

Assessing Physicians' Awareness and Knowledge of Nuclear Medicine in a Nigerian Hospital

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Abstract: Since its establishment in 1971, nuclear medicine has undergone significant advancements, replacing obsolete medical diagnostic and therapeutic techniques with innovative radiotracers and methods. In the current clinical landscape, nuclear medicine offers valuable diagnostic and therapeutic solutions across various medical specialties, enhancing patient care and quality of life. Despite the increasing significance of nuclear medicine in diagnosis and treatment of various diseases worldwide, there remains a notable gap in the awareness and knowledge of physicians regarding its applications and benefits, particularly in Nigerian hospitals. Understanding and addressing the factors contributing to this lack of awareness and knowledge gaps are crucial for improving patient outcomes, enhancing the quality of healthcare delivery, and promoting the effective utilisation of nuclear medicine services in Nigerian healthcare settings. The study aimed to assess physicians' awareness and knowledge of nuclear medicine in a Nigerian hospital and will potentially deliver valuable insights to support the ongoing professional development of physicians and improve the overall quality of healthcare services in Nigeria.

➤ Objectives:

- To evaluate the level of awareness and knowledge of nuclear medicine among physicians practicing in a Nigerian hospital.
- To explore factors influencing physicians' awareness and knowledge of nuclear medicine.
- To propose potential interventions to enhance awareness and knowledge of nuclear medicine in a Nigerian hospital.

➤ Method:

A descriptive cross-sectional survey was conducted to assess physicians' knowledge and awareness of nuclear medicine at Wuse General Hospital in Abuja, Nigeria. Data were gathered using a structured, self-administered questionnaire distributed to licensed medical doctors from various specialties. The questionnaire, developed based on relevant literature and expert consultation, covered demographic details, knowledge of diagnostic and therapeutic applications of nuclear medicine, awareness of available nuclear medicine services, and perceived challenges to the use of nuclear medicine. A purposive sampling method was employed to recruit clinicians actively involved in patient care, and the sample size of 80 clinicians was determined in relation to the hospital's medical workforce.

Ethical clearance was obtained from the Federal Capital Territory Health Research Ethics Committee as well as the hospital's management, and informed consent was obtained from all participants. Data was recorded using an Excel spreadsheet and analysed with the statistical functions available in MS Excel. Descriptive statistics, i.e. frequencies and percentages, were computed to characterize the physicians' awareness and knowledge of nuclear medicine at the research location. Inferential statistics was employed to assess associations between demographic variables (e.g. training and experience) and awareness/knowledge scores. This approach ensured a methodologically sound and ethically compliant investigation into the state of nuclear medicine awareness within a key Nigerian healthcare institution.

➤ Results:

A total of 80 physicians participated in this study. Only 6.2% of the physicians demonstrated a high level of awareness of nuclear medicine, while 58.8% had moderate awareness and 35.0% showed low awareness. There was no statistically significant association between physicians' gender or age and their level of awareness of nuclear medicine. In terms of knowledge, none of the respondents showed good knowledge; 52.5% had average knowledge, while 47.5% had poor knowledge. Overall, the distribution of scores indicates that although most physicians possess some level of awareness about nuclear medicine, their understanding is largely superficial. This inadequate knowledge base limits their ability to apply nuclear medicine effectively in clinical practice and underscores the need for improved training and exposure in this

specialized field. The p-values, which ranged from 0.474 to 0.495, indicate no statistically significant association between age and knowledge of nuclear medicine ($p > 0.05$). This suggests that deficiencies in knowledge are consistent across all age groups. Similarly, the observed differences in nuclear medicine knowledge between male and female physicians were not statistically significant ($p > 0.05$), implying that gender did not influence the level of understanding in this area.

Regarding strategies to enhance awareness and knowledge of nuclear medicine in Nigeria, 67.5% of physicians recommended organizing regular workshops and seminars on the subject. Additionally, 73.8% believed that the responsibility for establishing nuclear medicine facilities should not rest solely with the government. A significant 87.5% of participants supported the idea that public-private partnerships could help increase the number of nuclear medicine facilities across the country. Similarly, 87.5% of respondents emphasized the urgent need for more nuclear medicine facilities nationwide.

