Journal of Scientific Research & Reports

27(3): 84-92, 2021; Article no.JSRR.68223
ISSN: 2320-0227

Patient Awareness and Knowledge Level for Radiation in Different Radiology Modalities in Hospitals

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Author's contribution

The sole author designed, analyzed, interpreted and prepared the manuscript.

Article Information

DOI: 10.9734/JSRR/2021/v27i330371
Editor(s):
(1) Dr. Shunpu Zhang, University of Nebraska – Lincoln, USA.
Reviewers:
(1) Ouerdane Abdallah, Djilali Bounaama University, Algeria.
(2) Mostafa Aly Elnaggar, Medical Research Institute, Alexandria University, Egypt.
(3) Öznur Şenkesen, Acibadem University, Turkey.
Complete Peer review History: http://www.sdiarticle4.com/review-history/68223

Original Research Article

Received 09 March 2021
Accepted 18 May 2021
Published 21 May 2021

ABSTRACT

Aims: Understanding the knowledge gaps among the public regarding radiation protection of each modality has helped to assess the community awareness and perception, which reflects our urgent need for more education for the public. This project aims to evaluate the knowledge levels of patients undergoing medical imaging procedures is regarding the risk and benefits by providing sufficient information regarding their specific medical imaging technique upon examination.
Study Design: A prospective study with a special questionnaire to collect data.
Place and Duration of Study: Subjects: Different departments of Radiology in different hospitals, Jeddah, Saudi Arabia, for 3 months.
Methodology: The survey was conducted in Jeddah, Saudi Arabia, to include four major hospitals. The sample of the study included 500 patients (125 for each hospital). Patients are aged 18 years and over were referred by physicians for a radiological examination, including different radiologic modalities.
Results: It was found that 52% of patients were provided the information about radiology examination. The mean scores of questions ranged from 69% to 76%. So, there was a strong positive correlation between the radiology examination information received by patients and the radiation questions' score.

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Conclusion: The majority of patients who visited the radiology departments in Jeddah's hospitals did not receive sufficient information about radiation awareness when starting the radiology examination, which in turn reflects their level of general knowledge of radiation risks.

Keywords: Awareness; diagnostic imaging; radiology; radiation protection.

1. INTRODUCTION

Ionizing radiation can cause damage, and a systematic approach to ensure there is a compromise between exploiting the advantages should be used medical applications of it and minimizing the possible risk of patients, staff, and local members from radiation effects [1].

In several departments, radiation safety remains a priority for patients, surgeons, and workers. The largest dosage for medical workers is caused by radiation released during fluoroscopic procedures.

Any exposure to radiation poses a possible danger to both patients and healthcare staff. Radiation from computed tomography (CT), mammography, and nuclear medicine remains a minor contributor to healthcare personnel's combined dose sensitivity.

The use of radiation has become an inescapable instrument for the detection and treatment of several medical disorders. To mitigate the adverse effects of ionizing radiation, radiation safety attempts to prevent unwanted exposure in the medical field. There are three fundamental principles of radiation protection: optimization, justification, and dose limitation [2].

Experienced radiologic technologists subscribe liberally to an ethical code of social ethics that includes responsibility for carefully controlling and limiting radiation exposure to all patients under their care.

This is a significant responsibility, and each of the following seven ways of reducing client's exposure must be understood and consistently put into practice by minimum repeats radiographs, correct filtration, accurate collimation, specific area shielding (gonadal and breast shielding), protection for pregnancies, use of high-speed film-screen combinations (not applicable for digital imaging) and minimal patient exposure [3].

Computed tomography is the main important medical modality that contributes more exposure to patients in diagnostic radiology fields. So, a special concern must exist for radiation protection in this modality.

Comparing CT scans to all radiological medical examinations, it was found that CT scans account for 6% of all diagnostic X-ray examinations while they account for 41% of the total population dose [4].

On the other hand, in the United Kingdom, CT was reported to contribute to 47% of the collective dose from diagnostic radiology but representing uniquely 9% of all X-ray examinations [5,6].

Computed tomography investigations are increasing worldwide, and examinations using this type of imaging are becoming more countless [5,7].

These high overdoses should be kept to a minimum using careful assessments of global protocols, exposure standards, and a careful selection of screening techniques needed [8,9].

In nuclear medicine, radiation safety includes properly monitoring both the natural and possible exposure of responsible staff in any specific cases including the effective use of uncovered sources of active radiation.

The principles of the protection of workers from ionizing radiation in all areas of medicine include the use of dose limits for them and the public “As Low as Reasonably Achievable” (ALARA) [10].

Long-term adverse biological effects associated with prolonged exposure to the magnetic fields used in magnetic resonance imaging (MRI) have not been known to the modern date. Most of the study on MRI safety has been done in the USA, where much of the safety literature typically originates [11].

A survey was administered to emergency department patients coming for a CT scan. A 95% believed that the scan’s risks and benefits should be explained by the doctors before the test. About 77.3% of them thought that a consent

form should be signed, a bit under half the patients recognizes there is more excess radiation dose from a computed tomographic scan than a single chest X-ray scan. A 48.7% preferred an ultrasound scan first even if it will be followed by a CT scan, while 47.2% preferred a CT scan right away. It was also found that 41.3% of patients prefer to have a head scan because of an injury using a CT scan even if their doctor does not think it is necessary, and data indicates that patients have a limited understanding of CT scans [12].

Generally, all studies have demonstrated there was a shortage of information being provided to the patient regarding radiation awareness that highlighted a lack in communication between the health care providers and the patients. In conclusion, there is a need for more effective communication with the patients about their radiation exposure, and more studies focused on nuclear medicine patients [13].

