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PATIENT AWARENESS AND PERCEIVED HEALTH RISKS OF DIAGNOSTIC RADIATION IN NORTHERN NIGERIA

***[1]Abdulrahman Umaru, [1]Goni Fatima Umar, [1]Ibrahim Mohammed, [1]Abdullahi Shuaibu, [2]Abdulrazaq Bamanga and [3]Tasiu Isah**

[1]Department of medical radiography, Ahmadu Bello University, Zaria, Kaduna State, Nigeria.
[2]Department of Radiography, National Institute of Public Health and Infectious Diseases, Zaria, Nigeria.
[3]Department of Medical Radiography, Kaduna State University, Nigeria.

*Corresponding authors' email: abdulumaru08@gmail.com

ABSTRACT

Diagnostic imaging is essential in contemporary clinical practice, yet many patients have limited understanding of radiation exposure and its associated risks. Insufficient awareness may influence anxiety, informed consent quality and willingness to undergo necessary imaging procedures. This study assessed patients' knowledge and perception of radiation exposure during diagnostic imaging at a Nigerian teaching hospital. A descriptive cross-sectional study was conducted at the radiology department of Ahmadu Bello University teaching hospital, Shika. A structured, self-administered questionnaire was distributed to 210 patients undergoing diagnostic imaging. The questionnaire assessed demographic information, knowledge of radiation, perception of radiation effects, sources of information, and previous experiences with diagnostic imaging. Data were analysed using descriptive and inferential statistics. Overall awareness of radiation was low, with many respondents unable to correctly identify which imaging modalities use ionising radiation. Misconceptions were widespread, including the erroneous belief that ultrasound and MRI emit radiation. Knowledge of potential health risks was limited, and perceptions varied considerably across participants. Educational level demonstrated a significant association with radiation awareness, while many respondents reported never receiving radiation-related information from healthcare professionals, relying instead on informal sources such as family, friends or media. The study demonstrates substantial gaps in patient knowledge and perception of diagnostic radiation exposure. Improved communication within radiology departments is required, including structured counselling, simple educational materials and enhanced engagement by radiographers. Strengthening patient education may reduce misconceptions, support informed decision-making and promote safer use of diagnostic imaging services.

Keywords: Knowledge, Awareness, perception, Radiation exposure, Diagnostic imaging

INTRODUCTION

Diagnostic imaging is central in modern healthcare, providing essential information for disease detection, monitoring and treatment planning. Modalities such as X-ray, computed tomography and nuclear medicine uses ionising radiation, which carries recognised biological risks that vary with dose, tissue sensitivity and duration of exposure (Naqvi et al., 2019; Luka Bastiani et al., 2020; Ribeiro et al., 2019; Shuaibu, et al., 2024). Although the doses used in diagnostic procedures are relatively low, they still contribute to a measurable long-term risk of cancer, highlighting the importance of patient understanding and informed participation in imaging procedures.

Despite this, extensive research shows that many patients have limited or inaccurate knowledge of radiation exposure. Misconceptions range from confusion about which imaging examinations use ionizing radiation to incorrect assumptions about dose magnitude and long-term effects after procedures (Hawsawi et al., 2024; Lin et al., 2022). Studies report that some patients underestimate the risks of CT scans, while others overestimate the dangers of simple radiographs, demonstrating inconsistent and often misleading beliefs (Kotian et al., 2012). Even in well-resourced healthcare settings, patients frequently rely on informal sources of information, which contributes to persistent misunderstandings (Novak et al., 2021; Ribeiro et al. 2020).

A major factor contributing to these misconceptions is inadequate communication between healthcare professionals and patients. High workload, limited interaction time and staff shortages frequently reduce opportunities for effective counselling, leading patients to make decisions without accurate information (Konstantinidis 2024). Poor communication undermines informed consent, increases anxiety and may discourage patients from attending necessary examinations. This is particularly concerning in diagnostic imaging, where misunderstanding of radiation risks can shape attitudes and influence cooperation during procedures.

The challenge is even more pronounced in sub-Saharan Africa, where health-literacy barriers and limited access to structured patient education contribute to lower awareness of radiation risks (Habeebu et al., 2021; Soko et al., 2019). Nigerian studies similarly report inadequate understanding of diagnostic radiation, limited awareness of stochastic effects and minimal counselling before imaging procedures (Abdulrazaq et al., 2022; Adejumo, Enebeli and Bilewu 2020). However, within the northern region of Nigeria, evidence remains scarce, particularly in large tertiary centres such as Ahmadu Bello University Teaching Hospital, Shika. Given its large patient population and central role in diagnostic services, assessing patient knowledge in this setting is essential.