Furthermore, 77.5% of the physicians advocated for integrating nuclear medicine into the undergraduate medical curriculum, initiating residency training programs, and expanding nuclear medicine infrastructure as key steps toward improving knowledge and utilisation. About 20.0% of respondents attributed the low level of awareness to a lack of proper education and training, while 60.0% strongly agreed that nuclear medicine plays a critical role in effective healthcare delivery in Nigeria.

➤ **Conclusion:**

The findings of this study reveal a notable gap in physicians' awareness and knowledge of nuclear medicine and its clinical applications in Nigeria.

➤ **Recommendations:**

There is need to organise regular workshops and seminars on nuclear medicine, encourage partnerships between government and the private sector to establish more nuclear medicine facilities across the country, inclusion of nuclear medicine in the medical training curriculum at universities, and the initiation of residency training programmes for nuclear medicine. These are necessary as respondents agreed that nuclear medicine is extremely important for healthcare service delivery in Nigeria and that lack of proper education and training could be responsible for the low level of awareness and knowledge.

Keywords: Nuclear Medicine; Physician Awareness; Physician Knowledge; Nigeria; Radiopharmacy; Nuclear Imaging; SPECT; PET; Healthcare Delivery.

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I. INTRODUCTION

Nuclear medicine has undergone remarkable development since its formal establishment in 1971, evolving from conventional tracer techniques to a highly specialised discipline employing advanced radiopharmaceuticals for diagnosis, treatment, and disease monitoring. Unlike conventional imaging modalities such as radiography, computed tomography (CT), and ultrasound, nuclear medicine evaluates physiological and molecular processes, enabling early detection of disease before anatomical abnormalities become evident. This functional imaging capability provides clinicians with valuable information for diagnosis, staging, treatment planning, and therapeutic monitoring across numerous medical specialties.

Modern nuclear medicine relies primarily on Single Photon Emission Computed Tomography (SPECT) and Positron Emission Tomography (PET). These imaging modalities have transformed the management of oncology, cardiology, neurology, endocrinology, infectious diseases, and several other clinical disciplines by providing molecular-level information that cannot be obtained using conventional anatomical imaging alone. The continual development of new

radiopharmaceuticals has further expanded the diagnostic and therapeutic applications of nuclear medicine, contributing substantially to precision medicine and improved patient outcomes.

Despite these global advances, nuclear medicine remains underdeveloped in many low- and middle-income countries, including Nigeria. Limited infrastructure, inadequate investment, shortage of trained professionals, and restricted access to radiopharmaceuticals continue to hinder the effective utilisation of nuclear medicine services. In Nigeria, only a small number of institutions provide comprehensive nuclear medicine services, resulting in limited access for both healthcare professionals and patients.

An equally important challenge is the limited awareness and knowledge of nuclear medicine among physicians. Inadequate familiarity with available nuclear medicine procedures and referral indications may contribute to missed diagnostic opportunities, inappropriate treatment planning, delayed patient management, and increased healthcare costs. Understanding the extent of these knowledge gaps is therefore essential for improving clinical decision-making,

strengthening interdisciplinary collaboration, and enhancing healthcare delivery.

This study was conducted to assess physicians' awareness and knowledge of nuclear medicine at Wuse General Hospital, Abuja, Nigeria. Specifically, the study sought to evaluate physicians' level of awareness and knowledge, identify factors influencing these outcomes, and propose strategies that could improve awareness, knowledge, and utilisation of nuclear medicine within Nigerian healthcare institutions. The findings are expected to contribute to professional development, medical education, policy formulation, and the advancement of nuclear medicine practice in Nigeria.

➤ *Aim of the Study*

To assess physicians' awareness and knowledge of nuclear medicine in a Nigerian hospital.

➤ *Study Objectives*

- To evaluate the level of awareness and knowledge of nuclear medicine among physicians practicing in a Nigerian hospital.
- To explore factors influencing physicians' awareness and knowledge of nuclear medicine.
- To propose potential interventions to enhance awareness and knowledge of nuclear medicine in a Nigerian hospital.

