

Knowledge And Attitude Of Nurses About Radiation Safety And Radiation Protection: A Scoping Review

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Abstract:

Background: Radiation is an electromagnetic wave which is coming across the daily activity of humans. There are naturally occurring and man-made radiations. X-rays, being the commonest radiation mostly known to the people are used in the medical field for diagnostic and therapeutic aspects. Despite of being at good in the preliminary evaluation of pathologies, it also possess a risk of biological effects of radiation on living tissues. This is crucial for the people who are associated with radiation as part of their occupation. The occupational staff must be well aware of the biological effects of radiation and the different means of radiation protection and safety. Nurses, being the largest community in the healthcare, and associated with most of the procedures carried out in a hospital, are expected to have a good knowledge and understanding about the radiation and radiation safety. The aim of this review was to assess the nurses' awareness and knowledge of radiation safety and protection, which is essential for their health and performance as a healthcare team.

Materials and Methods: A systematic search was conducted using PubMed and ProQuest databases with relevant keywords from 2013 to 2023. A total of 104 articles were found based on the search techniques, were screened for eligibility based on predefined criteria and only 7 articles were included in the final analysis.

Results: The review found that nurses' knowledge and attitudes towards radiation safety and protection were insufficient and varied across different settings and specialties. The main barriers to adequate knowledge and practice were lack of education, training, and resources.

Conclusion: The review highlighted the need for improving nurses' knowledge and competence in radiation safety and protection through regular and comprehensive training programs, guidelines, and policies. This would enhance the quality and safety of the services provided by the nurses and protect them from the harmful effects of radiation exposure.

Keyword: Awareness; knowledge; perception; radiation safety; radiation protection; nurses

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I. Introduction

Radiation is a group of invisible rays that can travel through space or medium. Various types of radiation are part of the electromagnetic spectrum. The most important type is ionizing radiation, including the x-rays and gamma rays¹. Using ionizing radiation in the medical field has become a practice, while diagnostic imaging with radiation is a vital tool in the preliminary diagnosis. Radiation at different energy levels is used for diagnosis and therapeutic applications. Although the radiation was treated cautiously due to its various impacts on the living tissues, it was considered that the high dose only initially caused harm to the individuals. However, the low radiation dose can also induce severe health effects, even though detecting these effects is not so feasible². Every attempt to reduce the exposure to ionizing radiation and, thereby, the radiation dose is collectively called radiation protection.

Nurses are the largest population in every healthcare sector. They work in every hospital department, including the areas where radiation-involved procedures are performed, such as radiology, emergency departments, ICUs, operation theatres, and hospital wards³. Their curriculum trains all personnel working in the radiation department to know the aspects of radiation safety and protection before they are involved in professional work. These include the ALARA concept and the TDS principle, in which the radiation dose is managed by reducing the time of stay in the radiation, keeping maximum distance from the radiation source, and using the appropriate shielding mechanisms⁴. The nurses are expected to have knowledge and awareness of radiation safety and protection since they are working closely with radiation-related procedures. Understanding

radiation safety and security will help them protect themselves, advise the patients, and increase the efficiency of the services as a healthcare team.

Various research studies were conducted on this aspect. Therefore, this work aims to review the available literature on the knowledge and awareness of the nurses on radiation safety and protection by bringing the results of the original research works together.

II. Materials And Methods

A literature search was performed in September 2023 to identify research studies about nurses' knowledge and awareness of radiation safety and protection for the past ten years. The literature search was conducted electronically in PubMed and ProQuest databases. The investigations were performed using the keywords “awareness,” “knowledge,” “perception,” “radiation safety,” “radiation protection,” and “nurses.” An additional search was carried out using Google to check the availability of the relevant article of a similar nature.

This review considered original research focused on nurses' knowledge and awareness about radiation safety and protection. All the primary research works were evaluated for ten years, from 2013 to September 2023. There was no restriction on the location, and the studies done in any part of the world were included in the search. The research studies conducted among nurses alone and healthcare professionals with separate results on nurses' data were included.

