*Asian Journal of Research in Nursing and Health*

*3(1): 42-51, 2020; Article no.AJRNH.57359*

# Assessment of Knowledge and Attitude of Nurses in a Specialist Hospital towards Ionizing Radiation at Maiduguri, Borno State, Nigeria

**Samson Dauda Yusuf[1*], Ibrahim Umar[1], Usman Faruk Tarfa[1] and Abdullahi Abubakar Mundi[1]**

*[1]Department of Physics, Nasarawa State University, Keffi, Nigeria.*

***Authors' contributions***

*This work was carried out in collaboration among all authors. All authors contributed to the study conception and design. Material preparation, data collection and analysis were performed by authors SDY, UFT, IU and AAM. The first draft of the manuscript was written by author UFT, reviewed and re-drafted by author SDY and all authors commented on previous versions of the manuscript. All authors read and approved the final manuscript.*

***Article Information***

Editor(s):
(1) Dr. Alexandrina Cardoso, Escola Superior de Enfermagem do Porto, Portugal.
Reviewers:
(1) I. Akinlade Bidemi, University of Ibadan, University College Hospital, Nigeria.
(2) Abiola O. Ilori, University of KwaZulu-Natal, South Africa.
(3) Wiseman Bekelesi, Hiroshima University, Japan.
Complete Peer review History: http://www.sdiarticle4.com/review-history/57359

***Original Research Article***

***Received 20 March 2020***
***Accepted 27 May 2020***
***Published 02 June 2020***

## ABSTRACT

The effect of ionizing radiation on occupational workers is increasing at an alarming rate due to inadequate knowledge and attitude of workers. Despite this, little research has been done on the knowledge and attitude of Nigerian nurses towards radiation protection and practice. In this study, the knowledge and attitude of Nurses towards Ionizing radiation was carried out at Maiduguri, Borno State, Nigeria, using a self-structured questionnaire. The systematic sampling technique was used to collect 30 usable responses, corresponding to 75 percent response rate that was used for the analysis. The result shows that, even though the nurses are not well educated and have just an average knowledge of radiation and its effects, they are found to show a positive (right) attitude towards ionizing radiation during theatre and ward radiography. Educational level and years of experience were found to have a significant impact on their attitude towards radiation. However, their low level of education could prove fatal if proper measures are not in place. Hospital

**Corresponding author: Email: samsonyusufu@yahoo.com;*

management should embark on educational intervention programs, seminars and symposium for the nurses to improve their professional skills and knowledge for good radiation protection practices.

*Keywords: Knowledge; attitude; ionizing radiation; nurses; assessment; radiation protection.*

## 1. INTRODUCTION

Most nurses in hospitals and clinics have a major problem about the care of patients diagnosed or treated with radiation [1]. They are mostly of the view that ionizing radiation is very dangerous and therefore, such patients do not get the necessary care. This is due to the fact that these nurses are afraid of ionizing radiation and do not take part actively in caring for such patients. In line with this, Alotaibe and Saeed [2] explained that some nurses are anxious about the effects of occupational exposure to radiation, obviously due to inadequate knowledge about radiation protection however, there is difference of data on the knowledge and attitude of nurses towards radiation in the locality of the study. Ionizing radiation is the radiation that has enough energy to remove tightly bound electrons from atoms, thus creating ions [1].

The demand for radiological imaging procedures especially in medicine for diagnosis and therapy has increased, as 30–50% of the medical diagnosis is based on X-ray imaging reports [3]. According to Briggs-Kamara et al. [4] in medical practice, radiation workers and patients are exposed to potential hazards of ionizing radiation while using radiation for therapy. Lautin et al. [5] had explained that the potential hazards comprises of stochastic and deterministic effects.

Exposure to ionizing radiation could cause serious effects on hematopoietic, immune, reproductive, circulatory, respiratory, musculoskeletal, endocrine, nervous, digestive, and urinary systems [6,7]. Cataracts, skin burns, leukemia, genetic effects, and several other types of cancers are among the other adverse effects from ionizing radiation [6–9]. Therefore, the radiographer as well as all the radiation workers must understand the benefits and potential risk to the patients, radiation workers, and the public before carrying out any radiological examination [10].

