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Radiation Safety Practices: Awareness and Health Implications of Radiation Exposure among Health Workers in Federal Teaching Hospital Owerri

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ABSTRACT

The increasing use of advanced biomedical technology in hospital scenarios has contributed to the enhanced efficiency, accuracy, and contribution of healthcare services. However, the risk of radiation exposure is still a significant occupational health problem among health workers. Thus, maintaining safe practices in radiation is important to reduce exposure and adverse health effects. The awareness of radiation safety practices and the health effects of radiation exposure among health workers: A study at Federal Teaching Hospital Owerri. Developed a research narrative of four research objectives, four research questions and three hypotheses. Study design-A descriptive survey approach was employed, and the study population that comprised 300 health workers from radiology-related units. A sample size of 203 was identified using the formula by Slovin with a margin error of 4%. Methods-A self-structured and validated questionnaire (by subject experts) was used to collect data. The reliability was established based on test–retest, Pearson's Product Moment Correlation Coefficient (r = 0.99). The data were analyzed using frequency counts, percentages, mean, standard deviation, and chi-square statistics. Results revealed that respondents' a) awareness of radiation safety practices were high (Mean: 3.09 ± 0.57), and b) availability of safety practices in the facility as well (Mean: 3.31 ± 0.41). Infertility and pregnancy complication due to radiation (mean 3.70 ± 0.53) The majority attributed professional knowledge as a factor related to awareness of radiation safety, with 193 (95%) respondents agreeing with this. Radiation safety awareness did not differ between male and female workers with a calculated chi-square of 2.4 lesser than the tabulated chi square value of 7.81 ($\chi^2 = 2.4$, P = 0.05, df = 3), but between clinical and non-clinical workers there was a significant difference ($\chi^2 = 164.3$, P = 0.05 df = 1; P 3.84,). Health workers showed a generally good level of awareness and practice regarding radiation safety but sustained training, re-training and periodic equipment checks, among others, are high-priority recommendations.

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Awareness, Radiation, Radiation Safety Practices, Health Implications, Health Workers.

1. Introduction

Advanced technological equipment is an essential component of modern healthcare settings, allowing for efficient and effective clinical work. However, those tools — especially in the type of ionizing radiation they emit — put health workers at risk, and remain a perennial concern for occupational health. According to Almeida (2024), radiation exposure is an important public health problem, especially for occupationally exposed populations such as health workers, hence radiation safety has become a great concern primarily for radiological staff and patients.

According to the World Health Organization (2023), ionizing radiation is one factor that leads to several clinical situations, either acute or chronic. According to the Centers for Disease Control and Prevention (CDC, 2024), radiation can alter DNA in terms of morphology and chemical composition & conversely increase mortality at higher doses. Following this, Jain (2021) did an epidemiological survey wherein he established that radiation exposure increases the likelihood for cancer, on a case-to-case basis relative to dose with the needed organized public health management inputs. Olaboye et al. (2025) pointed out that among other risk factors, environment is highly associated with the health effects of radiation especially in areas with improper disposal of radiation waste. According to the United States Environmental Protection Agency (2025), these low-level exposures may act as weak carcinogens to a lesser degree, however, due to cumulative risk, exceeding no exposure limits is essential. All of these findings taken together bolster the view that radiation is a dangerous and persistent public health hazard on a global scale.

Radiation simply means the release of energy into the environment in form of waves or particles. The two major categories are ionizing and non-ionizing radiation It comes from natural sources such as cosmic rays, radioactive materials in the environment and artificial sources generally used by health care, industry and research (WHO 2021). X-rays are used in radiography to create images of internal body structures for diagnostic and therapeutic purposes. This includes medical imaging and x-ray, both of which use ionizing radiation.

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The International Commission on Radiological Protection (ICRP, 2023) describes that medical exposure to ionizing radiation includes direct exposure an individual receives for his or her own diagnosis or treatment of a disease as well as exposure of caregivers assisting patients and volunteers in clinical research. Most common medical procedures using ionizing radiation are X-rays, Computed Tomography (CT) scans, mammograms, lung ventilation/perfusion scans, angiography or interventional radiology and surgery done under C-arm view.

