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**Brief Report**

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# Awareness of Radiation Protection among Undergraduate Nursing Students

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## Abstract

**Background**: Since the use of ionizing radiation in the health sector has been expanding, it is critical for healthcare professionals to be trained and appropriately aware of ionizing radiation in order to protect them selves and their patients from its adverse effects. Despite this, radiation awareness among nurses is a poorly researched topic. This study was designed to assess awareness of radiation protection among nursing undergraduates at the Faculty of Allied Health Sciences, University of Peradeniya.

**Objectives:** A cross-sectional descriptive online survey was conducted with a pre-designed questionnaire among 108 nursing undergraduates. The questionnaire consists of 25 questions and was categorized into three sections to evaluate demographic data and awareness of radiation protection. Methods: Paper-based clinical records of 250 outpatients were reviewed randomly using an evaluation form.

**Results:** The response rate was 60.67%. Of the 178 participants, 68.5% were female. Most of the participants (87.0%) were aware of the possible risk associated with medical radiation in diagnostic imaging. 67% and 51.9% reported that they have seen either a lead apron or a thyroid shield when attending to an environment that entails radiation exposure and they knew how to use these on patients or staff, respectively. The mean scores of awareness of radiation hazards and protection of the 4$^{th}$ year, 3$^{rd}$ year, 2nd year and 1$^{st}$ year were 64.04% (SD=2.5725), 63.68% (SD=3.8269), 56.41% (SD= 5.0112) and 38.35% (SD=3.287), respectively.

**Conclusions:** The findings of the present study suggest that there is a lack of awareness of radiation protection among undergraduate nursing students. Therefore, enhancing medical education on radiation hazards and protection is essential.

*Keywords: Awareness, Radiation Protection, Nursing Students*





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## INTRODUCTION

Radiology is one of the main disciplines in the healthcare system which includes plain radiography, computed tomography, fluoroscopy, mammography and dental radiography. X-ray imaging is a diagnostic procedure that is regularly performed worldwide. Despite their great diagnostic utility, exposure to X-rays has been linked to a number of dose-dependent health problems such as cancer and genetic effect. Therefore, awareness among health professionals of the impact of X-ray imaging is crucial (1–10).

Although occupational radiation protection can be achieved with three principles of justification, optimization and dose limitation, it is a bit challenging to cover all three principals at once. All those who work with X-rays should have their own local regulations on radiation protection against ionizing radiation and adequate training programs. In fact, several international organizations such as the European Commission (EC) and the International Atomic Energy Agency (IAEA) have published guidelines for medical personnel on radiation protection in practice (6,11–15).

Any professional assigned to work in a radiology department should have adequate awareness on radiation (8,10–12,16,17). Distinctive professional groups such as doctor, radiographer, and nurses often involve preceding a successful radiology examination. Therefore, it becomes imperative for everyone to consider maintaining occupational radiation protection in a proper manner (18).

Nurses play an essential role in the healthcare sector because they accompany patients the majority of the time. Nurses work in clinical settings that use ionizing radiation, such as radiology departments, intensive care units, and operating rooms (4,8,9,16,17). Furthermore, there may be a risk of exposure to radiation during their word work by inward x-ray imaging. Therefore, it is essential to evaluate the awareness of radiation protection among nurses. Several studies have been conducted in the past to assess nurses' awareness of ionizing radiation. Some previous research has found that nurses who work with radiation had an overall inadequate level of knowledge on radiation (1,2,4,6–8,10–12,15–22).

Based on these results, it is important to assess the current state of radiation protection education among future professionals who will be involved in medical imaging examinations (12,19). Therefore, this study was performed to assess knowledge and awareness on radiation protection among undergraduate nursing students at the Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka.

## METHODOLOGY:

A cross-sectional descriptive study was conducted among undergraduate nursing students of the Faculty of Allied Health Sciences, University of Peradeniya, from April to July 2021. A total of 178 (1$^{st}$ year -49 students), 2$^{nd}$ year (44 students), 3$^{rd}$ year (49 students) and 4$^{th}$ year (36 students) undergraduate nursing students were chosen as the participants. The students who did not complete the questionnaire were excluded from the study. The ethical clearance (AHS/ERC/2021/075) was obtained from the Ethical Review Committee of the Faculty of Allied Health Sciences, University of Peradeniya. After receiving the ethical clearance, permission to conduct the study was obtained from the Head, Department of Nursing, Faculty of Allied Health Sciences, University of Peradeniya. A self-administered questionnaire comprised of 25 questions with closed-ended type questions related to the demographic information of the participants, knowledge and awareness of radiation protection was used for data collection. A pilot study was conducted among a sample of 10 nursing students to establish the reliability and face validity of the questionnaire. The questionnaires were distributed through a Google

sheet and informed consent was obtained from participants before data collection. Data were analyzed using Statistical Package for the Social Sciences (SPSS) (version 27.0). One-way analysis of variation (ANOVA) was used for analyzing data. The p-value < 0.05 was considered statistically significant.