II. LITERATURE REVIEW

➤ *Introduction*

Nuclear medicine is a specialised field of medicine that uses radiopharmaceuticals to diagnose, monitor, and treat disease by evaluating physiological and molecular processes rather than anatomical structures. Unlike conventional imaging modalities such as radiography, computed tomography (CT), and ultrasound, nuclear medicine provides functional information that enables earlier detection of pathological changes before structural abnormalities become evident. This capability has made nuclear medicine an integral component of modern healthcare, particularly in oncology, cardiology, neurology, endocrinology, and infectious disease management. Continuous advances in imaging technologies, including Single Photon Emission Computed Tomography (SPECT), Positron Emission Tomography (PET), and theranostic approaches, have further expanded its diagnostic accuracy and therapeutic applications, contributing significantly to precision medicine and improved patient outcomes.

Despite these global advances, access to nuclear medicine remains uneven, particularly in low- and middle-income countries (LMICs). Many healthcare systems continue to face substantial challenges, including inadequate infrastructure, shortages of trained nuclear medicine professionals, limited radiopharmaceutical production, and high equipment acquisition and maintenance costs. Consequently, nuclear medicine services remain concentrated in a small number of specialised centres, limiting patient access and reducing opportunities for

physician exposure and multidisciplinary collaboration. Although countries such as India and Brazil have expanded their nuclear medicine capacity considerably, many countries in sub-Saharan Africa continue to experience significant service gaps. These disparities highlight the need for sustained investment in infrastructure, workforce development, education, and collaborative healthcare policies to improve equitable access to nuclear medicine services.

Nigeria reflects many of the challenges experienced across LMICs. Although nuclear medicine has been introduced into clinical practice, the availability of comprehensive services remains limited. At the time of this study, only a few institutions offered established nuclear medicine services, with PET imaging and theranostic procedures available in only a limited number of facilities. The shortage of specialised personnel, coupled with the absence of structured university-based training programmes in nuclear medicine, continues to restrict workforce development and service expansion. While the International Atomic Energy Agency (IAEA) has supported specialist education and technical cooperation in several African countries, many trained professionals continue to practise outside Nigeria because of limited employment opportunities and inadequate infrastructure. These constraints reduce opportunities for physician exposure to nuclear medicine and may ultimately influence referral behaviour and service utilisation.

Physicians play a pivotal role in determining patient access to nuclear medicine because they are responsible for requesting investigations and referring patients for radionuclide therapy. Their awareness and understanding of available procedures directly influence the timely utilisation of these specialised services. Previous studies in Nigeria have shown that although specialist physicians, particularly clinical and radiation oncologists, generally demonstrate favourable perceptions of nuclear medicine, referral rates remain relatively low. Among general physicians, awareness is often limited to basic concepts, while detailed knowledge of available procedures, referral pathways, and the distribution of nuclear medicine facilities remains inadequate. Similar findings have been reported among radiographers and other healthcare professionals, where theoretical awareness is relatively high but practical exposure is limited because of the scarcity of functioning nuclear medicine centres. Collectively, these studies suggest that awareness alone does not necessarily translate into appropriate clinical utilisation. Instead, education, practical exposure, infrastructure, and access to specialist services all influence physicians' ability to incorporate nuclear medicine into routine clinical decision-making.

International organisations have recognised these challenges and continue to promote initiatives aimed at strengthening nuclear medicine capacity worldwide. Through its Technical Cooperation Programme, the IAEA supports Member States by providing technical assistance, professional training, equipment procurement, educational exchanges, and quality improvement initiatives. Regional

programmes have strengthened workforce development, promoted quality assurance through frameworks such as QUANUM, and encouraged collaboration among healthcare institutions. However, despite these efforts, many African countries continue to experience shortages of qualified personnel, diagnostic equipment, and sustainable nuclear medicine infrastructure, emphasising the need for continued investment in education and service development.

Recent technological developments, including total-body PET imaging, hybrid PET/MR systems, radiotheranostics, artificial intelligence, and machine learning, continue to redefine the future of nuclear medicine by improving diagnostic precision, treatment planning, and personalised patient care. Nevertheless, these innovations can only be effectively integrated into healthcare systems when physicians possess adequate knowledge of their clinical applications and referral indications. In resource-limited settings such as Nigeria, physician awareness therefore remains a critical determinant of the successful implementation and utilisation of nuclear medicine services.