It is the duty of the Nurses in the radiology department to prepare the equipment and support the patients during radiological procedures. Therefore, there is need for the Nurses to be well knowledgeable about radiation and radiation protection practices. This will be useful for the right protection practices amongst the Nurses as well as protection of the patients and the general public from unnecessary radiation exposure [11].

The benefits of radiation were first recognized in the use of X-rays for medical diagnosis, then later with the discoveries of radiation and radioactivity [12]. The rush in exploiting the medical benefits led fairly to the recognition of the risks and induced harm associated with it. According to Mojiri and Moghimbelgi [12], in those early days, only the most obvious harm resulting from high doses of radiation, such as radiation burns were observed and protection efforts were focused on their prevention, mainly for practitioners rather than patients. Mubeen et al. [13] had explained that although the issue was narrow, this lead to the origin of radiation protection as a discipline. Subsequently, it was gradually recognized that there were other, less obvious, harmful radiation effects such as radiation-induced cancer, for which there is a certain risk even at low doses of radiation. Not only high doses of radiation, but also long-term low doses of radiation also potentially put people at a risk of mutagenic and carcinogenic hazards [14]. This risk cannot be completely prevented but can only be minimized. Medical radiation workers who apply radiation for diagnostic and therapeutic purposes are categorized as people with low-chronic doses and are potentially at a risk of unwanted exposures. Therefore, the balancing of benefits from nuclear and radiation practices against radiation risk and efforts to reduce the residual risk has become a major problem of radiation protection [15].

It has been estimated that approximately, 7 million health-care workers worldwide are exposed to radiation doses every year attributable to their occupation [16]. Therefore, the knowledge and attitude towards ionizing radiation plays an important role in occupational radiation protection and safety [17]. According to Ralph [18], the general fear of radiation is a consequence of inadequate knowledge about the subject. Mojiri and Moghimbelgi [19] had

explained that, ionizing radiation may have effects on gastrointestinal system, central nervous system, gonads or even whole body. These effects may appear as somatic effects or in next generation as genetic effects [20,21]. Therefore, occupational radiation protection (including all workers and general public in the radiation environment) is of vital importance in medical diagnostic and therapy [19].

However, the researchers observed that during radiographic examinations on the ward, some nurses are extremely afraid to stay within the vicinity during radiation exposures, or just move some distance away but on sitting the radiographer with the mobile X-ray machine on the ward, they leave you with the patient and do not even want to come closer and help in lifting the patient even while no exposure is going on, and despite the reassurance and radiation protection measures employed by the radiographer. These reactions of some nurses towards ionizing radiation and the need to understand why they behave differently prompted the researchers' interest to find out the level of knowledge on ionizing radiation and their attitude towards radiation protection. This study aimed to assess the knowledge and attitude of nurses towards ionizing radiation protection during ward and theatre radiography at State Specialist Hospital, Maiduguri, Borno State.

## 2. METHODOLOGY

This study was carried out to assess the existing practice and to suggest ways of improving on the status quo. A self-structured questionnaire with 14-close ended questions was used to collect data and was analyzed using Microsoft Excel 2016.

### 2.1 Study Area

This study is conducted in the radiology department of the State Specialist Hospital in Maiduguri, Borno State. Maiduguri is a city found in Borno State, in the North-eastern Nigeria. It is located on Latitude 11.85 and longitude 13.16 and it is situated at elevation 325 meters above sea level. Maiduguri is estimated to have a population of 1,907,600 as of 2007 making it the biggest city in Borno State.

### 2.2 Population and Sample

The population of this study is made up of all registered nurses practicing at the State Specialist Hospital (SSH), Maiduguri. A total 250 Nurses forms the population of the study. A systematic sampling technique was used for the conduct of this research. The sample size of the study consists of 40 (16%) Nurses randomly sampled at the time of study.

