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Evaluation of Knowledge, Attitude, and Performance of Radiographers towards Radiation Protection in Southern Khorasan Province, Iran

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ABSTRACT

Introduction: Nowadays, X-ray radiographic imaging plays an essential role in disease diagnosis and treatment. In addition to benefits, X-rays have harmful effects for both patients and radiographers. Observing radiation protection principles reduces radiation exposure and the probability of radiation risk. Therefore, we sought to assess the knowledge, attitude, and performance of radiographers in this regard.

Material and Methods: This descriptive and analytic study was performed in South Khorasan Province in 2017. Data collection was performed by using a questionnaire containing items on knowledge, attitude, and performance. By using the census sampling method, 100 radiographers and senior radiology students were enrolled. To analyze the data, descriptive statistics were used in SPSS, version 20.

Results: The mean scores of knowledge, attitude, and performance were 61.8±13.8, 67.4±21.5, and 50.7±18.4, respectively. Gender had no significant effect on the radiographers' knowledge, attitude, and performance. The level of education was not significantly related to performance, while it had a significant direct association with knowledge and attitudes of the participants.

Conclusion: Considering the knowledge, attitude, and performance scores of the radiographers and their willingness to attend retraining courses, we recommend holding such courses. It seems that these courses could be very effective in improving the knowledge, attitude, and performance of radiographers towards the principles of radiation protection.

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Introduction

Since the discovery of X-ray by Rontgen in 1985, ionizing radiation has become one of the precise and powerful diagnostic tools in medicine [1, 2]. Nowadays, about 30-50% of medical decisions, especially in critical cases, are made on the basis of radiology examinations [3]. One of the key characteristics of ionizing radiation is that the delivered dose to the body is low while the biological effects are serious. X-ray as an ionizing radiation, despite its numerous advantages in the diagnosis and treatment of diseases, can cause serious harms to those exposed to it [4, 5]. In fact, radiation is a double-edged sword that can have many benefits on the one hand and cause irreparable damages (in case of not observing radiation safety principles) on the other [4-6]. Therefore, as the use of ionizing radiation increases in medicine, the accepted attributable risk of ionizing radiation, employment of well-trained radiographers, proper use of X-ray devices, and awareness regarding the radiation protection principles become more critical [7, 8].

According to the International Commission for Radiation Protection (ICRP) recommendations, any decision that changes the radiation exposure status should be more beneficial than the radiation harmful effects. That is to say, the doses to individuals from a particular source should be constrained, and the doses to individuals from planned exposure situations should not exceed the maximum permissible dose limits [8]. These principles can be observed through employing well-trained radiographers with sufficient knowledge about the principles of radiation protection, equipping radiology departments with radioprotective facilities, and encouraging radiographers to use the radioprotective equipment [9-11]. For the purpose of patient dose reduction, some measures such as the use of different shields, lead glasses, lead gloves, lead aprons, appropriate radiation parameters, good beam collimation, standard source to image-receptor distance (SID), and fast screen-film combinations are recommended [12].

All the above-mentioned points indicate the undeniable role of skilled radiographers in applying

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the principles of radiation protection. Because they are responsible for X-ray examination, radiographers should be aware of radiation dose reduction guidelines to minimize the side effects of ionizing radiation [13]. Therefore, we aimed to appraise the knowledge, attitude, and performance of senior radiology students and radiation technologists in South Khorasan Province, Iran, in terms of radiation protection principles.

Materials and Methods

This cross-sectional, descriptive, and analytic study was carried out among all the radiographers working in radiology centers and the senior students of South Khorasan Province in 2017. Based on the census sampling method, all the radiographers and senior students (n=158) were included in the study.

The study protocol was approved by the Ethics Committee of Birjand University of Medical Sciences, and all the participants participated voluntarily in this study and provided a written informed consent. In addition, the participants were assured of confidentiality of the data.

The self-designed questionnaire was validated by three physicists. After making the necessary revisions, 20 radiographers were selected to complete the questionnaire. In doing so, the test-retest reliability of the questionnaire was found to be 0.74 over a 2-week interval. The questionnaire includes items on demographic information, such as age, gender, level of education, and work experience, and 19 items on knowledge, attitude, and performance towards the principles of radiation protection. These principles encompass the following issues: the risks of ionizing radiation, the 10-day rule for women radiography, the units of dose and effective dose of ionizing radiation, the effect of anode heel, cancer risk following X-rays exposure, the radiosensitivity of different cells, the radioresistance of different tissues, gonad shielding, and ionizing radiation protection. The survey questions were designed based on a comprehensive review of the literature. Finally, after data gathering, the data were analyzed by using descriptive statistics and performing ANOVA test in SPSS, version 20.