➤ *Study Gap*

Although previous studies have evaluated awareness and perceptions of nuclear medicine among selected healthcare professionals, including radiographers, clinical and radiation oncologists, and physicians working in selected tertiary hospitals, important evidence gaps remain. Existing Nigerian studies have largely focused on specialist groups, individual professions, or tertiary institutions, with limited attention given to physicians practising across multiple specialties within secondary healthcare settings. Furthermore, few studies have simultaneously examined physicians' awareness, knowledge, and perceived strategies for improving nuclear medicine utilisation within routine clinical practice. Given that physicians serve as the primary gatekeepers for referral to nuclear medicine services, understanding their level of awareness and knowledge is essential for improving referral practices, strengthening multidisciplinary collaboration, and informing workforce development and health policy. Addressing this gap provides important evidence to support educational interventions and strategic planning for the expansion of nuclear medicine services in Nigeria.

Accordingly, this study aimed to assess physicians' awareness and knowledge of nuclear medicine at Wuse General Hospital, Abuja, Nigeria. Specifically, the study evaluated physicians' level of awareness and knowledge, explored factors influencing these outcomes, and identified potential interventions that could improve awareness, education, and utilisation of nuclear medicine within Nigerian healthcare institutions. The findings are expected to contribute to medical education, professional development, healthcare policy, and the advancement of nuclear medicine practice in Nigeria.

III. MATERIALS AND METHODS

➤ *Study Design*

This study employed a descriptive cross-sectional observational design to assess physicians' awareness and knowledge of nuclear medicine in a Nigerian hospital. A cross-sectional approach was considered appropriate because it enabled the assessment of awareness and knowledge at a single point in time among physicians from different medical specialties. The study was designed to determine the extent of physicians' awareness and knowledge of nuclear medicine, identify factors influencing these outcomes, and generate evidence to support future educational and policy interventions.

➤ *Study Setting*

The study was conducted at Wuse General Hospital, a district hospital located within the Federal Capital Territory (FCT), Abuja, Nigeria. Data collection was undertaken over a two-month period following receipt of all required institutional and ethical approvals. The hospital provides multidisciplinary clinical services and employs physicians across various specialties, thereby providing an appropriate setting for assessing awareness and knowledge of nuclear medicine among practicing clinicians.

➤ *Study Population*

The study population consisted of physicians practicing in various clinical departments at Wuse General Hospital. Inclusion of doctors from multiple specialties and professional cadres was intended to provide a comprehensive assessment across the hospital's clinical workforce.

Hospital records indicated that 84 physicians were employed at the time of the study and constituted the study population.

➤ *Inclusion and Exclusion Criteria*

The following inclusion criteria were applied:

- Physicians from different medical specialties.
- Physicians with varying levels of clinical experience, including house officers, medical officers, residents, and consultants.
- Physicians who voluntarily provided written informed consent.

The only exclusion criterion was physicians who declined participation in the study.

➤ *Sample Size and Sampling Technique*

Sample size estimation was performed using nQuery Advanced Version 9.3.1.0 (Statistical Solutions Ltd., Cork, Ireland) based on a finite population of 84 physicians, a 95% confidence interval, a population proportion of 50%, and a margin of error of 5%. The calculated minimum sample size was 70 physicians.

To maximise participation and strengthen the representativeness of the findings, all 84 eligible physicians were invited to participate rather than restricting recruitment

to the calculated sample size. Following voluntary enrolment, 80 physicians consented and completed the survey, representing a response rate of approximately 95%. Participants were recruited using purposive sampling, targeting clinicians actively involved in patient care across the hospital.

➤ *Data Collection*

Participants received information regarding the purpose of the study, confidentiality provisions, and their rights as research participants before enrolment. Written informed consent was obtained from every participant prior to questionnaire administration.

Data were collected using a structured, self-administered questionnaire consisting of 31 closed-ended questions. The questionnaire was distributed in hard-copy format and completed in the presence of the researcher in most cases to minimise external influences during completion.

The instrument collected information relating to:

- Demographic characteristics;
- Awareness of nuclear medicine;
- Knowledge of diagnostic applications;
- Knowledge of therapeutic applications;
- Previous training and exposure to nuclear medicine;
- Perceived barriers to nuclear medicine utilisation; and
- Suggested strategies for improving awareness and knowledge.

