

Radiation Safety While Providing Bedside Care During Portable Radiography Procedures: Knowledge and Awareness of Respiratory Therapists and ICU Nurses

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Abstract Respiratory Therapists (RTs) and Intensive Care Unit (ICU) nurses are at a potential risk of undesirable exposure to ionizing radiation when providing bedside care to patients requiring portable radiography. This study aimed to investigate RTs' and ICU nurses' knowledge of radiation safety and their attitude towards portable X-ray examinations. A total of 71 RTs and 29 ICU nurses were recruited in this cross-sectional descriptive study using non-probability convenience sampling during September and November 2020. The study setting was at King Abdulaziz Medical City, Jeddah, Kingdom of Saudi Arabia. Eight-item questionnaire were used. An expert panel confirmed the content validity of the questionnaire. The outcome of the study shows that; the level of awareness to the ionizing radiations potential risk amongst the RTs and ICU nurses was in a good comparable level. Due to the fact that 79.3% of ICU nurses and 87.3% of RTs did not take previous radiation safety educational course. 55.2% of ICU nurses and 78.9% of RTs never read an article pertaining to radiation safety. The radiation protection knowledge was limited as 51.7 % of the participating ICU nurses and 77.5 % RTs were not aware of the minimum safe distance to maintain during exposure without an intervening barrier. Hence, this study highlights the need for in-service educational programs and radiation protection training for both RTs and ICU nurses.

Keyword Radiation safety, Knowledge and Awareness, Respiratory Therapists, Nurses, Portable X-ray

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1. Introduction

Ionizing radiation has continuously been used for a variety of diagnostic and therapeutic purposes [1]. For healthcare personnel, being aware of the potential hazard associated with exposure to ionizing radiation as well as the proper radiation protection practice is of high importance [2-3]. In September 2019 and out of all diagnostic radiological examinations performed in England, radiography (i.e., X-rays) were the commonest accounting for 1.86 million X-rays performed [4]. The bedside (i.e., portable or mobile) chest X-ray is still one of the most frequently sought tests for the diagnosis and monitoring for Intensive Care Unit (ICU) patients [5]. ICU nurses and Reparatory Therapists (RTs) most often work with radiation sources from either mobile radiographic or C-arm fluoroscopy units. Although ICU nurses and RTs are considered non-occupationally exposed as they do not routinely and regularly work near radiation sources; however, they should have an appreciation and better understanding of concepts related to radiation safety precautions and how to implement the “As Low As Reasonably Achievable” (ALARA) principle. Some of these precautions include recognizing radiation sources (i.e., recognizing the international ionizing radiation hazard symbol), reducing exposure time through proper planning so that the procedure is completed as quickly as possible, increasing distance from radiation source as the farther away you place yourself, the less exposure to radiation according to the inverse square law, and using lead shields when available (i.e., wearing lead apron and lead gloves) [6]. Inadequate radiation safety awareness, limited knowledge of radiation protection practice, and negative attitude towards radiation safety policies and procedures have been reported previously among nurses, operation theaters’ healthcare workers, physicians, fellows, residents, interns, medical students, medical technicians, and support staff [1, 3, 7-13].

Reports regarding evaluating radiation safety awareness towards portable X-ray examinations in particular within King Abdulaziz Medical City, Jeddah (KAMC-J), Kingdom of Saudi Arabia (KSA), and for exclusively ICU nurses and RTs do not exist. Thus, this study aimed to investigate RTs’ and ICU nurses’ knowledge of radiation safety precautions and their attitude towards portable X-ray examinations.

2. Material and Methods

This is a cross-sectional, and prospective questionnaire study conducted at KAMC, Jeddah, KSA. Of the all 140 RTs and ICU nurses working at KAMC-J, a total of 71 RTs and 29 ICU nurses were recruited using non-probability convenience sampling during September and November 2020.

Eight structured close-ended multiple-choice questions (MCQs) were developed. The questionnaire encompassed two sections: (a) Demographic section included three questions pertaining to gender, profession (i.e., RT or ICU nurse), and experience (b) Knowledge and attitude section consisted of five questions pertaining to participants knowledge of ionizing radiation associated risks, knowledge of the minimum safe distance to maintain during exposure without an intervening barrier, frequency of portable X-rays encounter, and whether or not participants previously took any course or read any article related to radiation safety precautions. The developed questionnaire was piloted by expert panel consisting of three radiology technologists, two medical physicists, one nurse and one RT to ensure the validity and reliability of its contents, and to ensure that the questionnaire is concise and has clear focus and purpose. The questionnaire was then translated into an electronic format via a survey administration application (Google Forms) and distributed directly to the participant’s emails, and responses were exported into Microsoft Excel sheet for further analysis.

