WORLD JOURNAL OF PHARMACEUTICAL RESEARCH
SJIF Impact Factor 7.523
Volume 7, Issue 03, 1406-1421. Research Article ISSN 2277–7105

ASSESSMENT OF KNOWLEDGE AND AWARENESS AMONG SAUDI RADIOLOGY PERSONNEL REGARDING RADIATION PROTECTION AND RADIOLOGICAL EXAMINATION DOSES

Thabat A. Alfraidi*, Abdullah F. Alzayed, Nura N. Alahmadi, Aqelah A. Alsawbadi, Mona K. Alzayer, Zainab A. alsadeq

Saudi Arabia.

Article Received on
19 Dec. 2017,
Revised on 08 Jan. 2018,
Accepted on 29 Jan. 2018
DOI: 10.20959/wjpr20183-10923

***Corresponding Author**
Thabat A. Alfraidi
Saudi Arabia.

ABSTRACT

Objectives: to assess the knowledge and awareness among Saudi radiology personnel regarding radiation protection and radiological examination doses. **Methods**: The study consisted of a questionnaire survey. The questionnaire consisted of three sections, the first section regarding personal characteristics, while the second section included the questions regarding assessing knowledge and awareness towards radiation protection, and potential damage due to radiation exposure, and third section included questions regarding the assessing knowledge and awareness towards radiological examination doses. The study group included a total of 103 radiology personnel of several health facilities in the Kingdom of Saudi Arabia. between December 2017 and January 2018. **Results**: (71.8%) attended the radiation protection course. 84.5 % responders thought that it is necessary to use film-badge for radiographers during practice. 62% thought that X-ray radiation doses used for diagnostic imaging examinations might increase the risk of patients developing cancer in future. Only 27.2% knew that younger children are more susceptible to radiation risk. 80.6% knew that breast is more susceptible to ionizing radiation damage. **Conclusion**: There was a good level of knowledge and awareness about radiation impacts and protection among Saudi radiology personnel. But there was inadequate knowledge and awareness about radiation doses required for various radiological procedures. There is a requisite need for radiographers to improve their knowledge of radiological examination doses.

1. INTRODUCTION

Ionizing Radiation (IR) is a non-invasive procedure, has many medical uses including diseases diagnose, surgical guidance and it helps at evaluate and plan the therapeutic interventions for the treating physicians, using various techniques such as X-ray, Mammography and CT Scan.[1]

But, in addition to its diagnostic and therapeutic benefits, ionizing radiation have many bad side effects.[2] X-rays have the ability to damaging healthy cells and tissues. Where X-rays is interacted with biological tissues via different mechanisms and produces ions, these ions can impact normal biological processes.[3] The radiology pioneers were exposed to high radiation doses, which causing hematological disorders, several dermatitis, cataract or cancer diseases.[4] Inside the hospital the radiologists, the technicians of radiology and nuclear medicine, and others whose participates at x-ray and computed tomography (CT)-scan examinations, are in higher risk of radiation exposure than other general population of hospitals.[5] The doses absorbed by the first radiologists are estimated at 1 Gy/year.[4]

Radiation protection can be described as all activities that's aimed to reducing exposure of radiation among patients and personnel during x-ray exposure. The purpose of radiation protection is protection of individuals, and their generations against the ionizing radiation potential risks.[3]

The as low as reasonably achievable (ALARA) principle, which asserts utilizing procedures and techniques to exposure to maintain exposure to a reasonably low level can be achieved, should be followed to reduce the risk of radiation exposure to medical professionals. shielding options for personnel (e.g.,two-piece wraparound aprons, eye protection, and thyroid shields) should be used to reduce scattered x-ray levels effectively.[6]

During the past decades, ionizing radiation has been used increasingly for the purpose of diagnosing and treating various medical conditions.[2] This increased use of medical radiation can be interpreted to some extent by the inadequate and inaccurate knowledge among radiologists regarding radiation protection topics and radiation doses of usually conducted imaging procedures.[7] So there is a need to provide radiation protection for different radiation equipment in each health facility and to awareness of the appropriate radiological examination doses.

Accordingly, this study aimed to assess the knowledge and awareness among Saudi radiology personnel regarding radiation protection and radiological examination doses.