Completed questionnaires were securely stored to maintain participant confidentiality throughout the study.

➤ *Data Collection Instrument*

The questionnaire was specifically developed to address the objectives of the study and was designed with guidance from experienced academic supervisors who are qualified radiopharmacists.

The instrument assessed participants' understanding of:

- Fundamental concepts of nuclear medicine;
- Diagnostic applications;
- Therapeutic applications;
- Awareness of available nuclear medicine services;
- Factors influencing awareness and knowledge; and
- Potential interventions for strengthening nuclear medicine education and utilisation.

To preserve anonymity, respondents were assigned unique study identification numbers, and no personally identifiable information was collected.

➤ *Pilot Study*

A pilot study involving three physicians working within the Nuclear Medicine Department at Dr George Mukhari Academic Hospital was initially planned to evaluate the clarity, validity, and completion time of the questionnaire.

However, the pilot study could not be conducted because the required institutional approval was not obtained within the planned timeframe. Consequently, no pilot data were included in the final analysis.

➤ *Data Management and Statistical Analysis*

Collected data were entered into Microsoft Excel and analysed using the software's built-in statistical functions.

Descriptive statistics, including frequencies and percentages, were used to summarise physicians' awareness and knowledge of nuclear medicine.

Inferential statistical analyses were performed to examine associations between demographic characteristics and awareness or knowledge scores. Variables examined included age, gender, professional training, and years of clinical experience where appropriate.

Study findings were intended for dissemination through scientific publications, seminars, and hospital-based presentations to promote greater awareness and utilisation of nuclear medicine within the wider medical community.

➤ *Reliability and Validity*

Reliability and validity were strengthened through the development of a structured questionnaire specifically aligned with the objectives of the study.

Questionnaire development was undertaken under the supervision of experienced radiopharmacists and researchers with expertise in nuclear medicine. Content validity was enhanced through careful review of each question to ensure clarity, relevance, and alignment with the intended constructs.

Administration of the questionnaire in hard-copy format and completion in the researcher's presence reduced opportunities for participants to consult external information sources, thereby improving the authenticity of responses. The researcher was also available to clarify any questions, thereby improving consistency in questionnaire administration. These measures were intended to provide an accurate assessment of physicians' actual awareness and knowledge of nuclear medicine.

➤ *Bias Control*

Several measures were implemented to minimise potential sources of bias.

Response bias was reduced by assuring participants that responses would remain confidential and anonymous.

Recall bias was minimised through the use of straightforward closed-ended questions accompanied by clear response options. Participants were also given adequate time to complete the questionnaire in a relaxed environment.

Publication bias was addressed by reporting study findings comprehensively irrespective of whether outcomes were statistically significant or favourable. The research

process was conducted in accordance with accepted scientific standards, and limitations identified during the study were transparently acknowledged.

➤ Ethical Considerations

Ethical approval for the study was obtained from the Sefako Makgatho Health Sciences University Research Ethics Committee (Reference Number: SMUREC/P/309/2024:PG).

Additional approvals were granted by the Federal Capital Territory Health Research Ethics Committee (Reference Number: FHREC/2025/01/11/31-01-25) and the institutional review board of Wuse General Hospital (Reference Number: FCTA/HHSS/WDH/GEN/026/11).

Written informed consent was obtained from all participants prior to data collection. Confidentiality and anonymity were maintained throughout the study by assigning unique study numbers and excluding personally identifiable information from the dataset.

➤ Summary of Methodology

This study employed a descriptive cross-sectional design to evaluate physicians' awareness and knowledge of nuclear medicine at Wuse General Hospital, Abuja. Eighty physicians participated following purposive recruitment from a study population of 84 clinicians. Data were collected using a structured self-administered questionnaire and analysed using descriptive and inferential statistical methods. Measures were implemented to enhance reliability, validity, and minimise bias, while all ethical requirements governing human participant research were fully observed.

IV. RESULTS

➤ Participant Characteristics

A total of 80 physicians participated in the study, representing a response rate of approximately 95% from the target population of 84 physicians employed at Wuse General Hospital, Abuja. Respondents comprised physicians from different clinical specialties and professional cadres, thereby providing a representative assessment of awareness and knowledge of nuclear medicine within the institution.