### 2.3 Experimental Design

The self-structured questionnaire was developed in English. There are two (2) Sections; section A comprised of questions regarding demographic, section B comprised of questions involving items on knowledge and attitude towards radiation during ward radiography. The questionnaire uses close ended question where the respondent is to choose from a list of options. The Research tool was validated by two senior lecturers at Nasarawa state University (NSUK) and the chief Radiographer at State Specialist Hospital (SSH), Maiduguri. This was done to improve the face validity and content validity of the instrument. A pilot survey with five (5) subjects randomly sampled from nurses in a hospital which did not form part of the final survey was conducted for the reliability test. This was followed by the main survey conducted in the radiology department of the State Specialist Hospital in Maiduguri, Borno State using face-to-face interviews led by research assistants who were adequately instructed on what to do.

## 3. RESULTS

### 3.1 Data Collection

Table 1 represents the data for this study obtained through the survey using the practicing nurses at the State Specialist Hospital (SSH), Maiduguri. These are people who directly have access to the source of radiation and the patient being exposed. To ensure the active involvement of participants in the survey and to improve the response rate, we provided some incentives (pen and candy) to the respondents. Of the 40 questionnaires distributed, a total of 34 responses were received, corresponding to an initial response rate of 85%. After discarding invalid responses, we had 30 responses remaining, of which 37% responses were from males and 63% from females. The other questionnaire was invalid because it was not fully filled in. This is in line with the work of Alotaibe and Saeed [2] that also used higher frequency of female.

**Table 1. Demographics of respondents**

| Categories | Percentage | Categories | Percentage |
|---|---|---|---|
| Gender | | Qualifications | |
| Male | 37 | Certificate | 60.00 |
| Female | 63 | Diploma | 26.67 |
| Age range (21-50 yrs) | | BSc. | 13.33 |
| 21-25 | 33.33 | MSc. | 0 |
| 26-30 | 13.33 | PhD. | 0 |
| 31-35 | 6.67 | Years of experience | |
| 36-40 | 16.67 | 0-5 | 50 |
| 41-45 | 16.67 | 6-10 | 20 |
| 46-above | 13.33 | 11-15 | 10 |
| | | 16-above | 20 |

The age of respondents ranged from 21 to 50, with the highest (33.33%) in the age range of 21-35, followed by (16.66%) for age groups 36-40 and 41-45. The next, was (13.33%) for age groups 26-30 and 40-above while the least was (6.66%) 31-35 age group. For the entire sample, none of the nurses were educated to MSc or PhD. level as indicated by 0 percent. The majority of respondents have only certificate education (60%). Showing that there level of knowledge could be very low due to the low level of education. However, low percentage was educated at BSc level (13.33%). Similarly, there is also a low percentage of those with Diploma (26.67%). The majority of the respondents have only worked for 0-5 years given by 50%. This signifies that most of the respondents were still young in the professional practice. The least were those that have worked for 11-15 years indicated by 10%. Others have either worked for 6-10 years or 16 years and above as indicated by 20%.

## 3.2 Knowledge on Radiation

Table 2 shows the nurses knowledge on radiation. The items under investigation for the knowledge of radiation including benefits and the potential harmful effects of ionizing radiation were coded from A to G and the percentage of those nurses that have significant knowledge, those without knowledge and those that are not sure are presented.

From Table 2 it is clear that majority of the nurses are aware that radiation can cause harmful effects (66.67%) and are aware that they receive radiation in their everyday life as nurses (56.67%). Majority of the nurses are also aware that the lifespan of radiology workers is less compared to other health workers (46.67%) and are also aware that the objects in the room emits radiation after an X-ray exposure (43.33%). However, majority of the nurses do not believe that X-rays used in medical imaging can cause more harm than benefits (63.33%). Even though majority of them understand that radiation cannot be used for boosting the immune system (70%) they do not believe that radiation used in ward and theatres are more dangerous than those in the radiology department (56.67%).In general, it has been revealed from the Table 2 that the participants have an average level of the knowledge of ionizing radiation and about (43.33%) knew the source, benefit and the potential harm of ionizing radiation. The level of knowledge of the nurses is as shown in Fig. 1.

## 3.3 Attitude to Radiation

Table 3 shows the nurses attitude towards radiation. The items under investigation for the attitude towards ionizing radiation were coded from H to J and the percentage of those nurses that show the right attitude to radiation, those that do not show the right attitude and those that are not even sure of the attitude they can show towards ionizing radiation are presented.