**RESULTS:**

Even though a total of 135 responses (out of 178) were received, 27 of the responses had to be excluded due to incompleteness. According to responses, 68.5% (74) of nursing students were female while 31.5% (34) were male. Responses were received as 25.9% (28) from 1st year, 29.6% (32) from 2nd year, 27.8% (30) from 3rd year, and 16.7% (18) from 4th year (Table 1). Details of the medical imaging procedures they had involved in are given in Table 2 and **Error! Reference source not found.**

**Table 1 Demographic characteristics**

| Variables | | Frequency | Percentage (%) |
|---|---|---|---|
| **Gender** | Male | 34 | 31.5 |
| | Female | 74 | 68.5 |
| **Academic year** | 1st year | 28 | 25.9 |
| | 2nd year | 32 | 29.6 |
| | 3rd year | 30 | 27.8 |
| | 4th year | 18 | 16.7 |

**Table 2. Experience with different medical imaging modalities**

| Medical imaging modality | Frequency | Percentage (%) |
|---|---|---|
| **Plain Radiography** | 48 | 44.4 |
| **Mammography** | 0 | 0 |
| **CT (Computed Tomography)** | 14 | 13 |
| **Ultrasound *** | 24 | 22.2 |
| **Dental Radiography** | 14 | 13 |
| **MRI (Magnetic Resonance Imaging) *** | 4 | 3.7 |

| | | |
|---|---|---|
| **DEXA (bone density)** | 0 | 0 |
| **PET (Positron Emission Tomography)** | 2 | 1.9 |
| **PET-CT** | 2 | 1.9 |
| **Can't remember** | 10 | 9.3 |
| **Never** | 36 | 35.2 |

- Non-ionizing radiation Medical Imaging Modality

According to received questionnaires, there were 44.4% of students who had experience with plain radiography (X-ray) examinations in them past and 35.2% of nursing students had never had any experience with the listed examinations.

**Table 3. Experience with the number of medical imaging procedures**

| Number of medical imaging tests | Frequency | Percentage of response (%) |
|---|---|---|
| **None** | 45 | 42 |
| **1** | 36 | 33 |
| **2** | 6 | 6 |
| **3** | 5 | 5 |
| **4** | 2 | 2 |
| **> 5 times** | 4 | 4 |
| **Can't remember** | 10 | 9 |

According to responses, 33.3% of nursing students have experienced only one imaging procedure in their lifetime, while 42% had no experience.

Forty-one percentage of the nursing students out of all, were in the Radiology department or operating theatres during any type of medical imaging procedures in their clinical practice, while the rest of the nursing students had no experience.

In terms of batches, 88.8% of 4$^{th}$ year students had the experience with medical imaging procedures. According to the analysis of obtained data, there is no relationship between academic year and experience of attending in the Radiology department or operating theatres during a medical imaging procedure ($P > 0.05$).

**Table 4. Experience of attending the radiology department or/operating theater during a medical imaging procedure**

| Academic year | Frequency | Percentage of score (%) |
|---|---|---|
| **1st year** | 0 | 0 |
| **2nd year** | 16 | 50 |
| **3rd year** | 22 | 73 |
| **4th year** | 16 | 89 |

The descriptive data showed that 87% of nursing students were aware of the possible risks associated with X-ray radiation to the health of an individual. 7.4% of students haven't an exact idea about possible risk-related X-ray imaging procedures while 5.6% of students said "No" for possible risk-related X-ray imaging procedures. Awareness of stochastic effects and deterministic effects from ionizing radiation among nursing students seems to have a considerably low level (24.1%). 70.4% of participants had not heard about these effects. 37% of nursing students had mentioned that they have learnt radiation protection methods at the university. 42.6% of nursing students have learnt radiation protection methods during their clinical. 61.1% of nursing students have mentioned that they have never learnt.

The nursing students' responses to the awareness of radiation protection equipment such as lead aprons, thyroid collars had been mentioned as, 67% of them have seen lead aprons and thyroid collars during their clinical practices. Furthermore, 51.9% of the nursing students also responded that they know how to wear radiation protection equipment (lead aprons and thyroid collars).

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collars during their clinical practices. Furthermore, 51.9% of the nursing students also responded that they know how to wear radiation protection equipment (lead aprons and thyroid collars).