Table 1 Demographic Characteristics of Participants

Gender	Frequency (%)
Male	44 (55.0)
Female	36 (45.0)
Total	80 (100)

The demographic profile of respondents is presented in Table 1. Participants were distributed across different age groups, gender categories, years of clinical practice, and medical specialties. This diversity allowed assessment of whether demographic characteristics influenced physicians' awareness and knowledge of nuclear medicine.

➤ Physicians' Awareness of Nuclear Medicine

The study evaluated physicians' level of awareness regarding nuclear medicine and its clinical applications.

Overall findings showed that awareness remained suboptimal:

- High awareness: 5 physicians (6.2%)
- Moderate awareness: 47 physicians (58.8%)
- Low awareness: 28 physicians (35.0%)

These findings indicate that although the majority of respondents possessed some awareness of nuclear medicine, only a small proportion demonstrated a high level of awareness. More than one-third of physicians exhibited low awareness, highlighting substantial deficiencies in familiarity with nuclear medicine services.

Table 2 Overall Awareness Level

Awareness Level	Frequency	Percentage
High	5	6.2
Moderate	47	58.8
Low	28	35.0
Total	80	100

➤ Distribution of Physicians' Awareness Levels

The distribution of awareness scores demonstrates that moderate awareness predominated among respondents, while high awareness remained uncommon. The findings suggest that awareness of nuclear medicine exists among physicians but is insufficient to support optimal utilisation of available services.

➤ Association Between Awareness and Demographic Variables

The relationship between awareness and selected demographic characteristics was examined.

• Age

No statistically significant association was observed between physicians' age and their awareness of nuclear medicine ($p > 0.05$). Awareness levels were generally similar across all age categories.

• Gender

Similarly, no statistically significant relationship was found between physicians' gender and awareness of nuclear medicine ($p > 0.05$). Both male and female physicians demonstrated comparable awareness levels.

These findings indicate that demographic factors such as age and gender did not significantly influence physicians' awareness within the study population.

Table 3 Knowledge Level

Knowledge Level	Frequency	Percentage
Good	0	0
Average	42	52.5
Poor	38	47.5
Total	80	100

The overall findings demonstrated limited knowledge among respondents:

- Good knowledge: 0 physicians (0%)
- Average knowledge: 42 physicians (52.5%)
- Poor knowledge: 38 physicians (47.5%)

None of the physicians achieved the threshold for good knowledge. Although approximately half demonstrated average knowledge, nearly half exhibited poor knowledge, indicating substantial educational deficiencies regarding nuclear medicine.

➤ Distribution of Physicians' Knowledge Levels

Knowledge scores revealed that physicians generally possessed only superficial understanding of nuclear medicine. This limited knowledge may negatively influence referral behaviour, multidisciplinary collaboration, and appropriate utilisation of nuclear medicine investigations.

➤ Physicians' Knowledge of Nuclear Medicine

Knowledge of nuclear medicine was assessed using responses to questionnaire items covering diagnostic applications, therapeutic applications, available services, and clinical utilisation.

➤ Association Between Knowledge and Demographic Variables

• Age

Statistical analysis demonstrated no significant association between age and knowledge of nuclear medicine.

The observed p-values ranged from 0.474 to 0.495, indicating that knowledge deficiencies occurred consistently across all age groups ($p > 0.05$).

• Gender

Likewise, differences in knowledge between male and female physicians were not statistically significant ($p > 0.05$), suggesting that gender had no measurable influence on physicians' understanding of nuclear medicine.

➤ Physicians' Perceived Strategies for Improving Awareness and Knowledge

Table 4 Recommended Interventions

Intervention	Percentage (%)
Workshops and seminars	67.5
Public-private partnership	87.5
More nuclear medicine facilities	87.5
Undergraduate curriculum	77.5
Residency programme	77.5

Participants identified several interventions that could improve physicians' awareness and utilisation of nuclear medicine within Nigeria.

The most frequently recommended strategies included:

- Regular workshops and seminars: 67.5%
- Public-private partnerships for establishment of nuclear medicine facilities: 87.5%

- Expansion of nuclear medicine facilities nationwide: 87.5%
- Integration of nuclear medicine into undergraduate medical curricula: 77.5%
- Introduction of residency training programmes: 77.5%

These findings demonstrate strong consensus among physicians regarding the importance of education, workforce development, and infrastructure expansion.