Awareness: knowledge or perception of a situation or fact. According to the American Psychological Association, we define awareness as "the ability to perceive or know something." On a cognitive level, awareness allows attention, perception and memory to work in harmony, further allowing you to interpret the given concept/situation. According to Zhang (2024), awareness is not only perception but also perceptual self-awareness, emotional awareness, social perception, and social cognition. In neuroscience awareness is related to activities in the cerebral cortex that support consciousness experience by corrupted neural patterns--an experience aware (Ulhaq, 2024).

Radiation safety practices are the principles and regulations adopted in healthcare facilities, in industries, and in nuclear research laboratories that aim to minimize harmful effects of radiation on people from exposure to ionizing radiation. Radiation safety is defined by WHO (2018) as all actions and strategies for availability, protection of humans and maintenance of health through prevention/controlling exposure to radiation during practice. The IAEA (2021), on the other hand, defines radiation safety as the set of principles and practices embraced to ensure safety within services from radiology. According to the IAEA, in 2006 it defined three primary principles for radiation safety, which are justified system, optimized levels and limited doses. First of all, radiation safety is based on three concepts: time, distance and shielding.

Decreasing exposure time, increasing distance from radiation source and using physical barriers such as lead aprons, thyroid shields, face shields/goggles/hand gloves etc. will greatly reduce the amount of ionizing radiation that enters the body. Radiology unit personnel routinely use dosimeters to help track cumulative exposures, allowing blood lead levels to remain below permissible limits.

Radiation safety in Nigeria: The Nigerian Nuclear Regulatory Authority (NNRA) and the Radiographers Registration Board of Nigeria (RRBN)[1] These bodies are responsible for regulation of radiation facilities, monitoring of exposure of workers, enforcement f safety measures and training and certification (RRBN, 2023). In Nigeria, the NNRA conducts its activities based on Nuclear Safety and Radiation Protection Act, backed by Nigerian Basic Ionizing Radiation Regulations (NiBIRR) that provides standards for who can use ionizing radiation in a medical practice (NNRA, 2024).

The early use of ionizing radiation in Nigeria can be traced to the turn of the 20th century, after the discovery of X-rays systemically in 1895 globally. In 1913, British colonial medical services installed the first X-ray machine at Lagos General Hospital which was primarily used for fracture detection and tuberculosis diagnosis [18]. However, on the 1930s radiological services proliferated. And in the years that followed, newer technologies — such as fluoroscopy, angiography, computed tomography (CT), and radiotherapy — emerged to revolutionize diagnostic and therapeutic medicine across Nigeria (Adejoh et al., 2018; Ogbanya et al., 2024).

Ionizing radiation generates stability of nuclear medicine in Nigeria under three main fields: medical (diagnostic radiology and radio-therapy), research & experimental studies, industrial and environmental as pipeline inspection in Niger delta region. The biggest area of use is still in medical applications.

According to the ICRP (2023), there are two categories of health consequences from exposure to radiation, deterministic effects (which are dose-dependent effects that manifest above a specified threshold dose) and stochastic effects (which occur by chance and become more likely as the radiation dose increases). Occupational radiation safety focuses on the understanding and management of these risks using education, protective equipment and limits on doses received.

Here, we define dose limits for occupational exposure as stated by the IAEA and ICRP: (1) an effective dose of 20 mSv per year averaged over five years, but no single year exceeding 50 mSv; (2) a lens-of-eye dose of averaged over five years at 20 mSv per year (maximum in any single year 50 mSv); and (3) skin, hand and foot limits were set to10 times higher than those of organ limit. The annual effective dose limit for the public is 1 mSv. A limit of 1 mSv foetal dose over the course of pregnancy should be applied to pregnant workers (IAEA, 2023; ICRP, 2022; NNRA, 2023).
A cross-sectional study on radiation safety awareness and compliance was conducted by Allam et al (2024) using 384 health workers and the findings provided evidence of awareness-compliance gap in radiation safety principles and advocated for proper education and training of radiation officers on the safety practices.
A study was conducted to investigate the awareness of radiation safety principles and health risk related to exposure among health workers in Federal Teaching Hospital Owerri.