From Table 3, it has been revealed that majority of the nurse show positive (right) attitude towards radiation by staying away from the patients during exposure (70%), and using lead Apron during radiographic exposure (83.33%), but majority of the do come back immediately to the vicinity after X-ray exposure which may not be the right attitude for clinical practice (46.67%). In general the majority of the nurses (64.44%) were found to show positive (right) attitude towards ionizing radiation during theatre and ward radiography. The attitude of the nurses towards radiation is as shown in Fig. 2.

**Table 2. Nurses knowledge on radiation**

| Items code | Items | Yes (%) | No (%) | Don't Know (%) |
|---|---|---|---|---|
| A | Radiation Can cause harmful effects | 66.67 | 26.67 | 6.66 |
| B | X-rays used in Medical imaging can cause more harm than benefit | 33.33 | 63.33 | 3.34 |
| C | Radiation that is used in ward and theatres are more dangerous than those in the radiology department | 33.33 | 56.67 | 10.00 |
| D | Radiation is used for boosting the immune system | 23.33 | 70.00 | 6.67 |
| E | Generally, we receive radiation in our everyday life | 56.67 | 26.67 | 16.66 |
| F | The lifespan of radiology workers is less compared to other health workers | 46.67 | 33.33 | 20.00 |
| G | Objects in the room emit radiation after an X-ray exposure | 43.33 | 30.00 | 26.67 |
| Mean | | 43.33 | 43.81 | 12.86 |

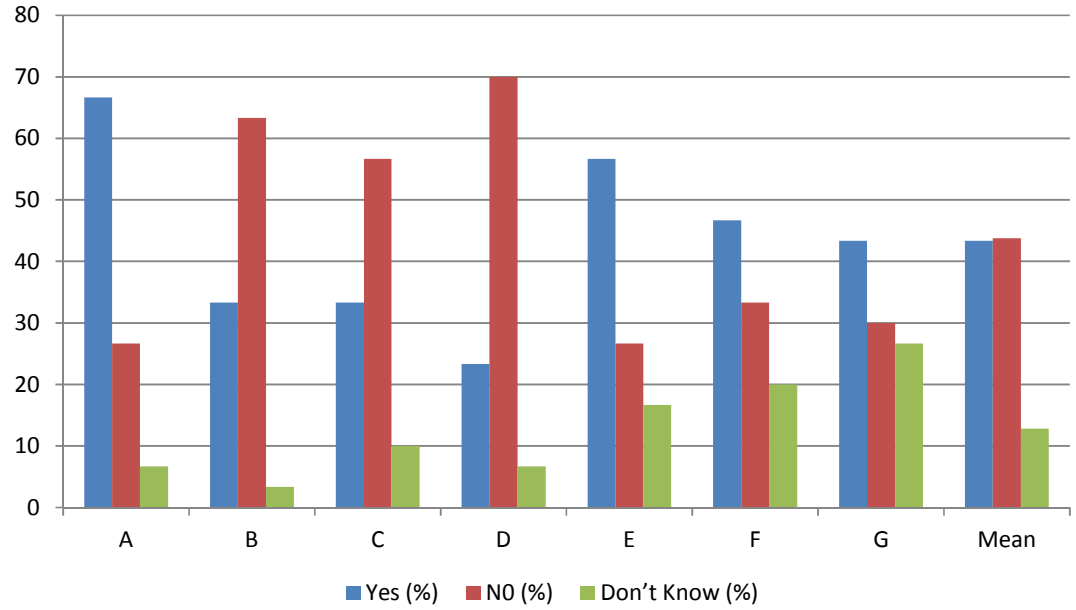


**Fig. 1. Nurses knowledge on radiation**

**Table 3. Attitude of nurses towards radiation**

| Items code | Items | Yes (%) | No (%) | Don't Know (%) |
|---|---|---|---|---|
| H | Do you stay away from patients during Exposure | 70.00 | 23.33 | 6.67 |
| I | Do you use lead Apron during radiographic Exposure | 83.33 | 10.00 | 6.67 |
| J | Do you come to immediately the vicinity after X-ray Exposure | 40.00 | 46.67 | 13.33 |
| Mean | | 64.44 | 26.67 | 8.89 |

### 3.4 Education and Attitude to Radiation

Table 4 shows the relationship between the level of education and attitude towards radiation. It shows the attitude of the nurses according to their education level divided in to three (3) groups as certificate, diploma and bachelor's degree.