2. OBJECTIVES

- Assess knowledge and awareness among Saudi radiology personnel regarding impacts of radiation exposure.
- Assess knowledge and awareness among Saudi radiology personnel regarding radiation protection.
- Assess knowledge and awareness among Saudi radiology personnel regarding radiological examination doses.

3. MATERIALS AND METHODS

A questionnaire survey was conducted between December 2017 and January 2018, among 103 radiology personnel of several health facilities in the Kingdom of Saudi Arabia. The survey included the following health facilities; in Madina El Monawara (King Fahad General Hospital, Prince Mohammed bin Abdul, Aziz National Guard Hospital, Meikat Hospital), in Qatif / Eastern Region (Ras Tanoura General Hospital, Safwa General Hospital, Al Qatif Central Hospital, Primary Health Care Center in Shuwaikah - Qatif, Al Burj Medical Hospital in Dammam), in Riyadh (Prince Sultan Medical City, King Abdulaziz Medical City, Prince Sultan Health Center), in Makkah (King Abdulaziz Hospital (Al Zaher), King Faisal Hospital, King Abdullah Medical City, Hira General Hospital) in jeddah (National Guard Hospital). The questionnaire consisted of three sections. The first section regarding personal characteristics which including age, gender, years of professional experience and level of education. While the second section included the questions regarding assessing knowledge and awareness towards radiation protection, and potential damage due to radiation exposure. And third section included questions regarding the assessing knowledge and awareness towards radiological examination doses, using a table to facilitate the answer.

Collected data was coded and analyzed using statistical analysis program (SPSS v.22), in addition to using of necessary statistical methods to achieve the objectives of the study including frequencies, percentages, and graphs.

4. RESULTS

4.1 Population & Sample of the Study

The study population includes all Saudi radiology personnel regarding radiation protection and radiological examination doses,in the health facilities; in Madina El Monawara (King Fahad General Hospital, Prince Mohammed bin Abdul, Aziz National Guard Hospital, Meikat Hospital), in Qatif / Eastern Region (Ras Tanoura General Hospital, Safwa General Hospital, Al Qatif Central Hospital, Primary Health Care Center in Shuwaikah - Qatif, Al Burj Medical Hospital in Dammam), in Riyadh (Prince Sultan Medical City, King Abdulaziz Medical City, Prince Sultan Health Center), in Makkah(King Abdulaziz Hospital (Al Zaher), King Faisal Hospital, King Abdullah Medical City, Hira General Hospital) in jeddah (National Guard Hospital).

A sample of (103) employees of several health facilities in the Kingdom of Saudi Arabia was selected randomly, the next table shows their properties according to their personal data.

Table 1: Distribution of the sample study to the demographic data.

Variable		N	%	P-value
Gender	Male	62	60.2	0.039*
	Female	41	39.8	
Age	20-29 years	55	53.4	0.000*
	30-39 years	42	40.8	
	40-49 years	6	5.8	
Years of professional experience	1-4 years	60	58.3	0.000*
	5-9 years	17	16.5	
	10-14 years	16	15.5	
	15-19 years	7	6.8	
	More than 20 years	3	2.9	
Level of Education	Diploma or less	13	12.6	0.000*
	Bachelor and higher	90	87.4	

Chi-squared test: *Significant at 0.05

It is clear from the previous table that almost 60% of the participants were males, while almost 40% of them were females. And their distribution according to their ages almost 53% of them were between$^{[20-29]}$ years old, almost 41% of them were between$^{[30-39]}$ years old, and almost 6% of them were between$^{[40-49]}$ years old.

And their distribution according to years of professional experience, almost 58% of the them were between$^{[1-4]}$ years, almost 17% of the them were between (5-9) years, almost 16% of the

them were between[10-14] years, almost 7% of the them were between[15-19] years, and almost 58% of the them were More than (20)years.

And their distribution according to level of education, almost 87% of them were Bachelor and higher, while almost 13% of them were diploma or less.

The next figure concludes all the previous results.

