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# To Assess Radiation Awareness Among Healthcare Workers and Their Approach Toward Radiation Protection

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***Abstract***

*Every healthcare professional, whether directly or indirectly exposed to radiation, needs to be knowledgeable about radiation protection to make sure that the potential risks do not outweigh the advantages of diagnostic imaging. The purpose of this study was to evaluate the healthcare staff at Indus International Hospital in Derabassi's understanding of radiation protection. Healthcare professionals, including nurses, technicians, doctors, and general duty personnel, participated in a cross-sectional survey. The quantitative descriptive analysis study employed a questionnaire with 22 multiple-choice questions broken down into three sections. Given the wide variety of correct-to-incorrect ratios provided for each question in the second and third sections, certain aspects of radiation protection are less well-known than others. The study shows that there is reasonable knowledge regarding radiation awareness among healthcare workers. Nursing staff from the emergency department, due to its frequent interaction with the radiology department, have significantly better knowledge regarding radiation awareness rather than nursing staff of the medical ICU (intensive care unit). Radiographers, as they belong to a radiological background, have relatively higher knowledge than the other healthcare workers. The findings of the study highlight the significance of training healthcare professionals on the requirements of national radiation safety laws and the practical applications of this new information.*

**Keywords-**Radiology department, radiation protection, awareness, knowledge, exposure, Cancer,

## INTRODUCTION

### History

The discovery of X-rays by Wilhelm Conrad Roentgen in 1895 marked a groundbreaking advancement in medical diagnostics, allowing physicians to visualize internal structures without invasive procedures. This revolutionary finding quickly led to widespread adoption of X-ray technology in medical practice, improving diagnostic accuracy across a range of conditions. However, the potential hazards of radiation exposure were not fully understood initially. The first documented cases of X-ray-induced cancer appeared as early as 1902, raising awareness of the risks associated with prolonged or high-dose radiation exposure. Over the years, the applications of medical radiation have expanded to include therapeutic uses in oncology, necessitating comprehensive radiation protection measures to ensure patient and healthcare worker safety.

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**Harmful Effects of Radiation Exposure**

Exposure to ionizing radiation, such as X-rays, poses several health risks, including genetic damage and an increased likelihood of cancer. These harmful effects are categorized as either deterministic or stochastic. Deterministic effects have a threshold dose, meaning that the severity of effects (e.g., skin burns, cataracts) increases with radiation dose once that threshold is exceeded. Stochastic effects, on the other hand, do not have a threshold dose but are probabilistic in nature; the risk of occurrence (such as cancer) rises with increased exposure, although severity remains unaffected by the dose level. To mitigate these risks, stringent radiation protection protocols and proper exposure techniques are essential, particularly in healthcare settings where staff may be exposed frequently or in high doses [1–7].

**AERB Guidelines for Radiation Protection**

The Atomic Energy Regulatory Board (AERB) in India plays a crucial role in regulating radiation exposure in healthcare and other industries. The AERB sets mandatory exposure limits and enforces safety guidelines designed to protect both patients and healthcare workers from the adverse effects of ionizing radiation. Key components of AERB guidelines include the use of personal dosimeters for monitoring radiation exposure, adherence to safety protocols, and implementation of the ALARA (as low as reasonably achievable) principle. This principle emphasizes minimizing exposure to radiation by optimizing operational practices, using protective barriers, and maintaining safe distances when feasible. These guidelines are especially important in medical settings where the potential for cumulative radiation exposure is significant [4, 5].

**Methodology**

This study was conducted at Indus International Hospital, Derabassi, employing a cross-sectional design to assess radiation safety practices and awareness among healthcare workers. Participants included staff from various departments frequently exposed to radiation, including radiology, emergency, ICU, general duty assistants (GDAs), and laboratory personnel.

A structured questionnaire, consisting of 22 multiple-choice questions, was administered to a total of 72 participants. The questionnaire was designed to evaluate participants' knowledge of radiation hazards, adherence to safety practices, and familiarity with radiation protection guidelines. The questions covered key areas, such as the importance of wearing personal dosimeters, understanding AERB regulations, and awareness of the ALARA principle.

To ensure representative sampling, a purposive random sampling method was used, selecting individuals from departments with regular radiation exposure. This approach allowed for a focused assessment of staff members directly impacted by radiation safety protocols, enabling insights into potential knowledge gaps and areas for improvement in safety practices [4–10].