The lack of regional data represents a significant gap that limits the development of effective patient-education strategies. Assessing patient knowledge and perception in this context is therefore necessary for improving radiation-safety awareness, strengthening informed consent and enhancing patient-centred radiology service.

MATERIALS AND METHODS

This study employed a descriptive qualitative cross-sectional design to assess patients' perceptions of the effects of radiation used during diagnostic imaging. The research was

carried out at Ahmadu Bello University Teaching Hospital, Shika, in Kaduna State, Nigeria. The hospital was considered an appropriate setting because it serves a large and diverse patient population and provides a wide range of diagnostic imaging services, including modalities that utilise ionising radiation.

Ethical approval for the study was obtained from the Research Ethics Committee of Ahmadu Bello University Teaching Hospital (NHREC/ABUTH/NHREC/29/08/23). Informed consent was obtained from all participants, who were assured that participation was voluntary and that they had the right to withdraw from the study at any stage. Confidentiality and anonymity were strictly maintained throughout the research process.

A total of 210 patients were recruited using a simple random sampling technique. This method ensured that every eligible patient presenting for non-emergency diagnostic imaging had an equal chance of being selected, thereby minimising selection bias and improving the representativeness of the sample.

The study population consisted of patients attending the radiology department for non-emergency diagnostic imaging that involved ionising radiation. The inclusion criteria required participants to be at least 18 years of age and capable of providing informed consent. The exclusion criteria removed individuals who were critically ill, admitted for inpatient care, presenting for emergency imaging, or undergoing therapeutic radiologic procedures. These criteria ensured that only respondents capable of providing accurate and meaningful information were included.

Data were collected using a structured questionnaire that had undergone validity testing by two experts in the field of radiation protection, and the reliability analysis produced a Cronbach's alpha value of 0.78, which indicates acceptable internal consistency. The instrument captured sociodemographic characteristics, knowledge of radiation exposure, sources of information, perceptions of radiation effects and personal experiences related to diagnostic imaging. The questionnaire allowed for a comprehensive assessment of patient understanding and attitudes toward radiation used in imaging procedures.

Completed questionnaires were coded and analysed using IBM SPSS. Descriptive statistics, including frequencies and percentages, were used to summarise demographic characteristics and response patterns. Spearman's rank correlation was applied to determine the relationship between educational level and perception of radiation effects, while the Mann–Whitney U test was used to examine the association between prior exposure to diagnostic imaging and patient perception. A p-value of less than 0.05 was considered statistically significant.

RESULTS AND DISCUSSION

A total of 210 patients participated in the study. Familiarity with the concept of radiation was generally low. Almost half of the respondents (48.6%, n = 102) reported not being familiar with radiation, while only 17.1% (n = 36) indicated familiarity. Most respondents (82.8%, n = 174) were unable to correctly describe radiation used in medical imaging, and 69.1% could not identify which diagnostic imaging modalities utilise ionising radiation. These patterns reflect limited foundational knowledge and are illustrated in Figure 1.

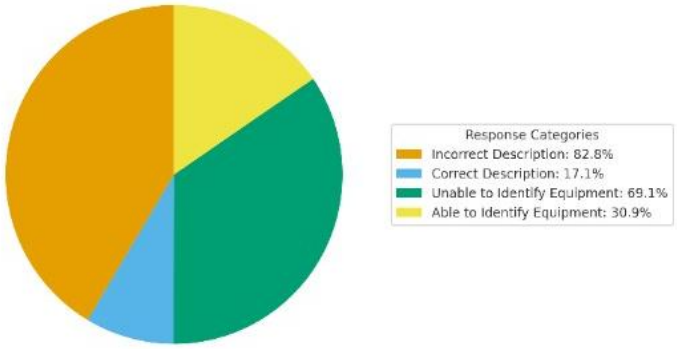

Figure 1: Knowledge of Radiation Concept Amongst Respondents

Sources of information about radiation varied considerably. Media outlets such as television, radio and newspapers were the most frequently reported source (46.5%). Additional sources included the internet (19.1%), healthcare professionals (13%), friends and family (12.4%) and books or journals (9.6%). Only 13.4% of participants had ever actively sought information about radiation, indicating strong dependence on informal sources. These findings are summarised in Figure 2.