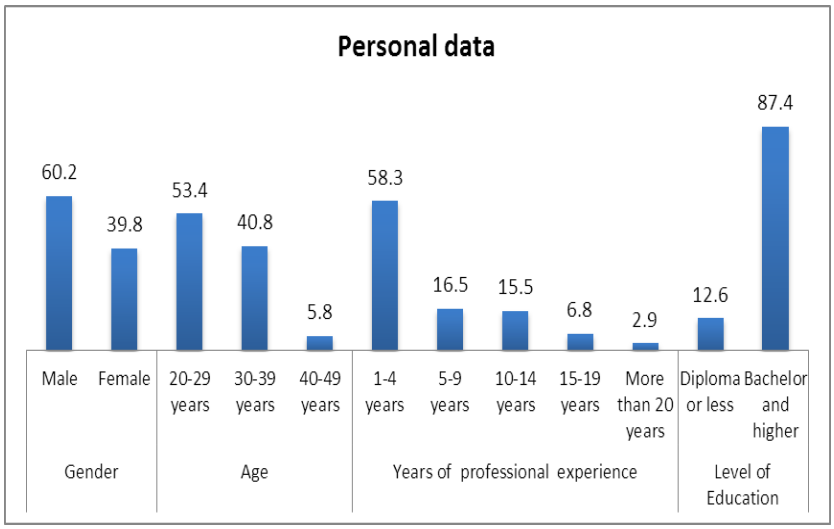

Figure 1: Distribution of the sample study to the demographic data.

4.2 knowledge and awareness towards radiation protection among Saudi radiologists.

The following table shows the knowledge and awareness towards radiation protection among Saudi radiologists.

Table 2: shows the knowledge and awareness towards radiation protection among Saudi radiologists.

		N	%	P-value
Have you ever attended a Radiation Protection course?	Yes	74	71.8	0.000*
	No	29	28.2	
Is it necessary to use film-badge for radiographers during practice radiography?	Yes	87	84.5	0.000*
	No	7	6.8	
	Don't know	9	8.7	
How frequent is your contact with imaging examinations of patients?	none	13	12.6	0.000*
	several	90	87.4	
Do you think that X-ray radiation doses used for diagnostic imaging examinations might increase the risk of patients developing cancer in future?	Yes	64	62.1	0.000*
	No	30	29.1	
	no opinion	9	8.7	
Which of the following professionals are more likely to be exposed to radiation because of their jobs?	nuclear medicine physicians	25	24.3	0.000*
	radiographers	28	27.2	

	interventional cardiologists	44	42.7	
	non-interventional radiologists	2	1.9	
	surgeons	4	3.9	
Identify patient's radiation protection measures you are aware of?	lead aprons	68	66.0	0.000*
	shields	12	11.7	
	distance from the source of radiation	8	7.8	
	time of exposure	5	4.9	
	collimation of the radiation beam	5	4.9	
	none	5	4.9	
Who is at highest risk of ionic radiation among the following patients?	1-years-old-male	28	27.2	0.000*
	20-years-old-female	14	13.6	
	40-year-old female	4	3.9	
	The risk of damage caused by radiation is not influenced by age or sex	57	55.3	
Which of the tissue is more susceptible to ionizing radiation damage?	Breast	83	80.6	0.000*
	Bone	8	7.8	
	Liver	3	2.9	
	Muscle	4	3.9	
	Kidney	5	4.9	
Total		103	100.0	

Chi-squared test: *Significant at 0.05

Note from the previous table that

- The vast majority of Saudi radiologists have already attended the radiation protection course.
- The vast majority of Saudi radiologists consider it necessary to use film-badge for radiographers during practice radiography.
- The vast majority of radiologists repeat contact with imaging examinations of patients.
- The vast majority of radiologists believe that X-ray radiation doses used for diagnostic imaging examinations might increase the risk of patients developing cancer in future.
- Almost 43% of radiologists believe that more people likely to be exposed to radiation because of their jobs is interventional cardiologists, almost 27% of radiologists believe that more people likely to be exposed to radiation because of their jobs is radiographers, and almost 24% of radiologists believe that more people likely to be exposed to radiation because of their jobs is nuclear medicine physicians.

- The vast majority of radiologists believe that lead aprons are the most important patient's radiation protection measures.
- Almost 55% of radiologists believe that the risk of damage caused by radiation is not influenced by age or sex.
- The vast majority of radiologists believe that most tissues susceptible to ionizing radiation damage are breast tissue.

4.3 knowledge and awareness towards radiological examination doses among Saudi radiologists

The following table shows the knowledge and awareness towards radiological examination doses among Saudi radiologists.

Table 3: shows the knowledge and awareness towards radiological examination doses among Saudi radiologists.