2. Methodology

2.1 Research Design

The study had a descriptive survey design. This design allowed the researcher to gather original data in a natural environment and describe, interpret, and answer questions about what was happening with current practices, relationships, and conditions. Uchegbu (2001) stated that descriptive survey seeks to explain opinion, relationship existing between variables. Similarly, Nworgu (2015) identified descriptive survey design as that which finds out existing practices, beliefs, opinions, attitudes, and trends of development and effects in a population. The researcher found this method as ideal for assessing the knowledge of radiation safety and health consequences of cumulative exposures to ionizing radiation by the health workers at Federal Teaching Hospital Owerri.

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2.2 Area of Study
The study was performed at Federal Teaching Hospital Owerri along Orlu —Owerri Road in the Owerri Municipal Area of Imo State.

2.3 Study Population
The population for the study included all health workers in radiology-related units of Federal Teaching Hospital Owerri (Radiology Department- Radiologists , Radiographers , Nurses , Dark-room/front desk officers, Ancillary staff) = 55, Anaesthesia Department (Doctors, Nurse Anaesthetists and Technicians) =40; Main Theatre and Recovery Room Nurses =42; Neuro-theatre unit =15, Consultants , Senior registrars and ,Registrars =102. (These Specialists across surgical sub-specialties), Ancillary staff = 30, Oncology Unit= 10 and Biomedical Engineers =6. This provided a cumulative total of 300 health workers (55 + 40 + 42 + 15 + 10 + 6 +30+102 = 300).

Through the Slovin formula: $n = N/(1 + Ne^2)$, with a margin of error of 4%, it was determined that the valid sample size was 203
N = Population
n = Sample
e2 = margin of error (4%)
300/ (1+300 x (0.0016)2
n = 300/ (1+300 x 0.48)
n = 300/1.48
n= 202.70
n= 203, Sample = 203
Therefore, the sample size used for the study were 203 health workers which is a very good representation of the population.

2.4 Inclusion and Exclusion Criteria
Inclusion criteria All health workers in Radiology Department, Surgical Theatres, Anaesthesia Department and Oncology Unit, other radiological intervention units. Exclusions included non-staff of Federal Teaching Hospital Owerri and health workers not currently working in the defined target areas.

2.5 Sampling Technique
A Multi-stage Sampling method was used to select the participants. In Stage I, health workers were grouped by profession and ancillary categories.
Stage II: Simple random and convenience sampling from all the eight identified target areas were used to select participants. They were proportionately selected, representing the overall sample including: Surgeons — 70 (34.5%), Radiology department — 38 (18.7%), Main Theatre Nurses — 30, (14.8%) Anaesthesia Department — 28(13.8%) Neuro-theatre Nurses -10(4.9%), Biomedical Engineers-4(1.9%) Oncology Unit-5/(2,5%) and Ancillary Staff — 18(8.9%). Total: 203 (100%).

2.6 Instrument for Data Collection
A self-structured questionnaire was the principal tool for data collection which seemed reasonable because of the large sample size. The instrument was self-administered by the researcher on several visits considering the convenience of the respondents. . The questionnaire were in five sections: Section A (personal/demographic data), Section B (awareness of radiation safety practices), Section C (availability of radiation safety practices), Section D (Health implication on Radiation exposure) and Section E (factors affecting the awareness). Responses were scored using a 4-points Likert scale of Strongly Agree (4), Agree (3), Disagree (2) and Strongly Disagree (1). Section E utilized the Yes/No options.

2.7 Validity and Reliability
Research supervisors and an expert from the research unit at Federal Teaching Hospital Owerri validated the instrument. We incorporated their feedback into the final version. Reliability: The instrument was administered to 20 health workers at Imo State Specialist Hospital Umuguma Owerri — a group with similar characteristics as the study population. Test–retest: the instrument was re-administered after two weeks. The reliability was also analyzed using Pearson's Product Moment Correlation Coefficient and the reliability index was found to be 0.99 indicating that this scale has at most very high reliability level.

2.8 Ethical Considerations
Ethical approval was obtained from Health Research and Ethical Committee of Federal University Teaching Hospital Owerri (Reference No.: FTH/OW/HREC/VOL. 1/206) and the Ethical Research Committee, University of Port Harcourt (UPH/R&D/REC/EXEC/168). This study adhered to the principles of the Declaration of Helsinki (2013) and National Health Research Ethics Committee guidelines. All participants provided informed consent for the study, and assurances were made with regard to confidentiality, anonymity, and autonomy. There was no any external financial sponsorship for this was a self -funded project.