**Results**

***Demographic Analysis***

**Table 1.** Distribution of participants by gender.

| S. No. | Demographic Variable | Frequency | Percentage (%) |
|---|---|---|---|
| 1. | **Gender** | | |
| | Male. | 39 | 54.16% |
| | Female. | 33 | 45.84% |

- *Interpretation*: Out of 72 participants, 39 were male (54.16%) and 33 were female (45.84%). Table 1 shows the gender breakdown of the 72 study participants. Out of the total, 39 participants (54.16%) were male, and 33 (45.84%) were female. This balanced distribution provides insights into the gender representation within the healthcare departments surveyed.

 

**Table 2.** Distribution of participants by department.

| S. No. | Demographic Variable | Frequency | Percentage (%) |
|---|---|---|---|
| 1.<br>2.<br>3.<br>4.<br>5. | **Department** | | |
| | Radiology. | 18 | 25% |
| | Emergency. | 11 | 15.27% |
| | ICU (Intensive care unit). | 11 | 15.27% |
| | GDA (General duty assistant). | 13 | 18.05% |
| | Laboratory. | 8 | 11.11% |
| | Other. | 11 | 15.27% |

*Interpretation*: Most participants were from the radiology department (25%), followed by GDA (18.05%) and emergency (15.27%). Table 2 categorizes participants by their respective departments. Most respondents were from the radiology department (25%), followed by general duty assistants (GDA) at 18.05%, and emergency and ICU departments, both at 15.27%. This distribution highlights the departments most frequently involved in radiation-related procedures.

**Table 3.** Distribution of participants by designation.

| S. No. | Demographic Variable | Frequency | Percentage (%) |
|---|---|---|---|
| 1.<br>2.<br>3.<br>4.<br>5.<br>6. | **Designation** | | |
| | Radiologist. | 1 | 1.38% |
| | Radiographer. | 18 | 25% |
| | Physician. | 07 | 9.72% |
| | Emergency nurse. | 11 | 15.27% |
| 7. | ICU nurse. | 11 | 15.27% |
| 8. | GDA. | 13 | 18.05% |
| 9. | Cath lab technician. | 8 | 11.11% |
| 10. | ICU and emergency. | 3 | 4.16% |

Table 3 organizes participants based on their professional roles. Radiographers formed the largest group at 25%, reflecting their high involvement in radiological work. Other notable groups include GDAs at 18.05% and nurses from the emergency and ICU departments, each constituting 15.27%. Smaller groups included physicians (9.72%) and cath lab technicians (11.11%), indicating a varied sample across different job roles.

**Table 4:** Distribution of participants by years of experience.

| S. No. | Demographic Variable | Frequency | Percentage (%) |
|---|---|---|---|
| 1.<br>2.<br>3.<br>4.<br>5. | **Years of Experience** | | |
| | >1 year | 40 | 55.55% |
| | 1–5 years | 22 | 30.55% |
| | 6–10 years | 06 | 8.33% |
| | >10 years | 04 | 5.55% |

*Table 4 Shows Distribution of Participants by Years of Experience*

*Interpretation*: Most participants had less than 1 year of experience (55.55%). The fourth table provides an overview of participants' years of experience. A substantial majority (55.55%) had less than 1 year of experience, indicating a relatively new workforce. Those with 1–5 years of experience constituted 30.55%, while those with 6–10 years and over 10 years made up smaller portions, 8.33% and 5.55%, respectively. This breakdown reveals a predominance of less experienced

 

staff, highlighting a potential need for training and awareness efforts in radiation safety for newer healthcare workers.

In summary, these (Tables 1–4) collectively outline the demographic and professional background of the participants, which offers context to the study's findings and supports understanding of radiation safety awareness across varied levels of experience and departmental roles.

**Graphical Representation**

- *Figure 1:* provides an overview of the demographic characteristics of the study participants:
- *Figure 1a:* Displays the gender distribution as a pie chart, illustrating the percentage of male and female participants. This visual gives insight into the gender representation within the study sample.
- *Figure 1b:* Shows the departmental distribution using a bar chart, highlighting the number of participants across different departments. This chart reveals how various departments are represented in the study.
- *Figure 1c:* Represents designation distribution with a bar chart, showing the count of participants based on their job designation. This allows for a clearer view of the roles within the participant pool.
- *Figure 1d:* Presents the experience distribution through a histogram, illustrating the range and frequency of participants' years of experience. This distribution provides a better understanding of the experience levels across the sample.

