Original Article :

Assessment of Knowledge about Nuclear Radiation, and Awareness of Radiation Protection among Medical Students in Riyadh Universities, Saudi Arabia.

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Received on 18-4-2022 , accepted for publication on 05-12-2022, dx.doi.org/10.5455/mjhs.2023.01.007

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Abstract

Background and Aims:

Nuclear medicine is considered one of the main medical specialties exposing practitioners to high radiation doses. Therefore, the assessment of knowledge about protection measures is imperative to ensure the safety. The aim of the study is to assess knowledge among medical students about nuclear radiation at Riyadh universities, Saudi Arabia.

Methods:

We conducted cross-sectional as an online survey which assesses knowledge about nuclear radiation safety and radiation protection awareness. We distributed it to medical students in Riyadh's governmental universities.

Results:

A total of 584 responses were collected. The participants represented four universities in Riyadh, and 64.9% of them were in clinical years. The study found that 16.1% had adequate knowledge and awareness toward nuclear radiation. Moreover, 44.7% had moderate knowledge while 39.2% had inadequate knowledge. Limitations include the lack of knowledge about personal monitoring devices (81.5%), how to use them (70.7%) and dose limits (51.5%). Furthermore, 74.1% of interns showed adequate awareness, when compared to clinical and preclinical students, who had figures of 16.3% and 8.1% respectively. 70.8% preferred obtaining information from medical websites, while 44.7% opted E-learning. Moreover, it emerged that King Saud University students had the highest level of awareness while Imam Mohammed bin Saud University students showed the lowest.

Conclusions:

The study revealed that the level of awareness among medical students about nuclear radiation protection is low. This stems from the lack of knowledge about personal monitoring devices with regards to safety and how best to use them.

Key words:

students, awareness, radiation, nuclear, Saudi Arabia, Riyadh

Introduction

Nuclear medicine is one of the main medical specialties contributing to high radiation doses exposure to radiation workers.[1] Advancement in technology has led to complex interventional radiological procedures and nuclear medicine investigations. With these advancements, different concerns regarding radiation dose to workers and patients have been raised.[2] Harmful effects of radiation use are well studied [2–4] and therefore, it is important to comprehend the magnitude and be aware of radiation exposure. Students with clinical experience are more aware of nuclear security and safety,[5] and it has been shown that the raising the level of radiation hazard awareness among doctors and clinicians can be improved by increasing knowledge of the topic in medical students.[6] It was reported that medical students worldwide do not possess adequate knowledge with regard to ionizing radiation, diagnostic imaging, and radiation safety[2]. One study illustrates that while all students are familiar with radiation-free imaging studies and unfortunately, high percentage of students are not familiar with, and commonly undervalue, the relative doses and risks of common imaging studies.[7] With the proper level of knowledge, future doctors can play a significant role in contributing to patient safety regarding ionizing radiation. This study aimed to assess medical students' knowledge about nuclear radiation safety and safety roles along with investigating their awareness of radiation protection and protection materials, before and during procedures. Most participants in a previous study[8] preferred workshops rather than web-baseline modules, so this study also attempts to assess preferred sources or platforms for medical students in the city of Riyadh to learn about nuclear radiation.

Methodology

Study Design

This is a web based cross-sectional study design that was conducted over a 5-month period, with the chosen participants being undergraduate medical students in Riyadh, Saudi Arabia.

Population

Five hundred and sixty-seven randomized participants were enrolled from the four medical schools in Riyadh, Saudi Arabia: Imam Mohammad Ibn Saud Islamic University, King Saud Bin Abdulaziz University of Health Sciences, Princess Nourah Bint Abdul Rahman University and King Saud University. The sample size was evaluated by the Open-Epi tool with a 95% confidence level as 346. The sampling technique depended on snowball sampling where students who participate in

the study were able to invite other students from their universities. The questionnaire link was distributed to students- groups at different social media platforms. The sampling was remaining to achieve the goaled sample size however, we received more than the required sample size and was included in the study.