2.9 Data Analysis
Data were cleaned, coded, ordered and scored. Data from Sections B, C and D were summarized using descriptive statistics (frequency counts; percentages; means and standard deviations). The decision rule, with a cut-off mean of 2.5 was to consider an item scoring 2.5 or above as a positive response and below 2.5 to be negative response for the items rated on numeric scale. Null hypotheses were tested using chi-square (χ^2) tests with a significance level of 0.05 and the appropriate degrees of freedom. The null hypothesis was rejected when the calculated χ^2 value was greater than the tabulated value and was rejected when the calculated value is less than the tabulated value.

3. Results
3.1 Socio -Demographic Data of Respondents
Of the 203 respondents, 103 (50.7%) were male and 100 (49.3%) were female (Table 1). Most respondents (177; 87.2%) had tertiary-level education. In terms of profession, doctors formed the largest group 86 (42.4%), then Nurses 51 (25.1%), followed by ancillary workers (37; 18.2%), nurses, radiographers/radiologists (25; 12.3%), and biomedical engineers (4; 2.0%). The majority worked in Surgical Theatres (138; 68.0%). Sixty (29.6%) had over 10 years of experience in their current unit. 25 (12.3%) had 1-3 years of experience, 73(36%) had 4-6 years of experience, 45 (22.1%) had 7-10 years of experience and 60 (29.6%) had 10years and above work-experience.

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Table 1: Socio-Demographic Data of Respondents (n = 203)

S/N	Variable	Frequency (n=203)	Percentage (%)
1	Gender: Male	103	50.7%
	Female	100	49.3%
	Total	203	100%
2	Education: Secondary	26	12.8%
	Tertiary	177	87.2%
	Total	203	100%
3	Profession: Doctor	86	42.4%
	Nurse	51	25.1%
	Radiographer/Radiologist	25	12.3%
	Biomedical Engineer	4	2.0%
	Ancillary Worker	37	18.2%
	Total	203	100%
4	Work Unit: Radiology	38	18.7%
	Surgical Theatres	138	68.0%
	Oncology Unit	5	2.5%
	Other Radiological Units	22	10.8%
	Total	203	100%
5	Experience: 1–3 years	25	12.3%
	4–6 years	73	36.0%
	7–10 years	45	22.1%
	10+ years	60	29.6%
	Total	203	100%

Source: Field survey (2026)

3.2 Awareness of Radiation Safety Practices (Research Objective 1)

The grand mean of 3.09 ± 0.57 (above the 2.5 cut-off) indicates a high level of awareness of radiation safety practices among health workers at Federal Teaching Hospital Owerri (Table 2). Most respondents strongly agreed that all health workers in radiological units are exposed to radiation dangers, that awareness of protective measures improves work habits, and that proper knowledge of safety strategies reduces radiation risk. Respondents largely disagreed with the statement in item 10, confirming that they understood the importance of safety adherence in reducing long-term radiation effects.

Table 2: Awareness Level of Radiation Safety Practices (Items 6–11)

S/N	Item	SA	A	D	SD	Mean ± SD
6	All health workers in radiological units are exposed to radiation dangers.	128(63%)	53(26.1%)	12(5.9%)	10(5%)	3.47±0.66
7	Awareness of radiation protection can improve workers' habits.	105(51.7%)	60(29.6%)	28(13.8%)	10(4.9%)	3.28±0.77
8	Knowing how to use safety strategies protects workers from radiation risks.	128 (63%)	55 (27.1%)	12 (5.9%)	8 (4%)	3.49±0.60
9	Ionizing radiation is more dangerous than non-ionizing radiation from natural sources.	138 (68%)	50(24.6%)	10(4.9%)	5 (2.5%)	3.58±0.48
10	Strict adherence to safety practices will NOT reduce long-term radiation effects.	13 (6.4%)	12 (5.9%)	58 (28.6%)	120 (50.1%)	1.59±0.74
11	Periodic radiation protection education can improve knowledge of safety practices.	38 (18.7%)	160 (78.8%)	5 (2.5%)	0 (0%)	3.16±0.18
	Grand Mean					3.09±0.57