Single chest X-ray equivalents		0	10–49	50–99	100–199	200–299	300–499	P-value
Head CT	#	7	33	32	15	8	8	0.000*
	%	6.8	32	31.1	14.6	7.8	7.8	
Thoracic CT	#	6	23	19	24	17	14	0.026*
	%	5.8	22.3	18.4	23.3	16.5	13.6	
Abdominal and pelvic CT	#	7	14	26	13	14	29	0.001*
	%	6.8	13.6	25.2	12.6	13.6	28.2	
Plain abdominal radiography	#	18	50	20	9	5	1	0.000*
	%	17.5	48.5	19.4	8.7	4.9	1	
Extremity angiography	#	13	25	27	9	13	16	0.010*
	%	12.6	24.3	26.2	8.7	12.6	15.5	

Chi-squared test: *Significant at 0.05

Note from the previous table that

- Almost 32% of radiologists believe that the radiological examination dose for Head CT is 10-49, while almost 31% believe the radiological examination dose for Head CT is 50-99 and almost 15% believe the radiological examination dose for Head CT is 100-199.
- Almost 23% of radiologists believe that the radiological examination dose for Thoracic CT is 100-199, while almost 22% believe the radiological examination dose for Thoracic CT is 10-49 and almost 18% believe the radiological examination dose for Thoracic CT is 50-99.

- Almost 28% of radiologists believe that the radiological examination dose for Abdominal and pelvic CT is 300-499, while almost 25% believe the radiological examination dose for Abdominal and pelvic CT is 50-99, almost 14% believe the radiological examination dose for Abdominal and pelvic CT is 10-49, and almost 14% believe the radiological examination dose for Abdominal and pelvic CT is 200-299.
- Almost 49% of radiologists believe that the radiological examination dose for Plain abdominal radiography is 10-49, while almost 19% believe the radiological examination dose for Plain abdominal radiography is 50-99, and almost 18% believe the radiological examination dose for Plain abdominal radiography is (0).
- Almost 26% of radiologists believe that the radiological examination dose for Extremity angiography is 50-99, while almost 24% believe the radiological examination dose for Extremity angiography is 10-49, and almost 16% believe the radiological examination dose for Extremity angiography is 300-499.

5. TESTING HYPOTHESES

5.1 Hypothesis 1

There is no statistically significant relationship at level 0.05 between the level of knowledge and awareness among Saudi radiologists towards radiation protection and: years of experience, level of education.

Table 4: The relationship between the level of knowledge and awareness among Saudi radiologists towards radiation protection and years of experience.

The level of knowledge and awareness among Saudi radiologists towards		years of experience					P-value
		1-4 years	5-9 years	10-14 years	15-19 years	More than 20 years	
Have you ever attended a Radiation Protection course?	Yes	43	10	13	5	3	.509
	No	17	7	3	2	0	
Is it necessary to use film-badge for radiographers during practice radiography?	Yes	48	15	14	7	3	.810
	No	6	0	1	0	0	
	Don't know	6	2	1	0	0	
How frequent is your contact with imaging examinations of patients?	none	9	2	1	1	0	.851
	several	51	15	15	6	3	
Do you think that X-ray radiation doses used for diagnostic imaging examinations might	Yes	39	11	7	5	2	.773
	No	17	4	6	2	1	
	no opinion	4	2	3	0	0	

increase the risk of patients developing cancer in future?							
Which of the following professionals are more likely to be exposed to radiation because of their jobs?	nuclear medicine physicians	15	3	3	2	2	.211
	radiographers	16	7	2	3	0	
	interventional cardiologists	27	7	7	2	1	
	non-interventional radiologists	1	0	1	0	0	
	surgeons	1	0	3	0	0	
Identify patient's radiation protection measures you are aware of?	lead aprons	41	15	9	2	1	.066
	shields	6	2	1	3	0	
	distance from the source of radiation	6	0	1	0	1	
	time of exposure	3	0	2	0	0	
	collimation of the radiation beam	2	0	1	1	1	
	none	2	0	2	1	0	
Who is at highest risk of ionic radiation among the following patients?	1-years-old-male	18	3	6	1	0	.548
	20-years-old-female	9	2	3	0	0	
	40-year-old female	3	0	0	1	0	
	The risk of damage caused by radiation is not influenced by age or sex	30	12	7	5	3	
Which of the tissue is more susceptible to ionizing radiation damage?	Breast	49	13	13	5	3	.812
	Bone	6	1	1	0	0	
	Liver	2	0	1	0	0	
	Muscle	1	2	0	1	0	
	Kidney	2	1	1	1	0	

Chi-squared test.