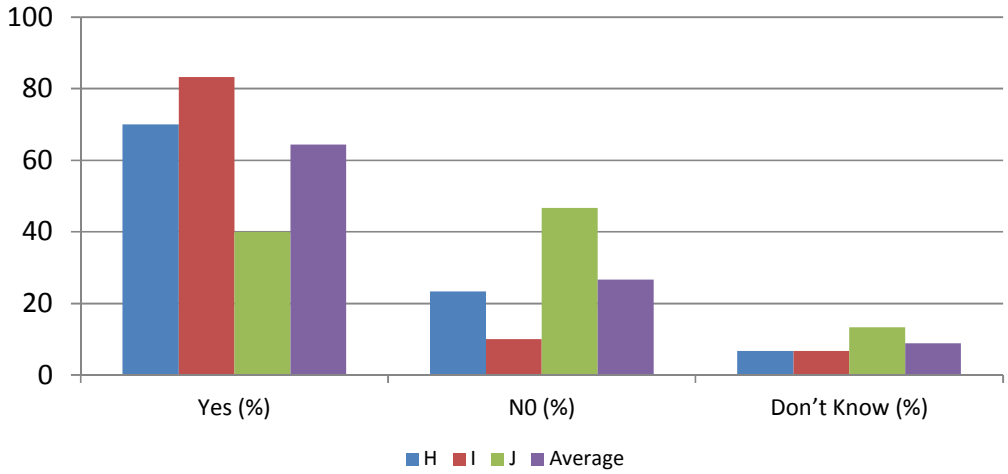


**Fig. 2. Attitude of nurses towards radiation**

**Table 4. Cross tabulation of educational level with attitude towards radiation**

| Items code | Items | Educational level | | |
|---|---|---|---|---|
| | | Certificate | Diploma | BSc. |
| H | Stay away from patients during exposure | 24.24 | 43.29 | 32.47 |
| I | Use lead Apron during radiographic exposure | 26.47 | 36.76 | 36.76 |
| J | Come back immediately to the vicinity after X-ray exposure | 22.60 | 26.03 | 51.37 |
| Mean | | 24.44 | 35.36 | 40.20 |

From Table 4 it is clear that the higher the education level of the nurses the better their attitude towards ionizing radiation. Even though majority of those with BSc. (51.37%) were found to always come back immediately to the vicinity after X-ray exposure which may not be the right attitude, they always use lead Apron during radiographic exposure (36.76%). However, majority of those with diploma were found to show the right attitude of staying away from the patients during exposure (43.29%). In general the level of education of the nurses has a great impact on their attitude towards radiation protection as revealed from the average percentage of those with diploma (40.20%) as compared with those with certificate (24.44%). The relationship between the level of education of the nurses and their attitude towards radiation is as shown in Fig. 3.

### 3.5 Years of Experience and Attitude to Radiation

Table 5 shows the relationship between the years of experience of nurses and attitude towards radiation. It shows the attitude of the nurses according to their years of experience divided into four (4) groups of 0 – 5 years, 6 – 10 years, 11 – 15 years, and 16 years above.

From Table 5 it is clear that the years of experience of the nurses has positive impact on their attitude towards ionizing radiation. Even though majority of those with experience above 16 year (53.19%) were found to always come back immediately to the vicinity after X-ray exposure which may not be the right attitude, they always use lead Apron during radiographic exposure (27.27%). However, majority of those with experience between 6 – 15 years were found to show the right attitude of staying away from the patients during exposure (30.30%). In general the level of experience of the nurses has a great impact on their attitude towards radiation protection as revealed from the average percentages. Those with experience 16 years above show shows the right attitude on an average (35.24%) as compared to does with experience less than 10 years (19.2%). The relationship between the years of experience of the nurses and their attitude towards radiation is as shown in Fig. 4.