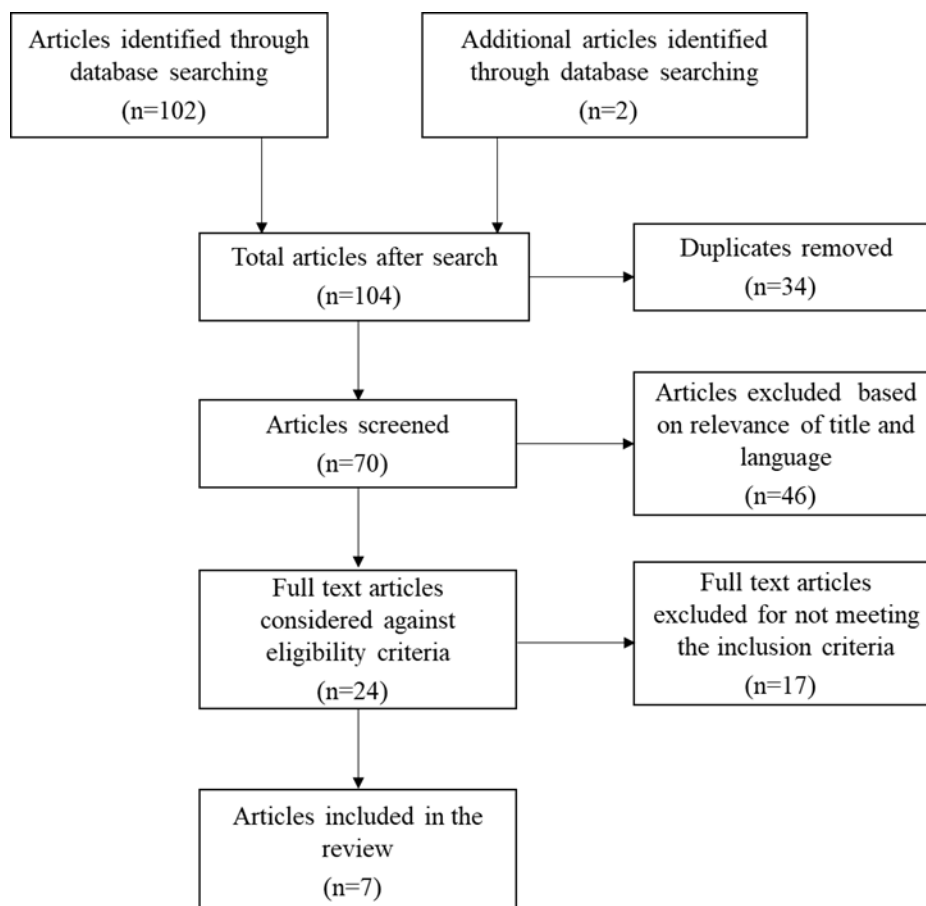


Figure 1: Flow chart of the article selection process

III. Results

The initial search was conducted in the databases, and the additional search provided 104 research articles. After removing the duplicates and applying the inclusion criteria for the relevance of the title, abstract screening, and the significance of the results in the full-text articles, seven primary articles remain and are included in this review. Figure 1 depicts the literature search and selection process.

The seven articles included in this review were conducted in Australia (n=1), Turkey (n=1), South Korea (n=1), Iran (n=1), Saudi Arabia (n=1), Japan (n=1), and Finland (n=1). The characteristics of the research works are explained in Table 1.

Table no 1: Characteristics of the included research works (n=7)

No.	Author	Year	Country	Title	Finding
1	Yurt et.al.	2013	Turkey	Evaluation of Awareness of Radiation Protection and Knowledge About Radiological Examinations in Healthcare Professionals Who Use Ionized Radiation at Work	There is a lack of knowledge of radiation—the educational component of radiation safety and the biological effects of radiation is to be improved in the curriculum.
2	MK Badawy et. al	2015	Australia	An assessment of nursing staff's knowledge of radiation protection and practice	42% of the nurses gave all correct answers, 26% answered incorrectly, and 32% marked 'I don't know' to the questions related to the background radiation and shielding and the hospital policies. 59% said no formal training in radiation safety was provided. 85% would like to have training in radiation safety.
3	Dianati M. et.al.	2015	Iran	Intensive care nurses' knowledge of radiation safety and their behaviors towards portable radiological examinations	Nurses employed different methods to get away from radiation exposure. None of the nurses used radiation protection equipment. The nurses had limited knowledge about radiation safety.
4	Morishima Y. et al.	2015	Japan	There is a need for radiation safety education for interventional cardiology staff, especially nurses.	In the longitudinal study, the understanding of radiation safety was increased in 2010 compared to 2008. However, the study indicates the insufficient knowledge of nurses in radiation safety and the need for further training for them.
5	Hirvonen et al.	2019	Finland	Nurses' Knowledge of radiation protection: A cross-sectional study	Nurses with medical radiation education had more knowledge of radiation protection. Those working in the cardiology laboratory were likely to have five times more knowledge than those working in operating theatres. Age was also found to be another factor associated with the knowledge level of guidelines for safe radiation use.
6	Park S and Yang Y	2021	South Korea	Factors Affecting Radiation Protection Behaviors among Emergency Room Nurses	There was a significant positive correlation between knowledge about radiation protection and attitude towards radiation protection, knowledge about radiation protection and radiation protection behaviors, and attitude towards radiation protection and radiation protection behaviors.
7	A.M.Alkhayal et.al.	2023	Saudi Arabia	Knowledge and attitude of radiation safety and the use of protective measures among healthcare workers in a tertiary center	The result reveals that 26% of the population in the study had a low attitude towards radiation safety. Out of the 69 nurses in the total population, 25 were identified to have a low-level attitude towards radiation safety.