We conclude from the previous table that there is no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation protection and years of experience.

Table 5: The relationship between the level of knowledge and awareness among Saudi radiologists towards radiation protection and level of education.

The level of knowledge and awareness among Saudi radiologists towards		level of education		P-value
		Diploma or less than	Bachelor and higher	
Have you ever attended a Radiation Protection course?	Yes	9	65	.823
	No	4	25	
Is it necessary to use film-badge for radiographers during practice radiography?	Yes	10	77	.647
	No	1	6	
	Don't know	2	7	
How frequent is your contact with imaging examinations of patients?	none	1	12	.567
	several	12	78	
Do you think that X-ray radiation doses used for diagnostic imaging examinations might increase the risk of patients developing cancer in future?	Yes	7	57	.146
	No	3	27	
	no opinion	3	6	
Which of the following professionals are more likely to be exposed to radiation because of their jobs?	nuclear medicine physicians	6	19	.000*
	radiographers	2	26	
	interventional cardiologists	0	44	
	non-interventional radiologists	1	1	
	surgeons	4	0	
Identify patient's radiation protection measures you are aware of?	lead aprons	7	61	.725
	shields	2	10	
	distance from the source of radiation	2	6	
	time of exposure	0	5	
	collimation of the radiation beam	1	4	
	none	1	4	
Who is at highest risk of ionic radiation among the following patients?	1-years-old-male	3	25	.200
	20-years-old-female	4	10	
	40-year-old female	1	3	
	The risk of damage caused by radiation is not influenced by age or sex	5	52	
Which of the tissue is more susceptible to ionizing radiation damage?	Breast	7	76	.021*
	Bone	3	5	
	Liver	0	3	
	Muscle	2	2	
	Kidney	1	4	

Chi-squared test: *Significant at 0.05

We conclude from the previous table that there is no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation protection and level of education, except that there is a relationship between the level of education and the belief of radiologists in the most professions that are exposed to radiation because of their jobs, and there is a relationship between the level of education and the belief of radiologists in the most exposed tissues to ionizing radiation damage.

5.2 Hypothesis 2

There is no statistically significant relationship at level 0.05 between the level of knowledge and awareness among Saudi radiologists towards radiation doses and: years of experience, level of education.

Table 6: The relationship between the level of knowledge and awareness among Saudi radiologists towards radiation doses and years of experience.

The level of knowledge and awareness among Saudi radiologists towards radiation doses		Years of experience.					P-value
		1-4 years	5-9 years	10-14 years	15-19 years	More than 20 years	
Head CT	0	6	0	1	0	0	.843
	10–49	21	6	3	2	1	
	50–99	12	8	7	3	2	
	100–199	10	1	3	1	0	
	200–299	5	1	1	1	0	
	300–499	6	1	1	0	0	
Thoracic CT	0	5	0	0	1	0	.524
	10–49	11	6	3	1	2	
	50–99	11	4	3	1	0	
	100–199	11	3	6	3	1	
	200–299	11	2	4	0	0	
	300–499	11	2	0	1	0	
Abdominal and pelvic CT	0	4	0	2	1	0	.809
	10–49	11	2	1	0	0	
	50–99	11	5	6	2	2	
	100–199	9	3	0	1	0	
	200–299	7	3	3	1	0	
	300–499	18	4	4	2	1	
Plain abdominal radiography	0	11	1	4	1	1	.417
	10–49	29	11	5	3	2	
	50–99	11	1	5	3	0	
	100–199	7	2	0	0	0	
	200–299	2	1	2	0	0	
	300–499	0	1	0	0	0	
Extremity angiography	0	8	1	3	1	0	.812
	10–49	15	6	2	1	1	

	50–99	13	6	5	2	1	
	100–199	5	2	0	1	1	
	200–299	8	0	4	1	0	
	300–499	11	2	2	1	0	

Chi-squared test

We conclude from the previous table that there is no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation doses and years of experience.

Table 7: The relationship between the level of knowledge and awareness among Saudi radiologists towards radiation doses and level of education.