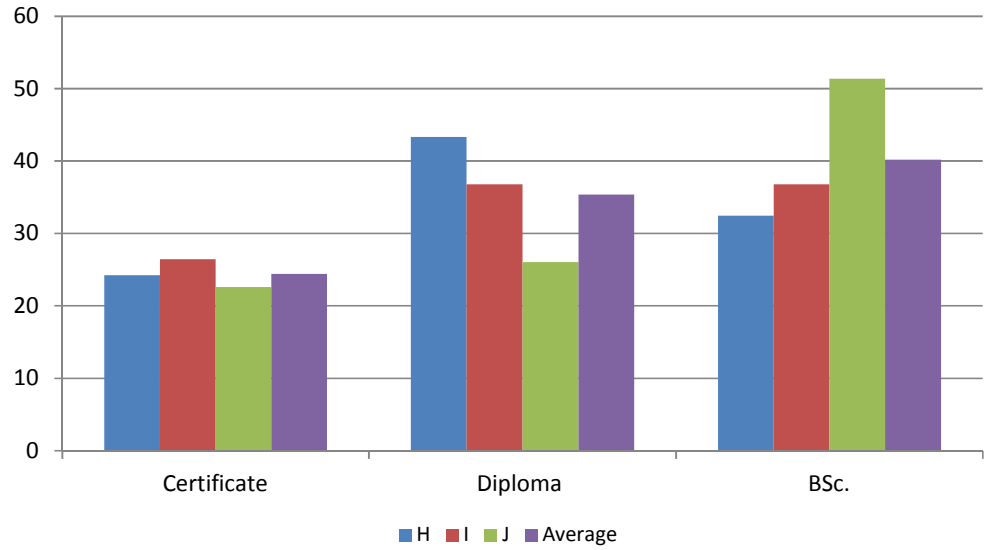


**Fig. 3. Educational level with attitude towards radiation**

**Table 5. Cross tabulation of years of experience with attitude towards radiation**

| Items code | Items | Years of practice | | | |
|---|---|---|---|---|---|
| | | 0 – 5 yr | 6 – 10 yr | 11 – 15 yr | Above 16 yr |
| H | Stay away from patients during exposure | 14.14 | 30.30 | 30.30 | 25.25 |
| I | Use lead Apron during radiographic exposure | 18.19 | 27.27 | 27.27 | 27.27 |
| J | Come back immediately to the vicinity after X-ray exposure | 25.53 | 0.00 | 21.28 | 53.19 |
| Mean | | 19.29 | 19.19 | 26.28 | 35.24 |