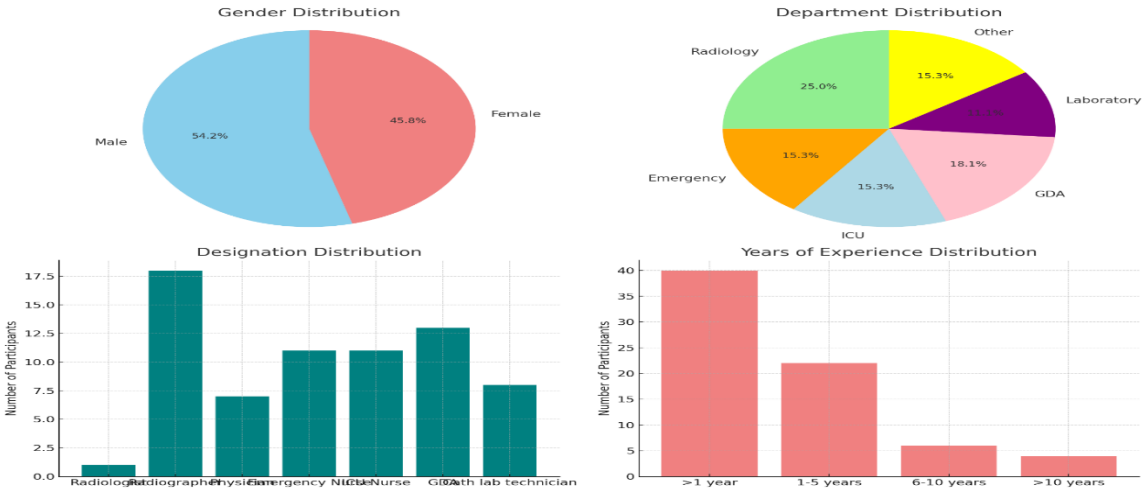


**Figure 1.** a: Gender distribution, b: Departmental distribution, c: Designation distribution, d: Experience distribution.

**Discussion**

The findings of this study indicate that although there is a general awareness of radiation protection practices among healthcare workers, specific areas require targeted education and enhancement. Healthcare professionals, especially those working in high-exposure environments, must possess a clear understanding of radiation safety protocols to protect themselves, their patients, and their colleagues.

The data revealed that radiographers and nurses in the emergency department displayed significantly higher levels of knowledge regarding radiation safety compared to other healthcare workers. This heightened awareness among radiographers can be attributed to their specialized training and frequent, direct interaction with radiographic equipment and radiation sources. Their training often includes comprehensive instruction on radiation physics, safe handling procedures, and protective equipment usage, which equips them with a strong foundation in radiation safety practices. Similarly, emergency department nurses likely have greater familiarity with radiation safety due to their frequent involvement

 

in urgent imaging procedures for trauma or critically ill patients, necessitating quick and safe handling of radiological exposure. In contrast, other healthcare workers, such as general duty assistants (GDAs) and laboratory personnel, showed comparatively lower levels of knowledge in radiation protection. This discrepancy may stem from a lack of targeted training in radiation safety, as their roles typically do not involve direct exposure to radiological procedures. However, because these workers may occasionally operate in proximity to radiation sources or in environments where radiological equipment is used, it is essential to enhance their understanding of basic radiation safety protocols.

The study underscores the importance of focused educational initiatives tailored to the varying needs of different healthcare roles. Developing mandatory training sessions, refresher courses, and easily accessible resources on radiation protection can help bridge knowledge gaps. Topics, such as proper use of personal dosimeters, adherence to the ALARA principle, and understanding the implications of both deterministic and stochastic radiation effects should be incorporated into training programs. These educational efforts can be reinforced by periodic assessments and practical drills that emphasize safe practices.

## CONCLUSIONS

Radiation protection is vital for all healthcare workers, especially those frequently interacting with radiological procedures. Continuous education on radiation safety practices is critical to ensuring the health and safety of both healthcare workers and patients. Regular monitoring and information dissemination that act as conduct between management and healthcare workers should be implemented; additionally, there must be federal regulations or radiological rules for radiation protection in every hospital. Being aware of the radiation safety in an institution provides an opportunity for continuous professional development, enhancing the quality of healthcare services provided. Hence the primary aim of the study is to assess the level of knowledge regarding radiation safety among different healthcare workers, whether they are directly or indirectly exposed to radiation.

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