In this review, three domains of radiation protection and the knowledge of radiation have been identified. They are radiation safety, ionizing radiation and radiation dose, and protection behaviors.

Radiation safety

Four research studies in this review focus on radiation protection and shielding, including background radiation. A survey conducted by MK Badawy et al. attempted to assess the knowledge of nurses working in a tertiary hospital in Australia on radiation protection and radiation practice. The questions to the nurses were related to background radiation and shielding, hospital policies, and general protection from gamma radiation. 147 out of 200 nurses responded, in which 42% of them gave all correct answers⁶. A longitudinal study by Morishima Y. et al. assessed the radiation safety knowledge of nurses working in Tohoku Kosei-Nenkin Hospital, Japan. It was observed that the knowledge and understanding of the nurses about radiation safety was not adequate, and the responses indicated nurses' anxiety due to the lack of knowledge¹⁰. A later study conducted by

Hirvonen et al. collected information regarding radiation protection from the nurses employed in operation theatres, first-aid clinics, and cardiology laboratories in eight hospitals in Finland. They used a standardized tool called the Healthcare Professional Knowledge of Radiation Protection (HPKRP) scale to calculate the knowledge scores. Nurses with master's degrees and who had completed medical radiation education were likely to have more knowledge of radiation physics, biology, and principles of radiation protection than their counterparts¹¹. Another study was conducted by A.M. Alkhayal et al. to estimate the knowledge and attitude of healthcare workers regarding radiation safety and to explore the association between radiation safety knowledge and the use of protective equipment. Out of 174 participants, 67 were nurses working in hospitals. 23% of the participants had a formal education on radiation safety. Out of the 69 nurses in the total population, 25 were identified to have a low-level approach towards radiation safety⁹.

Ionizing radiation and radiation dose

One of the studies in the review by Yurt et al. assessed nurses' knowledge of ionizing radiation and the radiation dose delivered during the radiological examinations. A questionnaire was distributed to 92 participants, of which 39 (42%) were nurses. The response rate to the informative questions was a maximum of 13% from the participants, and out of 39 nurses, the average number of correct answers on 42 points was 13 ± 4 . The participants' responses indicated poor knowledge about ionizing radiation and radiation dose considerations⁵.

Radiation protection behaviors

Two articles in this review worked on the aspects of radiation protection behaviors of the nurses and the association between the knowledge of radiation safety and their attitude or behavior towards radiation protection. The cross-sectional study conducted by Dianati M. et al. investigated the ability of nurses working in intensive care units of Shahid Beheshti Hospital of Kashan, Iran, regarding radiation safety and their behavior towards mobile radiography. The researchers administered the radiation protection knowledge (RPKQ) and a checklist. Another checklist was also used to identify the radiation protection measures employed by the nurses. The participants' mean understanding of radiation protection was 4.77 ± 1 . Thirty-eight out of a 10-point scale⁸. A later study conducted by Park S and Yang Y attempted to measure the knowledge about radiation protection, attitude towards radiation protection, and radiation protection behaviors of the nurses working in the emergency department of the general hospital in the G City and J Province of South Korea. The participants showed a mean score of 10.56 out of 16 points in the domain of knowledge about radiation protection and 4.35 out of 5 points in the field of attitude toward radiation. There was a significant relationship between radiation protection behaviors, experience in radiation protection education, wearing protective equipment, and expertise in radiation-related examinations. The results also show a significant positive correlation between knowledge about radiation protection and attitude towards radiation protection, knowledge about radiation protection and radiation protection behaviors, and attitude towards radiation protection and radiation protection behaviors⁷.

IV. Discussion

Multiple factors identified in the review caused variations in nurses' knowledge and awareness about radiation safety. Some factors affecting radiation protection behaviours were wearing protective equipment, experience of radiation protection education, attitude towards radiation protection, and knowledge about radiation protection⁷. The nurses employed different methods during the X-ray investigation to avoid radiation exposure, such as leaving the ICU during radiography, standing behind a lead apron, or staying at the nursing station and monitoring the patient⁸. The nurses working in the cardiology laboratory were likely to have five times more knowledge than those working in operating theatres¹¹. This substantiates the general fact that the place of work or working atmosphere impacts the awareness of the guidelines to be followed in the workplace. Though the nurses were trying to get away from the radiation, they were not using radiation protection equipment to safeguard them.

