability of the technology to a larger proportion of individuals. This is in keeping with the strategy for universal access to health and universal health coverage, which Jamaica adopted from the World Health Organization in 2014.<sup>[6]</sup>

In an assessment of the IAEA initiative to advance NM, Dondi *et al.* stated that the process should be guided by trends that match individual country needs.<sup>[1]</sup> This study sought to evaluate the types and frequencies of NM studies that were carried out at a privately-run NM facility in Kingston, Jamaica. It is intended to be used in assessing the diagnostic needs of the Jamaican population, as well as highlight the prevalence of diseases that require NM technologies for their management. Previous studies have not been done among this population, therefore the researchers sought to gather data which may prove to be useful for the growth of NM practice in Jamaica.

## METHODS

This study was a nonexperimental, retrospective study, aimed at establishing the types and frequencies of NM procedures that were carried out at a privately-run NM facility in Kingston, Jamaica. It involved an assessment of the records of all NM patients who received a radiopharmaceutical during January 1, 2017 to December 31, 2018. It caters to a maximum of 15 NM patients each day. NM diagnostic procedures that are offered at the facility include bone, lung, thyroid, parathyroid, renal as well as gastrointestinal scans. Patients with cancer of the thyroid may also receive NM therapy.

The data extracted included age, gender, radiopharmaceutical administered, indication for study, and impression from scan. Information gathered from the files of patients was assessed with the assistance of a consultant radiologist. Ethical approval was sought and granted from the University of the West Indies Mona Campus Ethics Committee prior to the commencement of the study (ECP 201, 18/19). All methods and procedures were performed in accordance with the guidelines and regulations of the committee.

Statistical analysis was performed with the Statistical Package for IBM SPSS Statistics software (version 22), Armonk, New York, United States and Microsoft Excel 2013. Results have been expressed as means, medians, or inter-quartile ranges or percentage frequencies as appropriate.

## RESULTS

The total number of NM scans that were carried out at the facility for the period of January 2017 to December 2018 was 3756. Of this number, 1889 (50.3%) were male and 1866 (49.7%) were female, with the age ranging from 3 months to 100 years. Of the 3756 patients, the indications of 2186 patients were documented in their files, while the age of 23 patients was not recorded. The most frequent indications were breast, prostate, colon, and cervical cancers for bone scans, urinary tract infection and hydronephrosis for renal scans, and Graves' disease, hyperthyroidism, and thyrotoxicosis for thyroid scans [Table 1].

Bone scans (2116, 56.3%) accounted for the majority of scans conducted over the study period, while 867 (23.1%) renal, 307 (8.2%) thyroid, and 254 (6.8%) lung scans were done. The most frequently used radiopharmaceutical was <sup>99m</sup>Tc-MDP (2116, 56.3%) for bone scintigraphy. <sup>99m</sup>Tc-Glucoheptonate (753, 20%) was the radiopharmaceutical of choice for renal scans, <sup>99m</sup>Tc-Pertechnetate (333, 8.9%) for thyroid and gastrointestinal procedures, and <sup>99m</sup>Tc-MAA (254, 6.8%) was utilized for lung scans [Figure 1].

Patients aged 60 years and over accounted for the majority of the bone scans (1353 of 2116). The age group 26–59 years accounted for most of the scans of the lung (123 of 254), thyroid (209 of 307), parathyroid (34 of 65), and whole body (26 of 34). Patients under 12 years accounted for the majority of the renal (596 of 867), gastrointestinal (22 of 26), and hepatobiliary (16 of 28) scans [Figure 2].

Fifty patients (1.3%) with age ranging from 18 to 71 years, received  $^{131}\text{I}$ -sodium iodide for therapeutic applications.