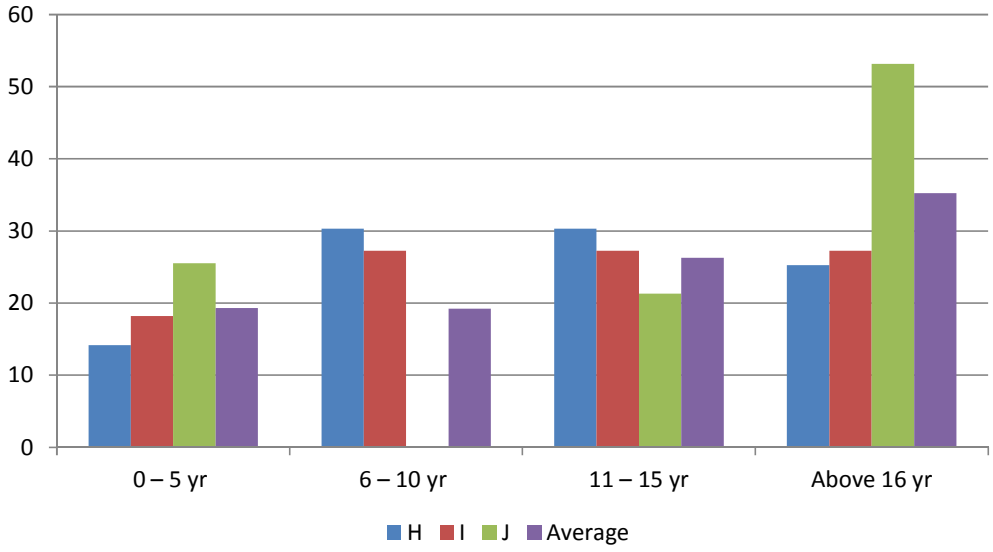


**Fig. 4. Years of experience with attitude towards radiation**

## 4. DISCUSSION

Findings from this study showed that the average level of knowledge of radiation could be probably as a result of the low level of education attainment by the nurses, since majority of them have only certificate education as revealed by the demographic statistics in Table 1. These finding is similar to the findings of Alotaibe and Saeed [2], and Maliro [22] who revealed that nurses lack knowledge on radiation sources and radiation protection methods. However, it is not in line with the studies of Rassin et al. [23], Bessho and Kusama [1] who found that majority 70% and 95% respectively of nurses had average knowledge on radiation. However, 64.44% of them practice good radiation protection by shielding (use of lead apron) and keeping distance from patients during radiographic exposures. This is perhaps because of the fear of radiation motivating them either ignorantly or intentionally to adopt good radiation protection practices. This finding is different from that of Rassin et al. [23] who found that though there was an average knowledge on radiation, most of the participants do not follow radiation safety methods.

Good radiation protection practice increases as their level of education increases as revealed by this study. This might be due to the fact that those nurses with higher educational level are well informed about the radiation protection practices and level of compliance with the safety standards and as well can show more positive attitude towards radiation protection. This finding is not in line with the findings of Alotaibe and Saeed [2], and Maliro [22] who found that there is no influence of educational level on the attitude of nurses towards radiation protection.

On the other hand, the nurses have an initial average attitude towards radiation as they are employed but as they acquired more experience and have understood the need for safety, their attitude towards radiation gets better and better. This might be because of the abated fear and misconceptions about ionizing radiation that may accrue over the length of years of practice. This finding is not in agreement with the findings of Alotaibe and Saeed [2], and Maliro [22], who found that years of professional practice did not affect the attitude towards radiation. However, geographical location, place and nature of practice should not be ignored as this could also impact on their attitude towards ionizing radiation.

## 5. CONCLUSION

The lack of sufficient knowledge and good attitude exhibited by Nurses towards ionizing Radiation could prove fatal if proper measures are not put in place to ensure good radiation protection practice. These study was able to find out that Nurses with least qualification and minimal years of Experience had average knowledge and attitude towards Ionizing Radiation, however, more needs to be done to improve on the curriculum content on Ionizing radiation in the nursing institutions and Nurses should also be encouraged to pursue further studies through the hospital management educational intervention programs so as to meet up with the current trend of evidence based practice. However, the unwillingness of some nurses to participate in the research contributed to the small sample size of the study. This small sample size may not fully represent the entire population; however, the results are still valid due to the sample technique adopted. Also, some incomplete filling of questionnaires led to some invalid questionnaires that were not used in the final analysis and failure to return some of the questionnaires was also one of the contributing factors that reduced the response rate of the study.

We recommend that the management should consider organizing seminars and symposium on a regular basis within the hospitals to educate all the staff on radiation protection. This will help most of the personnel to be continuously awakened about the various protection practices and the need to keep to the safety standards. The importance of this research cannot be over emphasized as it is highly significant to the nurses and management of the hospitals. Findings of this research will help the stakeholders and management of the hospitals in training of nurses on the curriculum development and improvement in the area of radiation protection and also, help radiographers understand the nurses' level of knowledge of radiation protection in order to enhance cordial interdisciplinary relationship during ward/theatre radiography.

## CONSENT

As per international standard or university standard, respondents' written consent has been collected and preserved by the author(s).

## ETHICAL APPROVAL

It is not applicable.

## COMPETING INTERESTS

Authors have declared that no competing interests exist.