➤ *Perceived Barriers to Nuclear Medicine Awareness*

Table 5 Perceived Barriers

Barrier	Percentage (%)
Lack of education/training	20.0
Nuclear medicine important for healthcare	60.0

Respondents also identified factors contributing to poor awareness and knowledge.

Approximately 20.0% of physicians attributed the problem primarily to inadequate education and training.

Despite the observed knowledge deficiencies, 60.0% of respondents strongly agreed that nuclear medicine plays an essential role in effective healthcare delivery in Nigeria.

These findings indicate that physicians recognise the clinical importance of nuclear medicine while simultaneously acknowledging shortcomings in education and service availability.

V. SUMMARY OF FINDINGS

The principal findings of this study are summarised below:

- Eighty physicians participated in the survey.
- Most physicians (58.8%) demonstrated moderate awareness of nuclear medicine.
- Only 6.2% demonstrated high awareness.
- More than one-third (35.0%) exhibited low awareness.
- No participant demonstrated good knowledge.
- 52.5% had average knowledge.
- 47.5% had poor knowledge.
- Age and gender were not significantly associated with awareness or knowledge ($p > 0.05$).
- Physicians strongly supported educational interventions, curriculum integration, residency training, expansion of nuclear medicine facilities, and public-private partnerships as strategies to improve awareness and utilisation.

Collectively, these findings reveal that although physicians acknowledge the importance of nuclear medicine in healthcare delivery, awareness and knowledge remain insufficient for optimal clinical utilisation. The results underscore the need for targeted educational initiatives and investment in nuclear medicine infrastructure to improve patient access and strengthen clinical practice in Nigeria.

VI. DISCUSSION

This study assessed physicians' awareness and knowledge of nuclear medicine at Wuse General Hospital, Abuja, Nigeria. The findings demonstrate that although most physicians possessed some level of awareness of nuclear medicine, their overall knowledge remained inadequate. Furthermore, neither age nor gender significantly influenced awareness or knowledge, suggesting that knowledge deficiencies are widespread across different demographic

groups. These findings highlight the need for improved education, specialist training, and expansion of nuclear medicine services within Nigeria.

➤ *Physicians' Awareness of Nuclear Medicine*

The study found that 58.8% of physicians demonstrated moderate awareness of nuclear medicine, while only 6.2% exhibited high awareness. Although these findings indicate that most physicians have heard of nuclear medicine and possess some understanding of its clinical applications, the very small proportion demonstrating high awareness suggests that comprehensive knowledge of available diagnostic and therapeutic services remains limited.

These findings are consistent with previous Nigerian studies reporting that physicians generally recognise the existence of nuclear medicine but remain unfamiliar with its full scope of clinical applications and referral indications. Similar observations have been reported among radiographers and other healthcare professionals, where theoretical awareness exceeded practical understanding because of limited exposure to nuclear medicine facilities and procedures. The relatively low number of functional nuclear medicine centres in Nigeria likely contributes to this limited awareness by reducing opportunities for interdisciplinary collaboration and clinical experience.

The findings further suggest that awareness alone is insufficient to ensure effective utilisation of nuclear medicine services. Physicians who possess only superficial awareness may be less likely to recognise appropriate indications for referral, thereby limiting patient access to valuable diagnostic and therapeutic procedures. Consequently, strengthening awareness should focus not only on introducing physicians to the existence of nuclear medicine but also on improving their understanding of its clinical value within routine patient management.

➤ *Physicians' Knowledge of Nuclear Medicine*

A major finding of this study is that none of the participating physicians demonstrated good knowledge of nuclear medicine. While 52.5% achieved average knowledge scores, 47.5% demonstrated poor knowledge, indicating substantial educational deficiencies within the study population.

These findings support previous reports that physicians in developing countries often possess limited knowledge regarding nuclear medicine procedures, radiopharmaceuticals, therapeutic applications, and referral pathways. Inadequate knowledge may reduce clinicians' confidence in requesting nuclear medicine investigations, contribute to delayed diagnosis, and restrict utilisation of available services. Similar findings have also been reported

internationally, particularly in countries where nuclear medicine infrastructure and specialist training opportunities remain limited.