**Table 1: Most frequently presenting indications for nuclear medicine procedures**

Indications	Frequency
Bone	2116
Prostate cancer	674
Breast cancer	457
Others	128
Missing	857
Gastrointestinal	26
Gastro-esophageal reflux	22
Meckel's diverticulum	4
Hepatobiliary	28
Biliary atresia	4
Others	13
Missing	11
Lung	254
Possible pulmonary embolism	125
Others	26
Missing	103
Parathyroid	65
Hyperparathyroidism	14
Others	19
Missing	32
Renal	867
Urinary tract infection	257
Hydronephrosis	58
Pelviureteric junction obstruction	18
Others	171
Missing	363
Thyroid	307
Hyperthyroidism	47
Graves' disease	43
Thyroid nodules	19
Thyrotoxicosis	11
Others	60
Missing	127
Whole body	34
Thyroid cancer	13
Others	9
Missing	12

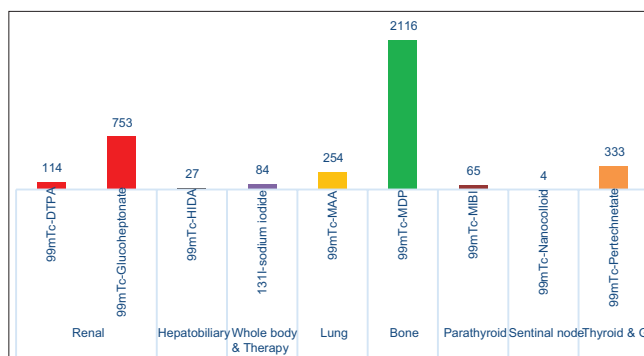
## DISCUSSION

This is the first study to report on the demand for NM technology services in Jamaica. The primary indications for NM services over the 2 years were found to be related to bone, renal, thyroid, lung, and parathyroid scans. These findings are consistent with the IAEA reports from both developing and developed countries.<sup>[1,7]</sup>

Most of the bone scans were requested for patients diagnosed with prostate and breast cancer. These are the leading sites of cancers in Jamaica for males and females,<sup>[8,9]</sup> and accounted for 2012 mortality rates of 33% in males and 20% in females.<sup>[10]</sup> The assessment of bone metastases, a prevalent form of metastases among these patients, is a crucial component of breast and prostate cancer management.<sup>[11-14]</sup> Emphasis should, therefore, be given to advancing the utilization of NM in Jamaica as a tool for the early detection and management of patients with bone metastases from these cancers.

Renal scans were the highest for the pediatric population. In pediatric NM units, nephro-urology scans make up the majority of studies conducted<sup>[15]</sup> as it is used for the detection of both structural and functional abnormalities, and for the determination of glomerular filtration rates in this category of patients.<sup>[16]</sup> Studies have demonstrated a rise in the incidence of chronic renal failure (from 3.2 to 7.83/million) among the Jamaican pediatric population over the 28-year period 1995–2012,<sup>[17-19]</sup> and with global trends of pediatric patients presenting with febrile urinary tract infection,<sup>[20]</sup> early detection of kidney involvement is of importance.

The audit of the single private NM facility reflects the documented demand of the IAEA database for Latin America and the Caribbean.<sup>[1]</sup> However, the findings are limited, as the IAEA database also documented a demand for cardiovascular and brain NM procedures in these countries, which are not services offered at the selected private institution.



**Figure 1: Types and frequencies of nuclear medicine procedures and the radiopharmaceuticals utilized**

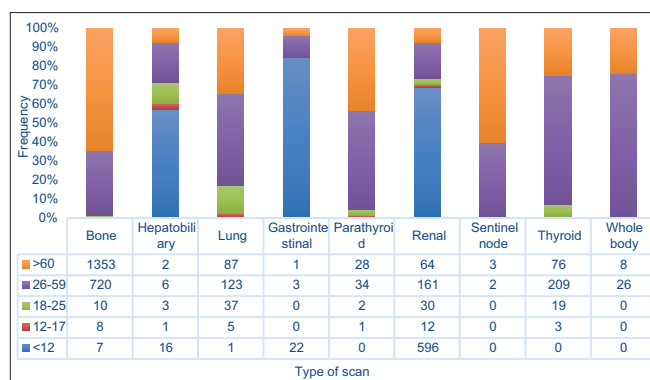


Figure 2: Age distribution of patients based on the type of scan

This investigation provides an assessment of the NM services at a facility in Jamaica and demonstrates the need for continuity of this specialized service in our population. The data provided may serve to guide future involvements with the IAEA in its role to provide support for countries which aim to address health needs through the peaceful applications of nuclear technologies.

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### Conflicts of interest

There are no conflicts of interest.

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