Institutional Review Board (IRB) approval from the local authority was obtained prior to

collecting data. Confidentiality and anonymity were maintained throughout.

Data were analyzed using statistical package IBM SPSS (version 24). Initial descriptive analysis (i.e., frequency and percentages) was generated. Chi-squared test was used to examine the differences in the level of awareness between categorical variables (i.e., RTs and ICU

nurses). P-value of less than 0.05 was considered significant.

3. Results

Out of the total 29 ICU nurses included, 3 (10.3 %) were male, and 26 (89.7 %) were female; while for the 71 RTs included 39 (54.9 %) were male, and 32 (45.1 %) were female as shown in (Fig. 1).

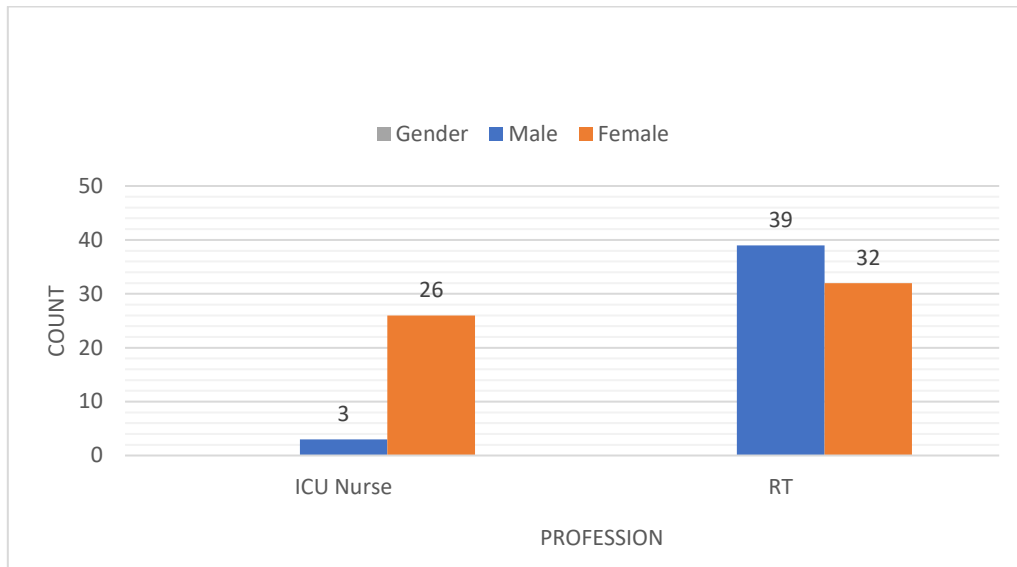


Fig. 1. Gender distribution among population

The analyzed data showed that 19 (65.5 %) of ICU nurses had less than 1 year of experience, 4 (13.8 %) had between 1 to 3 years of experience, and 6 (20.7 %) had more than 3 years of experience. On the other

hand, 55 (77.5 %) of RTs had less than 1 year of experience, 9 (12.7 %) had between 1 to 3 years of experience, and 7 (9.8 %) had more than 3 years of experience as shown in (Fig. 2).