Data Collection Methods and Study Tools

The data was collected via a self-administered questionnaire which was priorly validated[9], and then distributed using Survey Monkey, an online platform for survey development and distribution. Because the questionnaire was distributed among medical students who are known to understand the English language, we preferred to distribute the questionnaire in its original language (English). In this study, three sections in the questionnaire were used to evaluate the students' awareness. The participant's demographic information was collected in the first section while the second section assessed the student's perspective on radiation protection. The last section in the questionnaire covered the student's observation of the staff and the department of nuclear medicine regarding the safety arrangements.

Statistical Data Analysis

Statistical Package for the Social Sciences (SPSS, version 22) was used to analyze data with the help of an expert. Frequency and percent were used for description of categorical variables. According to the original study, the authors did not develop a method for classify the population which cause difficulties in comparison between different groups. Therefore, in this study, we classified the knowledge of the students as inadequate, moderate, and adequate and satisfaction into dissatisfied, neutral, and satisfied. To assess the knowledge all, correct answers would take 1 points and wrong answer would take 0 point, sum of the results was calculated and answering more than 60 % or higher of questions correctly was reported to have adequate knowledge, 30-60 % as moderate and < 30 % as inadequate. For 14 questions related to satisfaction, "yes" answers took one point and "No" take 0, sum was calculated and 60 % or higher of score was reported to have satisfied, 30-60 % as neutral and < 30 % as dissatisfied. Trichotomous variables were used in this study to define those who had moderate knowledge from those with no knowledge, and students with those who had moderate knowledge from those with no knowledge, and students with neutral satisfaction from those who were total dissatisfied. To ensure the correctness of the modifications and accuracy of the questionnaire, the questionnaire was audited, and the questions were

validated by administering a trial version to 18-25 individuals to ensure the clarity of the questions and establish linguistic validity. No changes were needed after pilot study and students needed 5-7 minutes to complete the questionnaire.

Ethical Consideration

This study was approved on 19/01/2021 by the Institutional Review Board (IRB) of Imam Mohammad ibn Saud Islamic University with the following number HAPO-01-R-001. It is important to note that all participants were made aware of the study's objective, and their informed consent was taken before the study was initiated. Likewise, the study did not require the participants to reveal their identity, and all responses were to remain confidential.

Results

In this study, 567 completed questionnaires were returned in which 64.9% of the participants indicated that they were in their clinical years when this research was conducted. As for those in the preclinical year, they made up 30.3% of the participants. Furthermore, the study indicated that 32.1% of the students were in King Saud University, 31.9% were in Imam Muhammad bin Saud University, and 23.6% came from King Saud bin Abdulaziz University of Health Sciences. As established, 64.4% of the participants reported that they had previous knowledge about nuclear radiation, mostly obtained from radiology courses in their respective universities (47.4%). For 22.4%, social media was the source of the information while 20.4% and 9.9% used medical websites and research/studies, respectively. Similarly, 64.6% reported having acquired some knowledge of radiation protection but only 16.1% of them indicated that they had previously participated in a program or seminar related to radiation protection (Table 1).

Table 1: Participant's baseline (N=584)

		N	N %
Academic level:	Preclinical years	172	30.3%
	Clinical years	368	64.9%
	Intern	27	4.8%
University:	King Saud University	182	32.1%
	King Saud Bin Abdulaziz University of Health Sciences	134	23.6%
	Imam Muhammad Bin Saud University	181	31.9%
	Princess Nourah Bint Abdul Rahman University	70	12.3%

		N	N %
Do you have previous information about nuclear radiation?	No	202	35.6%
	Yes	365	64.4%
Where did you get this information from?	Radiology course in university	269	47.4%
	Medical websites	116	20.4%
	Research / Studies	56	9.9%
	Social media	127	22.4%
Have you ever had any education on radiation protection?	No	191	35.4%
	Yes	349	64.6%
Did you participate in any programs/seminars related to radiation protection?	No	453	83.9%
	Yes	87	16.1%

As revealed by the study, 16.1% of the participants had adequate knowledge and awareness toward nuclear radiation. 44.7% had moderate knowledge and for 39.2%, their level of knowledge was deemed to be inadequate (Table 2).