Source: Field survey (2026)

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3.3 Availability of Radiation Safety Practices (Research Objective 2)

The grand mean of 3.31 ± 0.41 confirms that radiation safety practices are adequately available to health workers at the facility (Table 3). The majority of respondents affirmed the availability and importance of PPE, ALARA principles, lead-lined walls, dosimetry, and equipment checks. Most correctly rejected item 17, indicating an understanding that annual leave is indeed a recognized safety measure — not irrelevant to radiation protection.

Table 3: Availability of Radiation Safety Practices (Items 12–20)

S/N	Item	SA	A	D	SD	Mean ± SD
12	Lead-lined walls in radiology units are a radiation safety practice.	130 (64%)	60 (29.6%)	8 (3.9%)	5 (2.5%)	3.55±0.47
13	PPE (lead aprons, thyroid shields, goggles, face shields) are radiation safety measures.	150 (73.9%)	53 (26.1%)	0(0%)	0(0%)	3.73±0.63
14	Lead garments must be hung — not folded — in a dry, airy, cool place.	156(76.8%)	42 (20.7%)	5 (2.5%)	0 (0%)	3.74±0.23
15	ALARA (As Low As Reasonably Achievable) is a radiation safety measure.	125 (61.6%)	66 (32.5%)	8 (3.9%)	4 (2%)	3.53±0.44
16	Maintaining distance and limiting exposure time assures safety for workers and patients.	140 (69%)	54 (26.6%)	9 (4.4%)	0 (0%)	3.64±0.32
17	Taking annual leave is NOT a radiation safety measure.	5 (2.5%)	8 (3.9%)	145 (71.4%)	45 (22.2%)	1.86±0.25
18	Periodic monitoring of radiation accumulation in the body is a safety practice.	60 (29.6%	100 (49.2%)	38 (18.7%)	5 (2.5%)	3.05±0.48
19	Displaying radiation warning/danger signs is useful for radiation safety.	125 (61.6%)	70 (34.5%)	8 (3.9%)	0 (0%)	3.52±0.65
20	Checking equipment for radiation leakages ensures staff safety.	40	156 (76.8%)	4 (2%)	3 (1.5%)	3.18±0.22
	Grand Mean					3.31±0.41

Source: Field survey (2026)

3.4 Health Implications of Radiation Exposure (Research Objective 3)

The grand mean of 2.47 ± 0.38 — just below the 2.5 cut-off — reflects meaningful awareness of radiation's health implications, though slightly limited (Table 4). Most respondents correctly identified that radiation causes cancer, cataracts, goitre, hair loss, blood dyscrasias, acute radiation syndrome, and fertility problems. Nearly all (180; 88.7%) correctly identified radiation-emitting equipment. The highest mean item (3.88 ± 0.69) relates to identification of radiation-emitting equipment, while item 26 showed the highest concern — 144 (70.9%) strongly agreed that radiation can cause fertility problems and harm unborn children.

Table 4: Health Implications of Radiation Exposure (Items 21–30)

S/N	Item	SA	A	D	SD	Mean ± SD
21	Radiation exposure has both positive and negative effects.	50	130	17	6 (	3.10±0.32
22	Chronic radiation exposure CANNOT increase cancer risk.	10	23	108	62	1.90±0.60
23	Cataracts and goitre are complications of radiation exposure.	52	128	21	2	3.13±0.38
24	Radiation exposure is NOT an occupational health hazard.	0	11	30	162	1.25±0.17
25	Radiation-emitting equipment includes X-ray machines, CT scanners, radiotherapy machines.	180	23	0	0	3.88±0.69
26	Radiation exposure can cause fertility issues and affect unborn children.	144	58	1	0	3.70±0.53
27	Blood dyscrasias is NOT a complication of radiation exposure.	0	9	68	126	1.42±0.22
28	Radiation exposure CANNOT lead to hair loss.	1	2	96	104	1.50±0.17
29	Acute radiation syndrome is a health effect of radiation exposure.	80	110	9	4	3.31±0.42
30	Radiation burns/injuries CANNOT result from radiation exposure.	3	6	88	106	1.53±0.39
	Grand Mean					2.47±0.38

Source: Field survey (2026)

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3.5 Factors Influencing Radiation Safety Awareness (Research Objective 4)

The most significant finding was that 193 (95%) of respondents identified professional knowledge as the most critical factor influencing radiation safety awareness (Table 5). Most respondents (183; 90.1%) disagreed that attitude was not a determinant — confirming that attitude plays a role. The majority (170; 83.7%) rejected the idea that experience does not matter, indicating that years of practice contribute to safety awareness.