The level of knowledge and awareness among Saudi radiologists towards radiation doses		level of education		P-value
		Diploma or less than	Bachelor and higher	
Head CT	0	1	6	.706
	10–49	5	28	
	50–99	4	28	
	100–199	1	14	
	200–299	0	8	
	300–499	2	6	
Thoracic CT	0	2	4	.102
	10–49	1	22	
	50–99	4	15	
	100–199	5	19	
	200–299	1	16	
	300–499	0	14	
Abdominal and pelvic CT	0	3	4	.145
	10–49	2	12	
	50–99	3	23	
	100–199	2	11	
	200–299	2	12	
	300–499	1	28	
Plain abdominal radiography	0	4	14	.209
	10–49	3	47	
	50–99	5	15	
	100–199	1	8	
	200–299	0	5	
	300–499	0	1	
Extremity angiography	0	4	9	.272
	10–49	3	22	
	50–99	3	24	
	100–199	1	8	
	200–299	2	11	
	300–499	0	16	

Chi-squared test.

We conclude from the previous table that there is no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation doses and level of education.

6. DISCUSSION

The radiation use has become a fundamental tool at diagnosis and treatment in modern medical practice. But, it had some potential health risks. So, the implementation of radiation protection for radiographer is inevitable. In this cross-sectional study the knowledge and awareness was assessed among Saudi radiology personnel regarding radiation protection and radiological examination doses. A total of 103 radiology personnel responded to this study, from them there were (60.2%) male and (39.8%) female. Their ages ranged between 20 year and 49 years. (12.6%) their level of education was a diploma or less, while (87.4%) their level of education was bachelor and higher.

Our responders showed good knowledge and awareness about ionizing radiation hazards and radiation protection measures. This good knowledge in the two studies is expected because their specialist background. Also, a study conducted by Elnari et al. in Indonesia found that the level of knowledge and awareness are adequate among healthcare professionals who deal with ionizing radiation in CT scan units.[2] While another study conducted in KSA among radiographers found that only (41.3%) Have good knowledge regarding radiation protection. This could be justified by most of study sample were from Diplomas holders.[7] also, Hagi et al. found knowledge deficiency among medical student's in their study in KSA.[8] The difference in the results is due to the difference in the target group in this study, which included medical students and not the radiologist.

The present study demonstrated that there was no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation protection and radiation effects and years of experience. While, Mojiri et al. found a statistically significant relationship between awareness of radiation effects and work experiences.[9] Also, Paolicchi et al. found significant difference in knowledge depending on the level of experience, young radiographers showed a slight increase in score when compared with older radiographers.[10]

This difference at results between our study and the other studies could be because the majority of responders at our study attended the radiation protection course.

According to our results the majority of our responders (71.8%) attended the radiation protection course. This is reassuring and explains the knowledge and good awareness of the Saudi radiology personnel in our study. While, Mojiri et al., found that (43.7%) have participated in a radiation protection course.[9] Alos, Paolicchi et al. found that only (12.1 %) attended the radiation protection course on a regular basis.[10]

In the present study the most of responders thought that it is necessary to use film-badge for radiographers during practice. Film-badge is used in order to detect the occupational absorb dose.

Majority of our responders thought that X-ray radiation doses used for diagnostic imaging examinations might increase the risk of patients developing cancer in future. A study conducted in 13 countries to estimate the risk of cancer results from diagnosis using X-rays found that, in UK 0.6% of the cancer cumulative risk to age 75 years resulted from diagnostic X-rays. This proportion is equivalent to about 700 cases of cancer annually. while in Japan, cancer cumulative risk due to diagnostic X-rays was the highest, it was estimated more than 3% annually.[11] But the benefits of medical imaging will outweigh the relatively little excess cancer risk, and management of patients should not be changed on the basis of radiation risk.[12]

Studies found significant dose-response correlated with breast cancer.[13] The most of our responders thought that breast is more susceptible to ionizing radiation damage.

Persons exposed early in life have especially high relative risks for many cancers, and radiation-related risk of solid cancers appears to persist throughout life.[14] Because, the children's tissues are more radiosensitive and they have longer lifespans.[1] At the current study more than half of the responders thought that risk of damage caused by ionic radiation is not influenced by age or sex. This finding like Paolicchi et al. at their study in Italy.[10]

The use of x-ray in diagnostic radiology requires good practice, as well as proper knowledge of dose associated with all types of procedures. The inaccurate knowledge increase some doubts regarding radiographers' skills. As radiographers' skills are basic in the daily radiological examinations. radiographer with poor knowledge can put the patient at a higher risk through not optimizing all radiation-related imaging parameters especially the radiation

dose. Whereas doubling the dose of radiation doubles the probability of causing cancer or genetic impact occur.[7]

According to Health Protection Agency, if radiation dose estimates were within 20% (above or below) of the actual dose it defined as correct.[7] The results of the current study revealed a lack of estimation of doses required for various radiological procedures. This lack of knowledge is never acceptable because it would expose patients to harm. Even if this harm is small it may double with a double procedure.