Table 2: The relation between demographic factors of participants and their reported knowledge

		Knowledge						
	Inadequate		Moderate		Adequate		P- value	
	N	N %	N	N %	N	N %		
Academic level:	Preclinical years	90	52.3%	68	39.5%	14	8.1%	0.000*
	Clinical years	117	31.8%	191	51.9%	60	16.3%	
	Intern	5	18.5%	2	7.4%	20	74.1%	
University:	King Saud University	41	22.5%	95	52.2%	46	25.3%	0.000*
	King Saud Bin Abdulaziz University of Health Sciences	48	35.8%	67	50.0%	19	14.2%	
	Imam Muhammad Bin Saud University	100	55.2%	62	34.3%	19	10.5%	
	Princess Nourah Bint Abdul Rahman University	23	32.9%	37	52.9%	10	14.3%	
Do you have previous information about nuclear radiation?	No	115	56.9%	75	37.1%	12	5.9%	0.000*
	Yes	97	26.6%	186	51.0%	82	22.5%	
Where did you get this information from?	Radiology course in university	48	17.8%	147	54.6%	74	27.5%	0.000*
	Medical websites	24	20.7%	59	50.9%	33	28.4%	
	Research / Studies	13	23.2%	27	48.2%	16	28.6%	
	Social media	44	34.6%	64	50.4%	19	15.0%	

Have you ever had any education on Radiation protection?	No	113	59.2%	71	37.2%	7	3.7%	0.000*
	Yes	72	20.6%	190	54.4%	87	24.9%	
Did you participate in any programs/seminars related to radiation protection?	No	176	38.9%	223	49.2%	54	11.9%	0.000*
	Yes	9	10.3%	38	43.7%	40	46.0%	
*Significant at p value >=0.05								

The data shows that 81.5% of the participants did not know how to use different personal monitoring devices while 70.7% were not aware of the types of personal monitoring devices. In addition, 53% were unacquainted with materials used for shielding inside the nuclear medicine department, and 51.5% lacked awareness on dose limits for radiation workers. However, 83.7%, 64.6% and 56.5% of the students indicated that they had noticed an area or material labeled with warning signs. Thus, they were aware of the importance of dose record keeping and had knowledge about personal monitoring devices respectively (Figure 1).

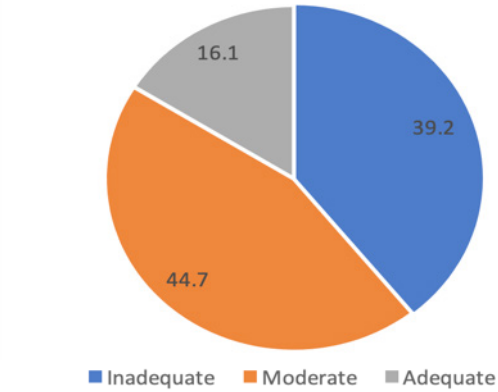


Figure1: Distribution of participants about level of knowledge about nuclear adiation

The analysis of the data revealed a significant difference in students' awareness depending on their academic level and university. Intern year students had a higher level of awareness about nuclear radiation than clinical years, and both possessed higher levels of knowledge than preclinical students. According to the data, 74.1% of interns showed adequate awareness compared to 16.3% for clinical students, and 8.1% for preclinical students. Additionally, students from King Saud University demonstrated the highest level of awareness whereas students from Imam Mohammed bin Saud University had the lowest awareness level. For the universities, the former had 25.3% of students who showed adequate awareness in contrast with 10.5% for the latter. Students who indicated having prior knowledge reported more significant awareness levels (P=0.000), and depending on the source of information, a significant difference existed for students who obtained information from social media, and they reported the

lowest level of awareness (P=0.000). Finally, students who indicated to have been previously educated or participated in any programs/seminars about radiation protection, reported higher awareness levels more than those who had not participated or received prior education on the topic (P=0.000) (Table 2).