Table 5: Factors Influencing Awareness of Radiation Safety Practices (Items 31–34)

S/N	Item	Yes	No	Total
31	The attitude of health workers is NOT a determinant of radiation safety awareness.	20 (9.9%)	183 (90.1%)	203
32	Male workers are more careful about radiation safety awareness than female workers.	43 (21.2%)	160 (78.8%)	203
33	Years of experience CANNOT increase individual perception of radiation safety.	33 (16.3%)	170 (83.7%)	203
34	Professional knowledge is paramount for radiation safety awareness.	193 (95%)	10 (5%)	203

Source: Field survey (2026)

3.6 Hypothesis Testing

Hypothesis I (Null): There is no significant difference in radiation safety awareness between male and female health workers at Federal Teaching Hospital Owerri.

The null hypothesis was accepted. There was no significant difference between male and female workers in their awareness of radiation safety practices (Table 6). This suggests that gender does not meaningfully influence radiation safety awareness at this facility.

Table 6: Chi-Square Analysis — Male vs. Female Radiation Safety Awareness

S/N	Gender	SA	A	D	SD | Total
1	Male	47 (23.1%)	35 (17.2%)	11 (5.4%)	10 (5.0%) | 103 (50.7%)
2	Female	45 (22.1%)	30 (14.8%)	10 (5.1%)	15 (7.4%) | 100 (49.3%)
	Total	92 (45.3%)	65 (32.0%)	21 (10.4%)	25 (12.3%) | 203 (100%)

χ^2 calculated = 2.4 < χ^2 tabulated = 7.81; df = 3; p = 0.05

Hypothesis II (Null): There is no significant difference in radiation safety awareness between clinical and non-clinical workers at Federal Teaching Hospital Owerri.

The null hypothesis was rejected. Compared with the clinical group, the non-clinical workers were very low in radiation safety awareness (Table 7). The general lack of awareness was lower amongst clinical workers which is unsurprising given professional development and training over time with direct patient work exposure about radiation-related topics.

Table 7: Chi-Square Analysis — Clinical vs. Non-Clinical Workers

S/N	Category	Yes	No	Total
1	Clinical workers (Doctors, Nurses, Anaesthetists, Radiographers/Radiologists)	190 (93.6%)	0 (0%)	190 (93.6%)
2	Non-clinical workers (Ancillary Staff, Porters, Health Attendants, Biomedical Engineers)	3 (1.4%)	10 (5.0%)	13 (6.4%)
	Total	193 (95%)	10 (5%)	203 (100%)

χ^2 calculated = 164.3 > χ^2 tabulated = 3.84; df = 1; p = 0.05

Hypothesis III (Null): There is no significant relationship between radiation safety awareness and knowledge of health implications of radiation exposure

The null hypothesis was rejected. Awareness of radiation safety practices was shown to be associated with knowledge on the health effects from exposure to radiation (Table 8). It also highlights the need for effective education about radiation, linking practices to health outcomes.

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Table 8: Relationship between Radiation Safety Awareness and Health Implications Knowledge

S/N	Variable	SA	A	D	SD	Total
1	Radiation safety awareness	92 (22.7%)	65 (16.0%)	21 (5.2%)	25 (6.1%)	203
2	Health implications awareness	52 (12.8%)	50 (12.3%)	44 (10.8%)	57 (14.1%)	203
	Total	144 (35.5%)	115 (28.3%)	65 (16.0%)	82 (20.2%)	406