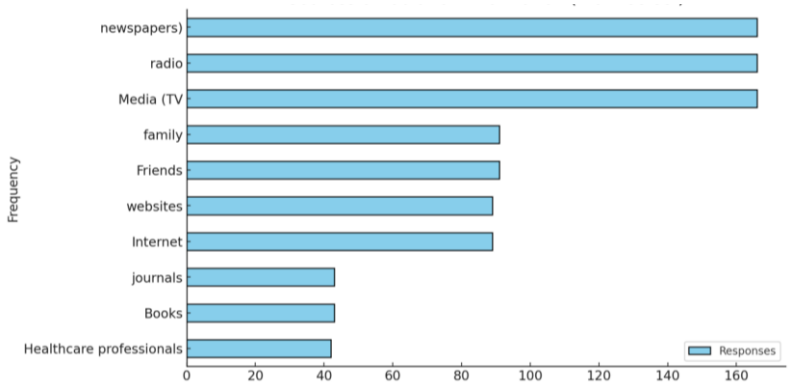

Figure 2: Sources of Radiation Information and Pattern of Information-Seeking Amongst Patients

Perceptions of radiation risk showed considerable variation among respondents. Slightly more than half (51.4%) agreed that radiation poses health risks, while 28.1% were unsure and 7.6% disagreed. Cancer was the most commonly identified potential adverse effect (38%), followed by uncertainty about the effects (29.2%), the belief that radiation causes no harm (19.9%), genetic mutations (9.3%) and skin burns (3.7%). These findings are presented in Figure 3 and details in table 1.

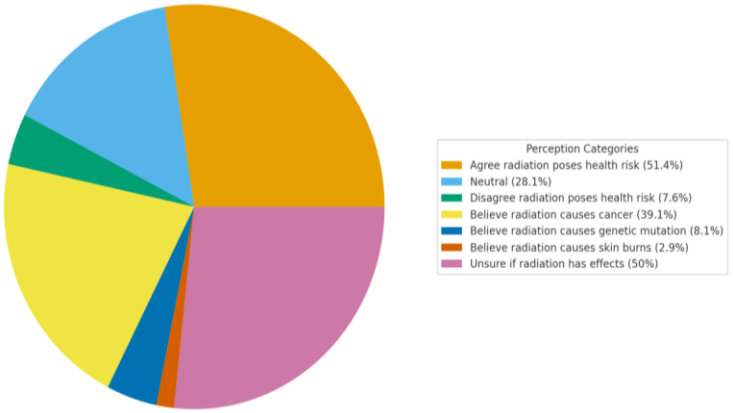

Figure 3: Perception of Radiation Risk and Exposure

Inferential analysis demonstrated a statistically significant moderate positive relationship between educational level and perception of radiation risk ($r_s = 0.310$, $p < 0.001$). A weaker but significant correlation was found between educational level and concern about radiation effects ($r_s = 0.197$, $p = 0.004$). These findings suggest that respondents with higher educational attainment were more likely to recognise radiation as a health risk and to express greater concern about its potential effects.

Half of the respondents had previously undergone imaging involving ionising radiation, such as X-ray or CT. Among these individuals, 28.6% reported not receiving any information during the imaging procedure, and 13% stated that they had to seek information on their own. Most respondents (82.9%) had never refused or delayed imaging because of radiation concerns, although 15.7% reported avoiding imaging at least once for this reason. The majority (68.1%) expressed a desire for more radiation-related information from healthcare providers, while 83.3% agreed that the benefits of an accurate diagnosis outweigh potential radiation risks. These findings are shown in Figure 4.

A Mann–Whitney U test showed no statistically significant difference in perceived health risks between respondents with prior imaging exposure (Mean Rank = 112.04) and those without (Mean Rank = 98.96), $U = 4826.0$, $p = 0.096$. Concern about radiation effects also did not differ significantly ($U = 4769.0$, $p = 0.058$). Although not statistically significant, respondents with previous imaging exposure demonstrated slightly higher awareness, suggesting minimal influence of past imaging experience on risk perception.

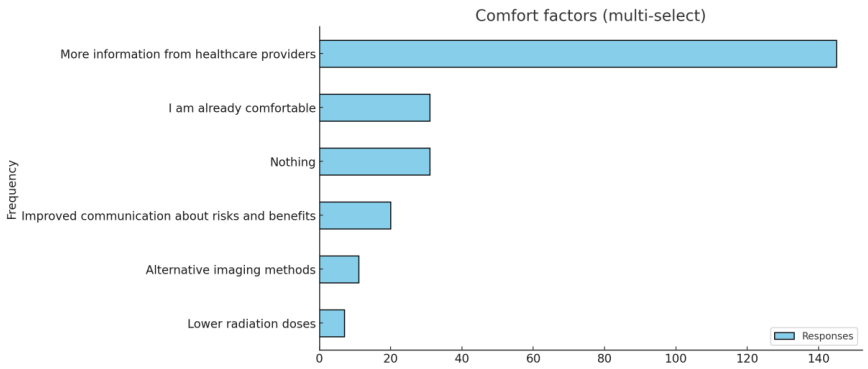

Figure 4: Personal Experiences and Concerns Regarding Radiation Exposure

Table 1: Perceived Effects Associated with Radiation

	Frequency	Percent
Cancer	82	38.0
Unsure	63	29.2
No effects	43	19.9
Genetic mutations	20	9.3
Skin burns	8	3.7