Regarding student satisfaction, 40.1% were noted to be satisfied with the measures, rules, and application for radiation protection whereas 37.8% were registered as unsatisfied (Table 3). In figure 2, the agreement level of the participants is shown over different statements regarding protection against nuclear radiation. The data reveals that 72.7% of the students reported that they did not notice the details of the radiation protection officer in the nuclear medicine department. Furthermore, 62.9% reported that they did not find any relevant information about dose limits, rules, or safety precautions at the department. 58.9% of them also denied having been given a briefing on radiation protection measures at the nuclear medicine department. On the other hand, 71.1% of the students were satisfied with radiation protection rules and regulations that were practiced by the staff. The study also reported a difference between the students in relation to satisfaction levels depending on the level of awareness. This is true where students with adequate awareness, reported higher satisfaction level (P=0.000). As for in their internship year, they were more satisfied with measures of radiation protection than clinical and preclinical students (P=0.001).

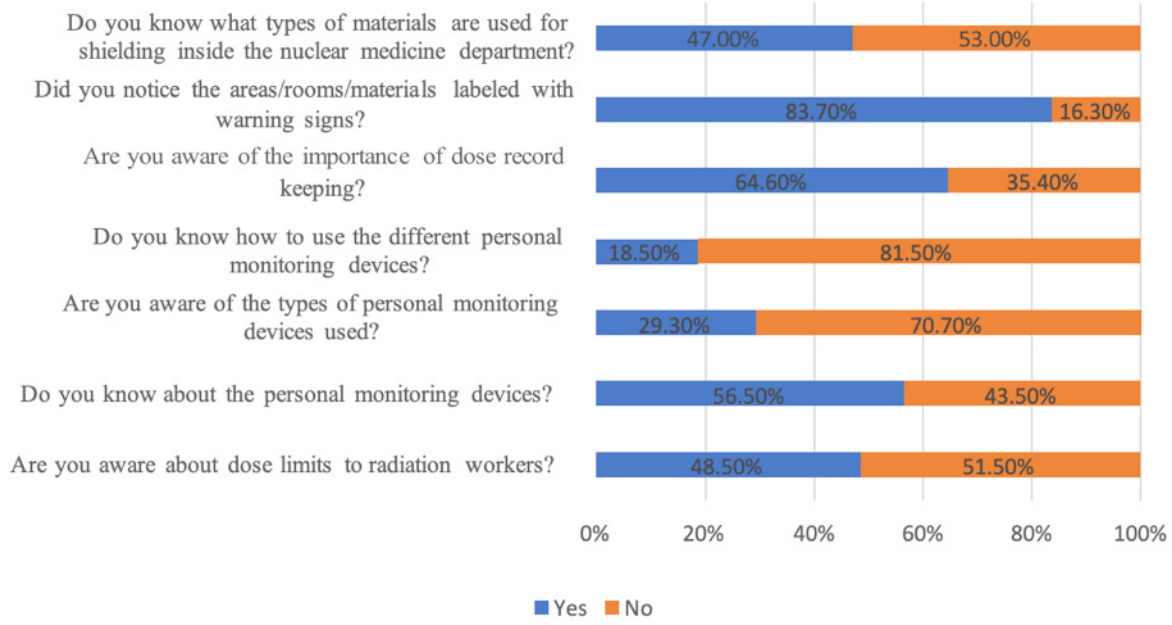


Figure 2: Responses of participants about having knowledge about nuclear radiation

Yet, there was no difference between students at different universities (P=0.765). It must be noted that students who indicated having previous knowledge, especially from medical websites, reported higher levels of satisfaction. Likewise, students who indicated having been educated or participants in any program related to radiation protection, reported significantly higher levels of satisfaction (Table 3).

Finally, the study found that 70.8% of

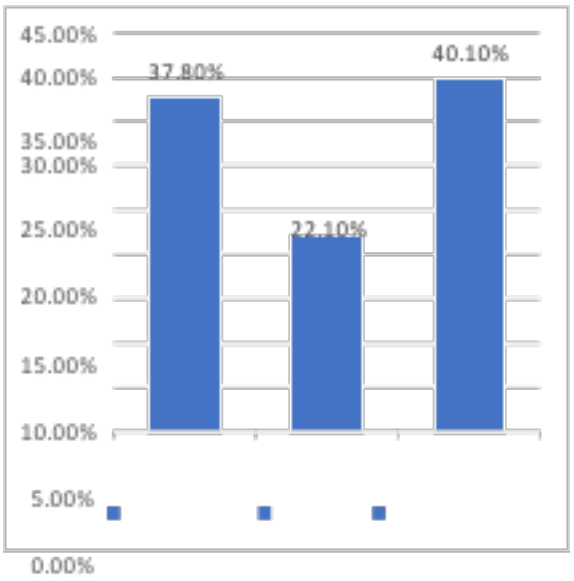


Figure1: Distribution of participants about level of knowledge about nuclear adiation