χ^2 calculated = 33 > χ^2 tabulated = 7.81; df = 3; P < 0.05

4. Discussion

The study reported that health workers at Federal Teaching Hospital Owerri are mostly aware of radiation safety practices (grand mean: 3.09 ± 0.57). Confirming the findings from Allam et al. (2024), Alkhayal et al. (2023), and Almohammed et al. (2024) showed that radiation safety awareness among health care workers across settings was generally positive. High level of awareness can be explained by the fact that most respondents were doctors and nurses working in high-risk radiological environments undergoing professional training with regular clinical exposure. The level of awareness observed should ordinarily boost the compliance rate to the use of the safety measures

On the availability of Radiation safety practices present at the facility, a grand mean of 3.31 ± 0.41 was calculated showing a positive response. Respondents confirmed PPE, ALARA principles, lead-lined walls, dosimetry and checks of the equipment were utilized. This is in accordance with the findings by Singh et al. (2023) and Shubayr (2025) who reported appropriate protective radiation behaviours in pedagogic settings from teaching hospitals. Though these safety measures are indeed encouraging, there must be steady enforcement and use of them at the University.

In relation to health implications, the grand mean value of 2.47 ± 0.38 implies consciousness that is close but does not certainly go beyond threshold limit. Health conditions most correctly recognized to be associated with radiation included cancer, cataracts, blood dyscrasias, hair loss (1), acute radiation syndrome, and fertility problems. A particular finding was a greater concern regarding fertility and effects on unborn children (mean: 3.70 ± 0.53), showing a better understanding of the impact of radiation on reproductive health. This is consistent with Amrenova et al (2024) with the recordings on acute adaptive responses to ionizing radiation in non-human species, and previous PACE research (2011-2024) documenting both inter-generational conditions like genetic mutations.

Radiation safety awareness was most influenced by professional knowledge (95% of respondents). This finding reinforces a well-established principle in occupational health: education and training as the first step towards radiation safe practices. Famurewa et al. (2025) and Rodrigues et al. (2024) likewise stressed that knowledge was the main factor influencing safe radiation practice behaviour in health. To buttress this Al Shamrani et al., (2024) emphasized that professionals with formal training on radiation practices a high level of awareness and compliance to radiation protocols.

The insignificant difference on awareness of radiation safety practices between women and men workers (χ^2 = 1.4) illustrates that, where it is shown, the gender does not determine knowledge of safety concerning radiation at this institution. This is perhaps because there was only a low level of both female and male awareness involving information about ionizing radiation and safety in these areas. This finding was confirmed in a study by Almohammed et al. (2024) and Kyei et al. (2025) and Rodriques et al (2024) also found no significant differences in radiation safety practices by sex.

Nevertheless, given the very large difference between clinical and non-clinical workers (χ^2 = 164.3), it comes as no surprise. While clinical providers receive more formalized training in the areas of radiation biology, safety measures, and use of protective equipment, ancillary or non-clinical staff typically lack formal education regarding radiation exposure. This gap emphasizes the need for providing targeted education and training about radiation safety to all staff who work in or near areas where there is exposure to radiation, irrespective of their profession.

5. Conclusion

Health workers at Federal Teaching Hospital Owerri demonstrated a commendable level of radiation safety awareness and access to protective measures. Professional knowledge emerged as the strongest predictor of safety awareness, while gender did not significantly differentiate awareness levels. Clinical workers showed significantly higher awareness than non-clinical staff. The study affirms that radiation safety education, consistent use of protective equipment, and periodic equipment checks are essential for safeguarding health workers in radiation-exposed environments.

Recommendations

1. Hospital administration should conduct compulsory periodic radiation safety training among the five groups of health workers (ancillary and non-clinical staff) to fill the knowledge gap highlighted between patients, clinical-oriented workers, and non-clinically oriented workers.
2. Provision of PPE to the staff (and training on its proper use, storage, and maintenance) working in or near radiation-exposed areas.
3. Expansion of dosimetry programs and rigorous oversight to ensure bodily radiation accumulation in workers remains within internationally established thresholds should be implemented.
4. Regular maintenance and technical checks of all radiation-emitting equipment should be planned by hospital management, in order to discover leakages immediately.

Therefore, international annual revision of radiation safety policies which is aligned with recent updates from the IAEA, ICRP and NNRA should be conducted for compliance to maintain international standards.

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