The absence of respondents with good knowledge suggests that nuclear medicine education receives insufficient emphasis during undergraduate medical training and postgraduate clinical education. Limited opportunities for continuing professional development, combined with restricted exposure to functioning nuclear medicine departments, may further contribute to these knowledge gaps. Improving physicians' understanding of nuclear medicine is therefore essential to strengthen multidisciplinary collaboration and optimise patient management.

➤ *Association Between Demographic Characteristics and Awareness or Knowledge*

The study found no statistically significant association between age or gender and physicians' awareness or knowledge of nuclear medicine. These findings indicate that deficiencies in awareness and knowledge occur consistently across demographic groups rather than being confined to particular categories of physicians.

This observation suggests that educational shortcomings are systemic rather than individual. Regardless of age or gender, physicians appear to receive limited formal education and practical exposure to nuclear medicine during medical training and clinical practice. Consequently, interventions aimed at improving awareness and knowledge should target the broader medical workforce rather than specific demographic groups.

➤ *Strategies for Improving Awareness and Knowledge*

Participants identified several practical strategies for strengthening awareness and utilisation of nuclear medicine within Nigeria. Most physicians recommended organising regular workshops and seminars, integrating nuclear medicine into undergraduate medical curricula, establishing residency training programmes, increasing the number of nuclear medicine facilities, and promoting public-private partnerships.

These recommendations align with international efforts led by organisations such as the International Atomic Energy Agency (IAEA), which emphasise education, workforce development, infrastructure expansion, and regional collaboration as essential components for strengthening nuclear medicine services in developing countries. Expanding specialist training opportunities and increasing physicians' exposure to nuclear medicine during undergraduate and postgraduate education may substantially improve referral practices and patient access to appropriate investigations and therapies.

The strong support expressed by respondents for public-private partnerships also reflects recognition that government investment alone may be insufficient to expand nuclear medicine infrastructure. Collaborative investment involving government, private healthcare providers, academic institutions, and international organisations may provide a

sustainable approach to increasing service availability throughout Nigeria.

➤ *Implications for Clinical Practice*

The findings of this study have important implications for healthcare delivery within Nigeria. Physicians serve as primary gatekeepers for referral to nuclear medicine services. Limited awareness and inadequate knowledge may therefore reduce the likelihood that appropriate patients receive timely diagnostic imaging or radionuclide therapy.

Strengthening physicians' education in nuclear medicine has the potential to improve referral accuracy, facilitate earlier diagnosis, enhance multidisciplinary collaboration, and optimise treatment planning. Increased utilisation of nuclear medicine may ultimately contribute to improved patient outcomes across oncology, cardiology, endocrinology, neurology, nephrology, and other clinical specialties where functional imaging and targeted radionuclide therapy provide significant clinical benefit.

➤ *Strengths of the Study*

This study provides one of the few assessments of physicians' awareness and knowledge of nuclear medicine conducted within a Nigerian secondary healthcare institution. The inclusion of physicians from multiple specialties and professional levels enabled a broad assessment of current knowledge across the hospital. In addition, the high response rate strengthened the reliability of the findings and reduced the likelihood of significant non-response bias.

➤ *Study Limitations*

Several limitations should be considered when interpreting the findings. First, the study was conducted within a single hospital, which may limit the generalisability of the results to other healthcare institutions in Nigeria. Second, the use of purposive sampling and self-administered questionnaires introduces the possibility of selection and response bias. Third, the cross-sectional design provides a snapshot of physicians' awareness and knowledge at one point in time and therefore cannot establish causal relationships between demographic characteristics and knowledge levels.

Despite these limitations, the study provides valuable baseline information regarding physicians' awareness and knowledge of nuclear medicine and identifies important opportunities for strengthening education, infrastructure, and healthcare policy within Nigeria.

➤ *Overall Interpretation*

The findings demonstrate that physicians recognise the importance of nuclear medicine in modern healthcare but possess insufficient knowledge to support optimal clinical utilisation. Improving awareness through continuing professional education, curriculum reform, specialist training, and infrastructure development represents an important step towards strengthening nuclear medicine practice in Nigeria. Addressing these educational and structural gaps may improve referral practices, expand patient

access to nuclear medicine services, and contribute to improved healthcare outcomes nationally.

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