Table 3: The relation between participants' baseline characters and satisfaction level

		Satisfaction level						
		Dissatisfied		Neutral		Satisfied		P-value
		N	N %	N	N %	N	N %	
Awareness	Inadequate	142	64.3%	43	33.3%	44	18.8%	0.000
	Moderate	70	31.7%	73	56.6%	118	50.4%	*
	Adequate	9	4.1%	13	10.1%	72	30.8%	
Academic level:	Preclinical	70	40.7%	36	20.9%	66	38.4%	0.001
	Clinical	132	35.9%	89	24.2%	147	39.9%	*
	Intern	2	7.4%	4	14.8%	21	77.8%	
University:	King Saud University	72	39.6%	34	18.7%	76	41.8%	0.765
	King Saud Bin Abdulaziz University of Health Sciences	47	35.1%	33	24.6%	54	40.3%	
	Imam Muhammad Bin Saud University	63	34.8%	45	24.9%	73	40.3%	
	Princess Nourah Bint Abdul Rahman University	22	31.4%	17	24.3%	31	44.3%	
	No	89	44.1%	55	27.2%	58	28.7%	
	Yes	115	31.5%	74	20.3%	176	48.2%	
	Radiology course in university	79	29.4%	55	20.4%	135	50.2%	
	Medical websites	19	16.4%	24	20.7%	73	62.9%	
	Research / Studies	14	25.0%	11	19.6%	31	55.4%	
	Social media	42	33.1%	24	18.9%	61	48.0%	
	No	85	44.5%	47	24.6%	59	30.9%	
	Yes	92	26.4%	82	23.5%	175	50.1%	
	No	165	36.4%	107	23.6%	181	40.0%	
	Yes	12	13.8%	22	25.3%	53	60.9%	

students preferred obtaining information about radiation protection from medical websites, 44.7% opted for E-learning and 37.3 % favored radiology courses (Table4).

Table 4: Favorite source of knowledge about radiation protection

Percent %	
Medical websites	70.80%
Research	30.10%
E-learning	44.70%
Radiology course in university	37.30%
Other	3.20%

Discussion

Crucially, radiology has a great role in modern medicine. Unfortunately, most of the diagnostic and interventional radiological procedures involve risk for practitioners in this field. This risk is the exposure to ionizing radiation or nuclear radiation in some types of the procedures3. There is growing concern about the side effects related to nuclear radiation on living organisms as radiation is known to be a