According to the results of the current study, there was no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation doses and years of experience or level of education. This indicates the seriousness of the situation because the highing in level of education and the extending in years of experience did not improve the knowledge of appropriate doses of radiation in different procedures. This reveals a deficiency in the system itself and the need to avoid default on this issue.

7. CONCLUSION

This study showed a good level of knowledge and awareness about radiation impacts and protection among Saudi radiology personnel. There was no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation protection and radiation effects and years of experience. But there was inadequate knowledge and awareness about radiation doses required for various radiological procedures. There was no relationship between the level of knowledge and awareness among Saudi radiologists towards radiation doses and years of experience or level of education. Increased attention must be paid to thorough and systematic education of all radiology personnel with regard to radiation doses required for various radiological procedures.

ACKNOWLEDGMENTS

Dr. Emran Hisham Alsawaf for his role in helping at data collection.

REFERENCES

1. Almatared, Mana Goblan, et al. "Knowledge and Attitude towards Ionizing Radiation among Patients Attending the King Khalid Hospital Najran, Saudi Arabia." *Journal of Biosciences and Medicines*, 2017; 5.10: 75.

2. Elnari, Meftah Ali, J. A. Noor, and Yuyun Yueniwati. "Assessment the Awareness and Knowledge Level about Radiation Protection: An Empirical Study on the Radiology Professionals of the Radiology Departments, East Java Indonesia." *Assessment*, 2016; 5.9: 34-40.
3. Elamin, A. M. "Radiation Safety Awareness and Practice in Sudanese Medical Facilities: A Descriptive." *International Journal of Science and Research*, 2015; 4.5: 2190-95.
4. Szarmach, Arkadiusz, et al. "Radiation safety awareness among medical staff." *Polish journal of radiology*, 2015; 80: 57.
5. Salama, Khaled Fikry, et al. "Assessment of occupational radiation exposure among medical staff in health-care facilities in the Eastern Province, Kingdom of Saudi Arabia." *Indian journal of occupational and environmental medicine*, 2016; 20.1: 21.
6. Sisson, The American Thyroid Association Taskforce on Radioiodine Safety; James C., et al. "Radiation safety in the treatment of patients with thyroid diseases by radioiodine 131I: practice recommendations of the American Thyroid Association." *Thyroid*, 2011; 21.4: 335-346.
7. Ahmed, Rania Mohammed, et al. "Knowledge and performance of radiographers towards radiation protection, Taif, Saudi Arabia." *IOSR Journal of Dental and Medical Sciences (IOSR-JDMS)*, 2015; 14.3: 63-68.
8. Hagi, Sarah, and Mawya Khafaji. "Medical student's knowledge of ionizing radiation and radiation protection." *The Saudi Medical Journal*, 2011; 32.5.
9. Mojiri, Maryam, and Abbas Moghimbeigi. "Awareness and attitude of radiographers towards radiation protection." *Journal of Paramedical Sciences*, 2011; 2.4.
10. Paolicchi, F., et al. "Assessment of radiation protection awareness and knowledge about radiological examination doses among Italian radiographers." *Insights into imaging*, 2016; 7.2: 233-242.
11. de Gonzalez, Amy Berrington, and Sarah Darby. "Risk of cancer from diagnostic X-rays: estimates for the UK and 14 other countries." *The lancet*, 2004; 363.9406: 345-351.
12. Lin, Eugene C. "Radiation risk from medical imaging." *Mayo Clinic Proceedings*, 2010; 85(12): Elsevier.
13. Linet, Martha S., et al. "Cancer risks associated with external radiation from diagnostic imaging procedures." *CA: a cancer journal for clinicians*, 2012; 62.2: 75-100.
14. Gilbert, Ethel S. "Ionising radiation and cancer risks: what have we learned from epidemiology?." *International journal of radiation biology*, 2009; 85.6: 467-482.