Results

A total of 100 questionnaires were completed and returned from the total number of 158 questionnaires. In general, 56 cases were female (56%); the age range of the radiographers was 24 to 52 years, work experience ranged from 1 to 28 years, and the age range of the students was 20 to 23 years. In terms of qualifications, 40 of the respondents held a Bachelor's degree, 39 had an associate degree, and 21 were students. All the scores in the tables and the text are out of 100. Table 1 shows the mean scores of knowledge, attitude, and performance of all the participants. The mean knowledge, attitude, and performance scores were 61.8±13.8, 67.4±21.5, and 50.7±18.7, respectively.

Table 1. The mean scores of knowledge, attitude, and performance of the entire participants

Variable	Knowledge	Attitude	performance
Mean	61.9	67.4	50.7
Standard eviation	13.8	21.5	18.4

Tables 2 and 3 present the relationship of gender and level of education with knowledge, attitude, and performance. As can be noted in Table 2, the mean scores of knowledge, attitude, and performance for the male participants were 61.3, 67.7, and 53.9, respectively, and for female respondents they were 62.3, 67.1, and 48.2, respectively. We found no significant relationship between knowledge, attitude, and performance and gender. As regards the level of education, the awareness and attitude of the radiographers increased with higher educational levels. As can be observed in Table 3, there was a significant association between the level of education and awareness and attitude, but educational degree had little impact on the performance of the radiographers.

Table 2. Relationship between workers gender and their knowledge, attitude, and performance

Variable	Knowledge	Attitude	Performance
Male	61.3	67.7	53.9
Female	62.3	67.1	48.2
P-value	P > 0.05	P > 0.05	P > 0.05

Table 3. Relationship between staff's degree of education with knowledge, attitude, and performance

Variable	Knowledge	Attitude	Performance
Student	62.5	66.5	50.6
Associate	58.2	64.6	50.0
Bachelor	65.3	70.6	51.5
P-value	P < 0.05	P < 0.05	P > 0.05

Table 4 shows the correlation coefficient of the work experience of the radiographers with the knowledge, attitude, and performance parameters. There was a significant inverse relationship between work experience and knowledge and performance. There was no significant relationship between the radiographers' attitude and work experience..

Table 4. Correlation of work experience with knowledge, attitude, and performance, all the scores in the table are out of 100

	Variable	Knowledge	Attitude	Performance
Work experience	Correlation coefficient	-0.14	0.05	- 0.05
	P-Value	P < 0.05	P > 0.05	P < 0.05

Discussion

The results of this study showed that knowledge, attitude, and performance of radiographers and senior radiology students in South Khorasan province have different strengths and weaknesses. The mean knowledge score of the participants was 61.9±13.8, which was higher than the scores obtained by Davodiantalab (48.3) [14], Chaparion (46.5) [15], and Alipoor (42.3) [16], while it was lower in comparison

with the scores reported by Slechta (82.5) [17], Abdul Saeed Shah (75.0) [18], and Su (65.8) [19]. Of course, the questions in these studies are not exactly described, then these comparisons is only done based on the average of scores reported in these studies.

In the current study, the mean scores of attitudes and performance were calculated to be 67.4±21.5 and 50.7±18.4 respectively. The mean scores of radiographers' attitude in the studies by Chaparion [15] Davoudiantalab [14], and Alipoor [16] were 78.3, 76.9, and 62.4, respectively, while their obtained scores for knowledge were 45.9, 48.7, and 48.5, respectively. Although the performance score was higher in this study relative to the mentioned studies, it is still not desirable. This finding can be attributed to the lack of facilities, the absence of standard protocols and regulations, limited patient information, and inadequate and ineffective monitoring by the respective authorities.

The results did not reveal a significant relationship between gender and the participants' knowledge, attitude, and performance, which is consistent with the findings of other studies. The relationship of level of education with knowledge and attitude was significant, that is, those with higher levels of education had higher knowledge and better attitudes.

There was a significant inverse relationship between work experience and knowledge and performance of radiographers, such that their knowledge and performance reduced by increasing work experience. This reduction points out the shortcomings in providing in-service training and monitoring the performance of radiographers. After several years, radiographers not only do not acquire any updated information, but also they forget their basic knowledge and only rely on their experience, which consequently, leads to gradual performance deterioration. To resolve these problems, it is necessary to conduct accurate and well-documented tests to measure the awareness of radiology staff and encourage them to promote their performance. One of the important and effective approaches to establishing and updating the principles of radiation protection among radiology staff is to promote standard protocols and new advancements among radiographers in the form of monthly or quarterly brochures.

These findings underscore the need to encourage radiographers to continue their studies and enhance their knowledge. Holding in-service courses and increasing the privileges of staff with higher educational levels and better performance could improve adherence to the principles of radiation protection in radiology departments. In this study, 88% of the participants were willing to attend retraining courses.

Conclusion

The obtained results demonstrated that the participants had optimal knowledge and attitudes towards the principles of radiation protection, but they had moderate performance. Regulatory organizations and bodies should monitor radiographers' performance more effectively and play a more intensive role to establish the principles of radiation protection among the radiographers. Considering the willingness of the target population to attend retraining courses, holding these courses can be very beneficial in boosting radiographers' awareness, attitude, and performance towards the principles of radiation protection.

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