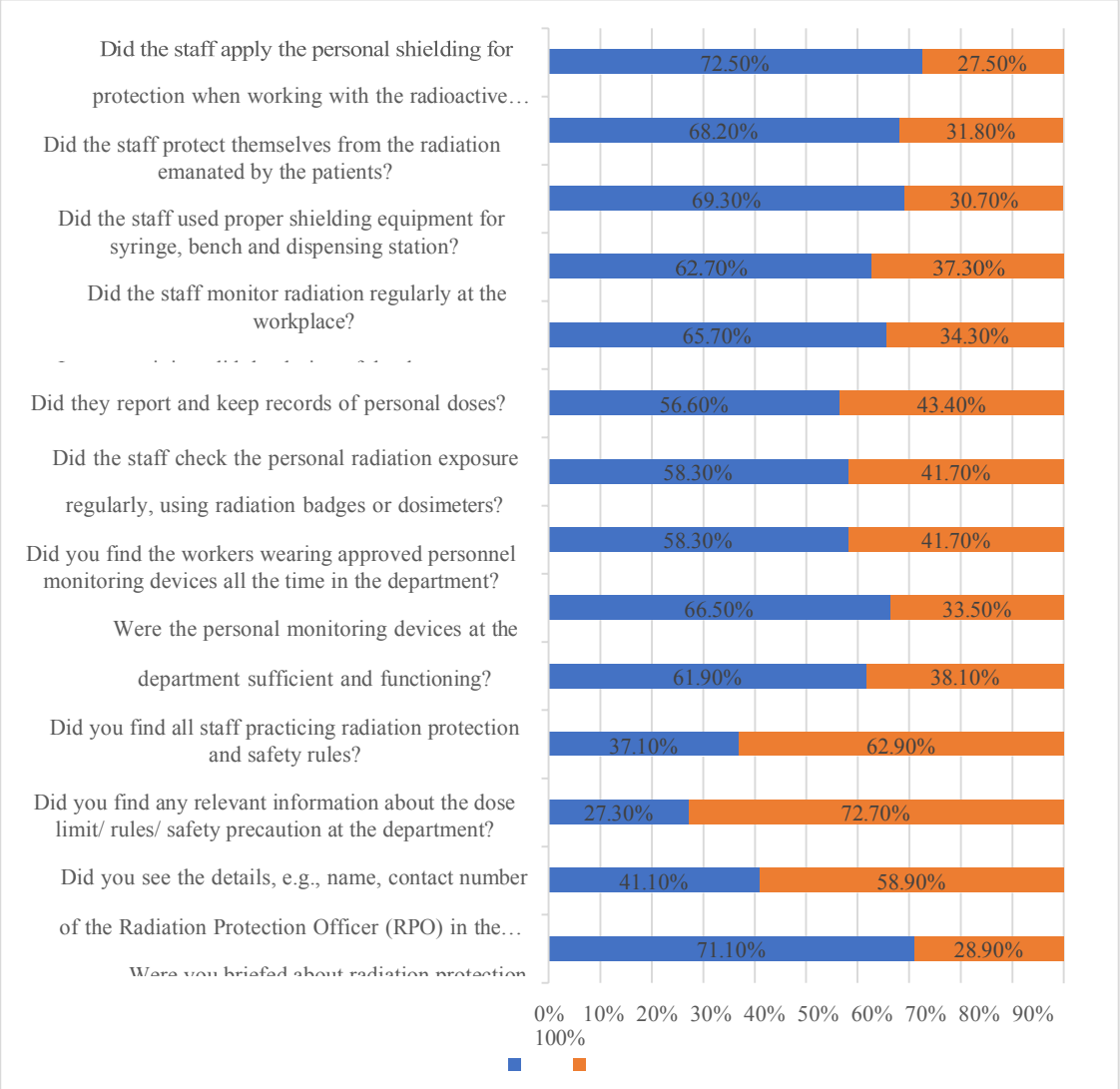


Figure 4: Response of questions related to satisfaction about rules

dose-dependent carcinogenic agent.4,10 Therefore, the use of diagnostic radiology requires good practice which usually needs proper knowledge of doses associated with all types of procedures. Many previously published studies highlighted that healthcare professionals have an inadequate level of knowledge considering nuclear radiation and associated risk with medical imaging examinations,6,11,12 as well as medical students.9 584 students from four universities in Al Riyadh, Saudi Arabia were included in this study, with the hope of evaluating their basic knowledge about radiation protection and share their observations on radiation protection facilities, tools. Likewise, their knowledge of radiation protection compliance and safety rules by the staff involved in dealing with the radioactive materials and patients in nuclear medicine departments was to be examined. This study also highlighted that 64.4% of the students indicated that they had information about nuclear radiation, mostly from radiology courses in the university while 64.6% and 16.1% of them indicated that they had received education on radiation protection and participated in programs or seminars related to radiation protection. This is much lower than the results reported by Sayed, who reported that all his sample had received education on radiation protection while 91.4% had indicated participation in programs or seminars related to radiation protection.3 The study was conducted among intern students which contrasts our study as the latter includes students of different academic levels. In the study of Sultan T. Alturki in Saudi Arabia, the authors found that 70.8% of the participating students indicated that they had taken radiology courses/rotations either as part of the university curricular or as extracurricular activities.13 A study by Suliman Salih showed that only 8% of the students had taken a training module on radiation hazards.13 With that, only 16.1% of the students showed adequate awareness about nuclear radiation. The low percentage of perceived knowledge about nuclear radiations among medical students was also reported by other studies, including that of Suliman Salih who found that 98.95% of the students had low and basic knowledge of radiation protection.2 The same can be said about the studies of Sarah K. Hagi14 and Jennifer O'Sullivan.10 There is a collection of other studies that showed slightly higher percentages of perceived knowledge of students, including a study by Omid Azadbakht15, and that of Surendra Maharjan.9 Results from this current study demonstrated most of the students did not know the types of personal monitoring devices or how to use them, which is in contrast with the results