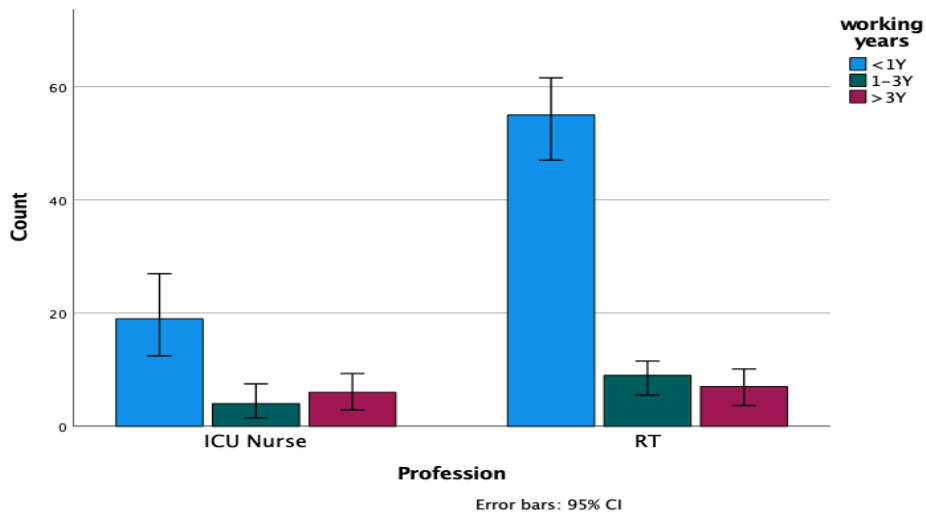


Fig.2. Years of experience among population

There was no significant difference in the level of awareness for ionizing radiation potential risks between ICU nurses and RTs ($p = 0.258$), as 26 (89.7 %) of ICU nurses and 57 (80.3 %) of RTs were aware of the ionizing radiation associated risks. This indicates that both ICU

nurses and RTs have comparable knowledge of ionizing radiation associated risks.

Overall, RTs had more bedside portable X-rays encounters, compared to ICU nurses as illustrated in (Fig. 3).

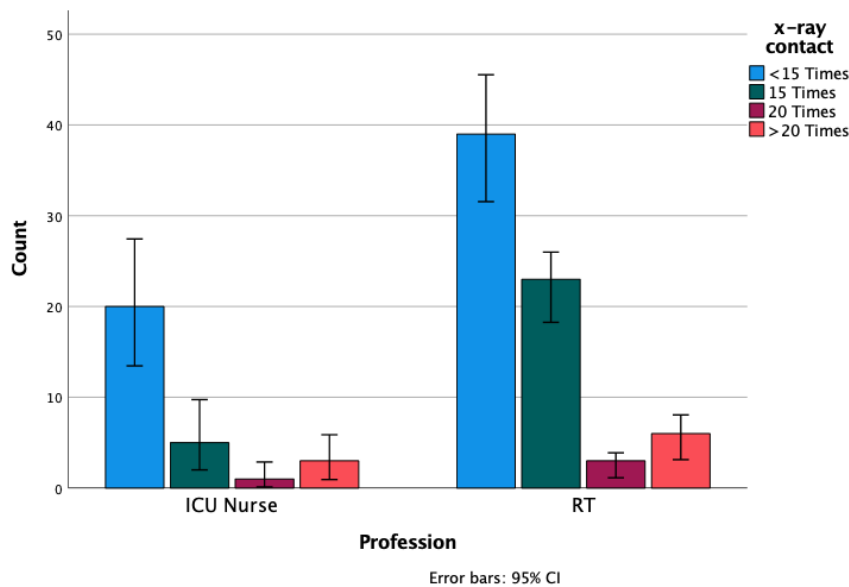


Fig.3. Number of Portable X-rays encounters among population

As reported in table 1, 23 (79.3 %) of ICU nurses and 62 (87.3 %) of RTs did not take previous radiation safety educational course.

Moreover, 16 (55.2 %) of ICU nurses and 56 (78.9 %) of RTs never read an article pertaining to radiation safety.

Table 1. Population response to questions pertaining to taking previous course or reading articles about radiation safety precautions

	ICU Nurses (n = 29)		Respiratory Therapists (n = 71)	
	Yes n (%)	No n (%)	Yes n (%)	No N (%)
- Taking previous course related to radiation safety precautions.	6 (20.7 %)	23 (79.3 %)	9 (12.7%)	62 (87.3 %)
- Read any article related to radiation safety precautions.	13 (44.8 %)	16 (55.2 %)	15 (21.1 %)	56 (78.9 %)

As reported in Table 2 and considering the recommended minimum safe distance of 2 meters to be maintained during exposure without an intervening barrier, about a half of the ICU

nurses (51.7 %) either did not know the answer or chose the wrong answer. On the other hand, roughly three quarters of the RTs (77.5 %) either did not know the answer or chose the wrong answer.

Table 2. Population response to question pertaining to the minimum safe distance to maintain during exposure without an intervening barrier

	Distance from X-ray source (Meters)			
	5	2	1	I do not know
ICU Nurses (n = 29)	7 (24.1 %)	14 (48.3 %)	2 (6.9 %)	6 (20.7 %)
Respiratory Therapists (n = 71)	36 (50.7 %)	16 (22.5 %)	4 (5.7 %)	15 (21.1 %)

4. Discussion and Conclusion

In this study, we investigated and compared the level of knowledge and awareness regarding radiation safety among RTs and ICU nurses at KAMC- J. The main finding is that the level of awareness to ionizing radiation potential risks was in a good level of comparability among RTs and ICU nurses. Although still considered deficient, ICU nurses may have more radiation protection knowledge compared to RTs as 48.3 % of ICU nurses were aware of the minimum safe distance to maintain during exposure without an intervening barrier compared to 22.5 % for RTs, as a distance of roughly 2 meters is recommended [3, 14].