Discussion

This study explored patients' knowledge and perception of radiation exposure during diagnostic imaging at a major tertiary hospital in Northern Nigeria. The findings reveal substantial knowledge gaps and widespread misconceptions, particularly regarding the basic concept of radiation, identification of ionising modalities and the potential health effects of radiation exposure. These results are consistent with previous studies that have reported limited radiation literacy among patients in both local and international contexts (Hollada et al. 2015; Ricketts et al. 2013; Adejumo, Enebeli and Bilewu 2020).

A notable finding was the high proportion of respondents who were unfamiliar with the concept of radiation and unable to correctly describe radiation used in medical imaging. Many respondents struggled to identify which modalities use ionising radiation, with a substantial proportion incorrectly associating ultrasound and MRI with radiation exposure. This aligns with earlier findings by Lin et al. (2022) and Kotian et al. (2012), who similarly reported confusion between ionising and non-ionising imaging techniques. Such misunderstandings may influence patient attitudes, generate unnecessary fear and compromise informed consent, especially when patients inaccurately perceive harmless procedures as risky.

Awareness of actual radiation risks was also limited. Although cancer was recognised as a potential effect by some respondents, uncertainty remained high, and many participants were unaware of stochastic effects associated with cumulative radiation exposure. The distribution of perceived effects, demonstrates persistent misconceptions, including beliefs that radiation causes skin burns or infertility at diagnostic doses. Similar patterns have been reported by Novak et al. (2021), suggesting that inadequate understanding of risk mechanisms is a recurring problem across different settings.

Educational level showed a significant influence on perception, with higher levels of education associated with greater awareness and concern regarding radiation risks. This supports observations by Ribeiro et al. (2020), who highlighted the role of health literacy in shaping patients' understanding of diagnostic imaging. The finding underscores the need for communication strategies that are sensitive to varying literacy levels, particularly in regions where formal education may be limited.

The study also identified a major gap in information delivery from healthcare professionals. Respondents reported relying primarily on media outlets, friends and family for radiation information, with only a small proportion citing radiographers or radiologists as sources. Limited communication between imaging staff and patients has been reported in previous Nigerian studies (Adejumo et al. 2020; Habeebu et al. 2021), and this trend persists in the present study. The absence of structured patient counselling likely contributes to the misconceptions observed and reduces opportunities for evidence-based guidance.

Experiences with prior imaging did not significantly influence perceptions, as shown by the Mann-Whitney U analysis. Although those with previous imaging exposure showed slightly higher awareness, the difference was not statistically significant. These findings suggest that routine imaging experiences alone do not enhance radiation literacy unless accompanied by effective communication and patient education.

The implications of these results are significant for clinical practice. Improving radiation communication within radiology departments is essential for addressing misconceptions, reducing patient anxiety and strengthening informed consent. Implementing brief, standardised explanations before imaging procedures, developing simple educational materials for waiting areas and encouraging radiographers to provide verbal guidance may substantially improve understanding. Broader community education initiatives may also help counter misinformation obtained from media or social networks.

While the study provides valuable insight into the knowledge gaps in Northern Nigeria, its findings should be interpreted with consideration of its limitations. The use of a single hospital setting and self-reported data may limit generalisability, although the relatively large and diverse sample enhances confidence in the overall trends observed.

In summary, the study highlights the need for targeted educational interventions and improved patient communication practices within radiology departments. Addressing the misconceptions identified is crucial for enhancing patient engagement, promoting safe imaging

practices and improving the overall quality of radiological care, particularly in low-resource settings.

CONCLUSION

This study reveals substantial gaps in patient knowledge and perception of radiation exposure during diagnostic imaging at a major Nigerian teaching hospital. Many respondents demonstrated limited understanding of radiation concepts, relied heavily on informal information sources and held misconceptions regarding the risks associated with diagnostic procedures. Educational level emerged as an important factor influencing awareness, while prior imaging experience showed little effect. These findings underscore the need for improved communication practices within radiology departments. Strengthening patient education through clear explanations, structured counselling and accessible information materials will enhance informed decision-making, reduce misconceptions and support safer imaging procedures.

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