**Table 5. Radiation protection awareness among nursing students by academic year**

| | Academic year | Number of students | Mean (%) | SD |
|---|---|---|---|---|
| Academic year | $4^{th}$ year | 18 | 64.04 | 2.5725 |
| | $3^{rd}$ year | 30 | 63.68 | 3.8269 |
| | $2^{nd}$ year | 32 | 56.41 | 5.0112 |
| | $1^{st}$ year | 28 | 38.35 | 3.287 |

According to the overall performance of the four batches, there was a statistical difference in awareness of radiation protection among nursing students ($p < 0.005$). The mean percentage of awareness was 64.04% (SD= 2.5725), 63.68% (SD= 3.8269), 56.41% (SD= 5.0112) and 38.35% (SD=3.287) among nursing students of $4^{th}$ year, $3^{rd}$ year, $2^{nd}$ year and $1^{st}$ year, respectively. Nursing students of the $4^{th}$ year showed the highest mean score for the questionnaire on awareness of radiation protection. Moreover, mean scores have gradually decreased from $3^{rd}$ year to $1^{st}$ year.

There was no significant difference in the percentage score of awareness of radiation protection between males and females ($p > 0.05$) (Table 6). Male nursing students shows higher mean score (60.84%, SD = 3.6614) than the female students (52.35%, SD = 4.5658).

**Table 6. Awareness of radiation protection**

| Gender | Number of students | Mean | Mean (100%) | SD | SE |
|---|---|---|---|---|---|
| Male | 34 | 11.5588 | 60.84 | 3.6614 | 0.6279 |
| Female | 74 | 9.9459 | 52.35 | 4.5658 | 0.5308 |

*SD= Standard Deviation*

*SE=Standard Error*

Self-satisfaction regarding their awareness of radiation protection had been given by nursing students on a Likert scale. Overall, 59.3% of nursing students were not satisfied with their awareness of radiation protection while 7.4% of students were very satisfied.

**DISCUSSION:**

This study sought to address the level of radiation protection awareness of undergraduate nursing students of the Faculty of Allied Health Sciences, University of Peradeniya, Sri Lanka. Even though several studies were conducted relating nursing awareness to radiation protection, it was hard to find any study that was based on undergraduate nursing students' awareness of radiation protection in Sri Lanka.

The 2nd year and 3rd year students answered at a higher percentage level to the questionnaire than the other batches.

It should be noted that 3rd year and 4th year nursing students usually have a higher frequency of clinical hours than the 1st year and 2nd year; therefore, they should attend all the departments to acquire knowledge. Therefore, the 4th year students have responded positively at the highest percentage when compared to other academic years in terms of the questions regarding attending the Radiology department and operating theaters.

Responses in terms of academic years showed gradual decline from 4th year to 1st year. It is essential to note that the mean score percentage did not exceed 70% in 4th year in particular. According to the overall responses of 1st year students, they have a considerably low level of awareness of radiation protection when compared to other batches. However, they were not in the Radiology department or theater during a medical imaging procedure, most of them had a better awareness of a few questions in the questionnaire regarding radiation protection equipment and basic principles of ionizing radiation (78.85%).

Even though there is a significant difference among batches, there is no difference when considering the mean score between male and female nursing students separately on awareness of radiation protection. Nonetheless, the mean score of males had a higher value than the females.

Being aware of warning signs in radiation protection and following guidance strictly according to the Radiology department is crucial for the nursing students during their clinical appointments to minimize radiation exposure. The lack of awareness of these leading theories has been identified around the world (8–10,23).

As ionizing radiation has hazardous effects to humans, it is very important to be aware of radiation not only as a nursing student but also in general. Even though the nursing students have sufficient knowledge, it seems practical usage of their awareness is at a lower percentage at hospitals. The data show that most nursing students are aware of the harmful effects of medical radiation but not well familiar with the stochastic and deterministic effects of a particular radiation dose in medical radiation. More than half of nursing students (59.3%) were not satisfied with their awareness of radiation protection even though it is such an important area to consider.

Providing better medical radiation education to nursing students is mandatory since the lack of awareness of radiation protection will put both nursing students and their hospital surroundings' health at risk. Moreover, continuous assessments regarding radiation protection and providing updated regulations of medical radiation to nursing students can make them professional in the field.

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**Author contribution**

Author 1 was involved in the initial conception of the study/data collection, analysis and drafted manuscript.

Author 2 provided planning for the study, statistical support and edited the final manuscript.

**Conflict of interest**

Authors declare that there is no conflict of interest.

**Ethical clearance**

Ethical clearance was obtained from the Ethical Review Committee, Faculty of Allied Health Sciences.

Permission was obtained from the Head of Department, Department of Nursing, Faculty of Allied Health Sciences, University of Peradeniya.

**Data availability**

Data is available on request.

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