The deficiency in radiation protection knowledge may be attributed to the lack of experience as 65.5 % of ICU nurses and 77.5 % of RTs had less than 1 year of experience. Another potential reason is the low enrollment in courses and low interest in reading articles pertaining to radiation safety precautions among both ICU nurses and RTs.

The findings of this study are in agreement with previous work reporting limited knowledge of radiation protection practice among nurses, operation theaters' healthcare workers, physicians, fellows, residents, interns, medical students, medical technicians, and support staff [1, 3, 7-13].

To our knowledge, this is the first study reporting radiation safety awareness and knowledge of radiation protection practice for exclusively respiratory therapists' cohort in Saudi Arabia.

The limitations of this study may stem from the low sample size, which may have affected statistical significance. This highlights the need for future multicenter work within Saudi Arabia to include more ICU nurses and RTs sample.

In conclusion, awareness of ionizing radiation risks as well as knowledge of radiation protection practice are essential for all healthcare professionals. This study highlights the need for in-service educational programs and radiation protection training for both RTs and ICU nurses.

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السلامة من الإشعاع أثناء تقديم الرعاية بجانب السرير عند إجراءات التصوير الإشعاعي المتنقل: معرفة وموقف أخصائيين العلاج التنفسي ومرمضات وحدة العناية المركزة

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المستخلص:

يتعرض أخصائيو العلاج التنفسي (RTs) وممرضو وحدة العناية المركزة (ICU) لخطر محتمل للتعرض غير المرغوب فيه للإشعاع المؤين عند تقديم الرعاية بجانب السرير للمرضى الذين يحتاجون إلى تصوير إشعاعي محمول. هدفت هذه الدراسة إلى التحقيق في مدى معرفة ممرضات العناية المركزة وأخصائيو العلاج التنفسي بالسلامة الإشعاعية وموقفهم تجاه فحوصات الأشعة السينية المحمولة. تم تعيين مجموعته ٧١ أخصائي/ة علاج التنفسي و ٢٩ ممرضًا/ة في وحدة العناية المركزة في هذه الدراسة الوصفية المقطعية باستخدام أخذ عينات ملائمة غير احتمالية خلال شهري سبتمبر ونوفمبر ٢٠٢٠. كان إعداد الدراسة في مدينة الملك عبد العزيز الطبية، جدة، المملكة العربية السعودية. تم استخدام استبيان مكون من ثمانية بنود. وأكدت لجنة خبراء صحة محتوى الاستبيان. كان مستوى الوعي بالسلامة الإشعاعية قابلاً للمقارنة بين الممرضين في وحدة العناية المركزة وأخصائيو العلاج التنفسي. ٧٩.٣٪ من ممرضو وحدة العناية المركزة و ٨٧.٣٪ من أخصائيو العلاج التنفسي لم يأخذوا دورة تعليمية سابقة عن السلامة الإشعاعية. ٥٥.٢٪ من ممرضو وحدة العناية المركزة و ٧٨.٩٪ من أخصائيو العلاج التنفسي لم يقرؤوا أبدًا مقالة تتعلق بالسلامة الإشعاعية. كانت معرفة الحماية من الإشعاع محدودة حيث لم يكن ٥١.٧٪ من ممرضو وحدة العناية المركزة المشاركين و ٧٧.٥٪ من أخصائيو العلاج التنفسي على دراية بالحد الأدنى للمسافة الآمنة للحفاظ عليها أثناء التعرض للأشعة دون حاجز. ومن ثم، تسلطت هذه الدراسة الضوء على الحاجة إلى برامج تعليمية أثناء الخدمة وتدريب على الحماية من الإشعاع لكل من أخصائيو العلاج التنفسي والممرضات في وحدة العناية المركزة.

كلمات مفتاحية:

السلامة من الإشعاع / الحماية من الإشعاع / أخصائيين العلاج التنفسي / ممرضين وحدة العناية المركزة / الأشعة السينية المحمولة.