## REFERENCES


1. Bessho SA, Kusama NJ. Assessment of nurses training programme on radiation. Journal of Radiology Nursing. 1996;47(9): 1-10.
2. Alotaibe M, Saeed R. Radiology nurses awareness of radiation. Journal of Radiology Nursing. 2006;125(6):1-8.
3. Herrmann, TL, Fauber TL, Gill J, Hoffman C, Orth DK, Peterson PA. Best practices in digital radiography. Radiological Technology. 2012;84(1):83–89.
4. Briggs-Kamara MA, Okoye PC, Omubo-Pepple VB. Radiation safety awareness among patients and radiographers in three hospitals in Port Harcourt. American Journal of Scientific and Industrial Research. 2013;4(1):83–88.
5. Lautin EM, Novick MK, Jean-Baptiste R, Tailored CT. Primum non nocere. The British Journal of Radiology. 2008;81(966): 442–443.
6. Stewart F, Akleyev A, Hauer-Jensen M, Hendry J, Kleiman N, Macvittie TJ, et al. ICRP publication 118: ICRP statement on tissue reactions and early and late effects of radiation in normal tissues and organs-threshold doses for tissue reactions in a radiation protection context. Annals of the ICRP. 2012;41(1):1–322.
7. Popanda O, Marquardt JU, Chang-Claude J, Schmezer P. Genetic variation in normal tissue toxicity induced by ionizing radiation. Mutation Research/Fundamental and Molecular Mechanisms of Mutagenesis. 2009;667(1):58–69.
8. ICRP. ICRP Publication 103: The 2007 recommendations of the international commission on radiological protection. Annals of the ICRP. 2007;37(1):1–332.
9. Little MP. Ionising radiation in the workplace. BMJ: British Medical Journal (Online). 2015;351:1-2:h5405.
   DOI: 10.1136/bmj.h5405
10. Grover SB, Kumar J, Gupta A, Hanna L. Protection against radiation hazards. Regulatory bodies, safety norms, dose limits and protection devices. Indian Journal of Radiology and Imaging. 2002;12(9):1-10.
11. Urushizaka M, Noto Y, Ogura N, Kitajima M, Nishizawa Y. Changes in nurses impression of radiation after attending educational seminars on radiation. Radiation Emergency Medicine. 2013;2(7): 1-9.
12. Mojiri M, Moghimbelgi A. Awareness and attitude of radiographers towards radiation protection. Journal of Paramedical Sciences. 2008;2(6):1-8.
13. Mubeen SM, Abbas Q, Nisar N. Knowledge about ionizing and non-ionizing radiation among medical students. 1st Ed. Ayub Medical College, Abbottabad, Karachi, Pakistan; 2008.
14. Kruszewski M, Wojewódzka M, Iwanenko T, Collins AR, Szumiel I. Application of the comet assay for monitoring DNA damage in workers exposed to chronic low-dose irradiation. II. Base damage. Mutation Research/Genetic Toxicology and Environmental Mutagenesis. 1998;416(1): 37–57.
15. World Health Organization. Health effects and protective measures; 2011.
   (Accessed 8 May 2018)
   Available:http://www.who.int/mediacentre/factsheets/fs371/en/
16. World Health Organization. Global initiative on radiation safety in healthcare settings: Technical meeting report. World Health Organization. Geneva; 2008.
17. Environmental Protection Agency. Ionizing & non-ionizing radiation; 2017.
   (Accessed 5 May 2018)
   Available:http://www.epa.gov/rpdweb00/understand/ionize_nonionize.html
18. Ralph M. Physical hazards: Ionizing radiation. The OHS Body of Knowledge; 2012.
19. Mojiri M, Moghimbelgi A. Awareness and attitude of radiographers towards radiation protection. Journal of Paramedical Sciences (JPS). 2011;2(4):1-4.
20. Amirzadeh F, Tabatabaee SHR. Evaluation of healthy behavior in radiation employees in hospitals of Shiraz. The fourth international cyberspace conference on ergonomics. International Ergonomics Association Press; 2005.
21. Kronenberg A. Radiation-induced genomic instability. International Journal

of Radiation Biology. 1994;66(5):603–9.

22. Maliro FMJ. Ionizing radiation protection awareness among nurses working at Queen Elizabeth Central Hospital Malawi PhD. 1st Ed. Department of Health Sciences, University of Johannesburg; 2011.

23. Rassin M, Granat P, Berger M, Silner E. Attitude and knowledge of physicians and nurses about ionizing radiation. Journal of Radiology Nursing. 2005;24(6):1-15.



*Peer-review history:*
*The peer review history for this paper can be accessed here:*
*http://www.sdiarticle4.com/review-history/57359*