of Sayed's study. That particular study reported that all students were aware of personal monitoring devices and how to use them.16 Personal monitoring devices ensure that the dose limits are not exceeded and, through regular review, the results of individual monitoring are used to assess the effectiveness of strategies for optimization.17 Therefore, a low percentage of students who demonstrated little awareness of these devices should be alarming and instill a need for more education on radiation protection. Many substances are used in shielding inside nuclear medicine, including lead-depending materials which are the most common ones and some new non- lead compounds.18 In this study, it was discovered that more than half of the sample did not know the materials used for shielding inside the nuclear medicine department.

The risk of exposure to nuclear radiation is a dose-dependent manner, therefore, medical staff importantly need to know the correct dose limits for radiation workers. This study found that 51.5% of students were not aware of the dose limits for radiation workers. This result is similar to those reported by other studies, including the study of Sundaran Kada, who reported that only 45% of the students knew the dose limit for radiation. 10 Despite this, other studies reported better rates of knowledge and the study of Lorenzo Faggioni is an example of that. It found that three-quarters of the students knew the correct dose-limit for radiation9 while in the study of I Sayed, the figure was stated as at 85.7%.3 As observed in this study, the academic level of students significantly affects the level of reported awareness where the student in the internship year has a higher level of awareness. This is harmonious with study of S Alturki, who found that the level of awareness significantly increases with progress in a student's academic life 13. Similar conclusions were made by Suliman Salih,14 O'Sullivan,10, and Lorenzo Faggioni.2-4 Interestingly, students of Imam Mohammed bin Saud University reported the lowest level of awareness which indicated the need for more education courses that could be provided to students at this university. The effect of having previous knowledge, courses, or training on radiation protection on the students' awareness is reported by many studies9 and further strengthened by results from this study. These results are an addition to the literature review, that social media did not provide the students with complete knowledge. Furthermore, 40.1% of the students were satisfied with the measures, rules, and application of radiation protection among workers in their institutions. Considering the data obtained,

there are some limitations in our institutions regarding radiation protection measures and evidence of this is that 72.7% of students did not notice the details of the radiation protection officer in the nuclear medicine department. Additionally, 62.9% did not find any relevant information about dose limits, rules, or safety precautions at the department. 58.9% of them denied having any briefing on radiation protection measures at the nuclear medicine department. The study of I Sayed reported that 22.9% of the students revealed that they did not notice the details of the radiation protection officer in the nuclear medicine department. 100 % would find any relevant information about dose/limit/rules/ safety precaution at the department while 100% of them reported having any brief about radiation protection measures at the nuclear medicine department.9

Factors including a high level of knowledge, advanced academic year, having prior knowledge, and courses or training are associated with higher satisfaction levels among students. However, in this case, there is no difference amongst students at different universities. To find the most suitable method to increase student awareness regarding nuclear radiation protection, the students were asked to state the best method for acquiring the information. Interestingly, most of them preferred obtaining the information about radiation protection from medical websites (70.8%), while 44.7 % opted for E-learning and 37.3 % chose radiology courses.

Conclusion

The study revealed that there is little awareness among medical students about nuclear radiation protection, including knowledge of personal monitoring devices and how to use them as well as dose limits for practitioners. Students of preclinical years and those of Imam Mohammed bin Saud University exhibited the lowest level of awareness.