Most of the studies in this review identified an association between radiation safety training and the nurses' approach toward radiation protection or recommended the need for a radiation safety training program based on the results of their research. Park S and Yang Y identified a significant relationship between radiation protection behaviors and experience of radiation protection education⁷. It was observed that the nurses who completed medical radiation education were likely to have more knowledge of radiation physics, biology, and principles of radiation protection than their counterparts¹¹. Most of the nurses felt that they may benefit from dealing with radiation if they are provided training in radiation safety⁶.

The ICRP also recommended that the professionals working in radiation-involved environments must have undergone training in radiation safety and protection¹². This also applies to the nurses as they are the large community involved in every hospital department where radiation-involved investigations occur. Surprisingly, the nurses exposed more to radiation are less aware of the radiation protection principles and measures.

The lack of knowledge and awareness of nurses is evident from the research, and this happened basically due to the unavailability of formal training in radiation safety and awareness programs for staff development. The educational background or training in radiation safety will always impact the staff's radiation safety approaches and the ability to employ appropriate radiation protection measures. This will also enable them to know about the radiation dose of each investigation and the dose limits approved by the regulatory bodies. Nurses' appropriate knowledge of radiation safety and protection will enhance patient care and efficiently deliver healthcare services.

V. Conclusion

This review identified the role of nurses in the investigations into where radiation is used. However, there is a lack of knowledge and awareness of radiation safety and radiation protection among nurses. This can even affect patient care delivery in certain conditions. These results clearly emphasize the importance of structured training in radiation safety and related aspects for nurses to improve their awareness of radiation safety and protection. This may be incorporated into the curriculum or provided as a professional development program by radiation safety and protection experts. This would improve the nurses' awareness of radiation safety and protection.

Conflict of interest

The authors declare no conflict of interest.

References

- [1] Bushberg, J.T. And Boone, J.M., 2011. *The Essential Physics Of Medical Imaging*. Lippincott Williams & Wilkins.
- [2] Abel, J., 1994. *Biological Effects Of Low Doses Of Ionizing Radiation: A Fuller Picture*. Iaea Bulletin, P.37.
- [3] Bwanga, O.B., 2020. *Nurses' Knowledge Of Radiation Protection In Medicine: A Literature Review*. Professional Nursing Today, 24(3), Pp.21g-21.
- [4] World Health Organization, 2015. *Radiation Protection In Medicine: Setting The Scene For The Next Decade*. Proceedings Of An International Conference.
- [5] Yurt, A., Çavuşoğlu, B. And Günay, T., 2014. *Evaluation Of Awareness On Radiation Protection And Knowledge About Radiological Examinations In Healthcare Professionals Who Use Ionized Radiation At Work*. Mol Imaging Radionucl Ther, 23(2), Pp.48-53.
- [6] Badawy, M.K., Mong, K.S., Lykhun, U.P. And Deb, P., 2016. *An Assessment Of Nursing Staff's Knowledge Of Radiation Protection And Practice*. Journal Of Radiological Protection, 36(1), P.178.
- [7] Park, S. And Yang, Y., 2021. *Factors Affecting Radiation Protection Behaviors Among Emergency Room Nurses*. International Journal Of Environmental Research And Public Health, 18(12), P.6238.
- [8] Dianati, M., Zaheri, A., Talari, H.R., Deris, F. And Rezaei, S., 2014. *Intensive Care Nurses' Knowledge Of Radiation Safety And Their Behaviors Towards Portable Radiological Examinations*. Nursing And Midwifery Studies, 3(4).
- [9] Alkhayal, A.M., Alothman, A.S., Alathel, A.H., Almaslamani, A., Alfehaid, O.N., Alhassan, I.A., Alrabeeah, K.A. And Ghazwani, Y.G., 2023. *Knowledge And Attitude Of Radiation Safety And The Use Of Protective Measures Among Healthcare Workers In A Tertiary Center*. Eur Rev Med Pharmacol Sci, 27(5), Pp.2047-2051.
- [10] Morishima, Y., Chida, K., Katahira, Y., Seto, H., Chiba, H. And Tabayashi, K., 2016. *There Is A Need For Radiation Safety Education For Interventional Cardiology Staff, Especially Nurses*. Acta Cardiologica, 71(2), Pp.151-155.
- [11] Hirvonen, L., Schroderus-Salo, T., Henner, A., Ahonen, S., Kääriäinen, M., Miettunen, J. And Mikkonen, K., 2019. *Nurses' Knowledge Of Radiation Protection: A Cross-Sectional Study*. Radiography, 25(4), Pp.E108-E112.
- [12] Salama, S., Gomaa, M.A. And Alshoufi, J.H., 2013. *In Brief, Education And Training In Radiological Protection For Diagnostic And Interventional Procedures Icrp 113*.