Conflict of interest

No conflict of interest

Source of funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not for- profit sectors.

Acknowledgment

We would like to acknowledge the research committee at Al Imam Mohammed bin Saud University

References

1. Lumsden MA, Bore M, Millar K, Jack R, Powis D. Assessment of personal qualities in relation to admission to medical school. Medical Education. 2005;39(3):258–65.
2. Rahmatullah TA, Abo Alela KA, Ala-

nazi KA. Medical student's knowledge of ionizing radiation and radiation protection in Riyadh, Saudi Arabia. The Egyptian Journal of Hospital Medicine. 2018;70(2):205–9.

3. Albusair MA, Alturki ST, Aljalajel KM, Alshahrani AS, Albadrani MS, Alhuwaymil AA, et al. Awareness and knowledge of radiation in common radiological investigation and associated risks among medical students in Saudi Arabia: A cross-sectional study. Imam Journal of Applied Sciences. 2020;5(1):16.
4. Soye JA, Paterson A. A survey of awareness of radiation dose among health professionals in Northern Ireland. The British Journal of Radiology. 2008;81(969):725–9.
5. Rane S, Harris JT, Foss EK, Sheffield C. Nuclear and radiological source security culture assessment of radioactive material users at a university. Health Physics. 2018;115(5):637–45.
6. Singh RK, McCoubrie P, Burney K, Ash Miles J. Teaching medical students about radiation protection—what do they need to know? Clinical Radiology. 2008;63(12):1344–9.
7. Scali E, Mayo J, Nicolaou S, Kozoriz M, Chang S. Senior medical students' awareness of radiation risks from common diagnostic imaging examinations. Canadian Medical Education Journal. 2017;8(4).
8. Abuelhia E. Awareness of ionizing radiation exposure among junior doctors and senior medical students in Radiological Investigations. Journal of Radiological Protection. 2016;37(1):59–67.
9. Sayed IS, Muthahharah N. Radiation protection and safety measurements in nuclear medicine departments: Students perspective. International Journal of Mathematics and Physical Sciences Research. 2016; 4:2348-5736.
10. Faggioni L, Paolicchi F, Bastiani L, Guido D, Caramella D. Awareness of radiation protection and dose levels of imaging procedures among medical students, radiography students, and radiology residents at an academic hospital: Results of a comprehensive survey. European Journal of Radiology. 2017; 86:135–42.
11. Zhou GZ, Wong DD, Nguyen LK, Mendelson RM. Student, and intern awareness of ionising radiation exposure from common diagnostic imaging procedures. Journal of Medical Imaging and Radiation Oncology. 2010;54(1):17–23.

12. Dellie ST, Admassie D, Ewnetu Y. An assessment of final-year medical students and interns' awareness of radiation exposure to common diagnostic imaging procedures. Advances in Radiology. 2014;2014. doi:10.1155/2014/426909

13. Salih S, Zeidan Z, Al-zalabani A, Albadrani M, Yousef M. Awareness, and knowledge towards ionizing radiation hazard among medical students, interns, and residents in Al-Madinah Al-Munawarah, KSA. Life Science Journal. 2014;11:6-10.

14. O'Sullivan J, O'Connor OJ, O'Regan K, Clarke B, Burgoyne LN, Ryan MF, et al. An assessment of medical students' awareness of radiation exposures associated with Diagnostic Imaging Investigations. Insights into Imaging. 2010;1(2):86–92.

15. Maharjan S, Parajuli K, Sah S, Poudel U. Knowledge of radiation protection among radiology professionals and students: A Medical College-based study. European Journal of Radiology Open. 2020; 7:100287.

16. Le Heron J, Padovani R, Smith I, Czarwinski R. Radiation protection of medical staff. European Journal of Radiology. 2010;76(1):20–3.

17. Abu AlRoos Nj, Baharul Amin Na, Zainon R. Conventional and new lead-free radiation shielding materials for radiation protection in nuclear medicine: A Review. Radiation Physics and Chemistry. 2019; 165:108439.

18. Kada S. Awareness and knowledge of radiation dose and associated risks among final year medical students in Norway. Insights into Imaging. 2017;8(6):599–605.