Patient's education and information regarding awareness of radiation should be improved to avoid any unnecessary exposure to ionizing radiation [14].

A review study showed academic intervention was indeed effective in increasing the knowledge levels of the participants, but there is a need to identify if it translates into an impact on their clinical practice/behavior [15].

The awareness and knowledge of patients regarding ionizing radiation are considered an important factor to minimize the need for diagnostic imaging and its effects [16].

It was recommended that all patients' exposures must be justified and kept as low as possible. Doses should also be limited [17].

Organizations should step up their efforts to provide patients with more accurate information. Doctors must also be careful in choosing medical examinations and thus explain their importance to the patient [18].

There must be a close correlation between awareness and knowledge of the effects of X-ray imaging for patients. This would greatly help to have a more effective discussion between the patient and his doctor, and then to have the active participation of the patient in making an effective clinical decision [19].

A study was conducted to measure radiological awareness among clinicians about the diagnostic risks to individuals' health. About 73% of them acknowledge the existence of multiple gaps in public awareness [20].

A computed tomography study was carefully conducted among radiologic technologists and radiation therapists in Cyprus. Some regions of radiation safety are rarely properly-recognized compared to other areas [21].

There were no differences between the organizations or levels of work experience concerning the outcomes. Some radiographers expected patients to ask questions before telling them, according to the open question. Lack of time has seldom been cited as a factor [22].

Investigators proved that there is a shortage in the awareness and implementation of secure pediatric related to radiation dose guidelines. A minor number of respondents 57% shared a positive opinion regarding their knowledge of pediatric dose protocols for radiation [23].

There is a lack of understanding among patients regarding radiation exposure that has to do with spine imaging techniques. Most patients have a belief that an MRI scan can expose them to some radiation [24].

Consequently, there is a need to increase knowledge of radiation dose and the risks involved, as well as communication between radiologists working in clinical practice. This may cause radiographers to be confident and typically able to provide adequate information [25].

It appeared prominently that the successful use of electronic platforms may be powerfully conveyed the extensive knowledge more effectively to the concerned patients [26].

Our study aims to evaluate the knowledge levels of patients undergoing medical imaging procedures regarding the risk and benefits. Then, identifying the knowledge gaps and give ideas to possibly enhance the situation better by providing sufficient information regarding their specific medical imaging technique upon examination.

2. MATERIAL AND METHODS

The survey was conducted in Jeddah, Saudi Arabia, to include four major hospitals (two general government hospitals "H1 and H2", private hospital "H3" and university hospital "H4"). The sample of the study included 500 patients (125 for each hospital).

Table 1. Questionnaire Questions (Yes or No questions)

1. Have you known that radiation divided into two types: ionizing and non-ionizing radiation?
2. Is ionizing radiation used in an MRI scan?
3. Is ionizing radiation used in CT?
4. Is ionizing radiation used in ultrasound (US)?
5. Is ionizing radiation used in fluoroscopy?
6. Actually, is medical radiation the only primary source of radiation and its risks?
7. As far as you know, can radiation cause cancer?

A questionnaire consisted of two parts; demographic information part to determine gender, years of work experience, type of job, and the possibility of receiving radiological information when starting the examination and diagnosis from the diagnostic technologists. A second section was on radiological awareness consisting of seven questions related to imaging methods used in different modalities, as shown in Table 1.

The question of whether the patient receives information about the required examination is also an important factor, which in turn affects the patient's knowledge and awareness. Of course, it is to be expected that patients receiving this information will have a better understanding and awareness of the benefits and risks of diagnostic imaging.

The radiation awareness section, which consisted of seven questions, examined the knowledge of the different types of radiation and their relationship with cancer, which reflects the main confirm sides of awareness for radiation protection.

The numerical variables such as age were tested using one-way analysis of variance while the categorical variables such as gender were tested using Chi-square statistic.

To evaluate questions related to the section of radiation awareness for each participant in this study, evaluations were scored out of 7, where 0 equal incorrect answers and 1 equal correct answer.

Hospital scores were compared. Spearman's test was used to measure the level of correlation between radiation-related information provided by each hospital separately with demographic information. SPSS 10 was used to analyze numerical data to calculate the average, standard error, and standard deviation.

3. RESULTS AND DISCUSSION

It is represented in Table 2 the gender of patients who activated with the questionnaire. The ratio of males was more than females for two hospitals 1.23 and 1.02 for H1 and H4 respectively while the ratio of females' respondents was higher than in males for H3 (1.5) and H2 (1.12). The P-value was ($P > 0.05$) that indicates the significant difference among hospitals was not existing.

The job categories of participants were classified as medical and non-medical jobs as tabulated in Table 2. The ratio of medical jobs was less than the non-medical one in all the hospitals: H1 (0.62), H2 (0.32), H3 (0.58), and H4 (0.09). The ($P < 0.05$) indicates the significant difference among hospitals was existing.

As shown in Table 2, the lowest experience was found in H1 while the highest experience was found in H2. It was found that the $P > 0.05$ so the significant difference among hospitals was not existing.

Table 2. The patients' demographic information in the four selected hospitals

Variables		Hospitals				*P*-Value
		H1	H2	H3	H4	
Gender	**Male**	69	59	50	63	0.11
	Female	56	66	75	62	
Job	**Medical**	48	30	46	11	< 0.05
	Other	77	95	79	114	
Work Experience (years)		6.61* ± 6.09•	8.70* ± 8.46•	7.19* ± 7.44•	7.64* ± 6.42•	0.45

** Average. • Standard deviation*

Table 3 shows the number of patient participants who were provided with educational information about radiation at the time of the tests. The highest proportion of participants who had received the information at the time or before the procedures were in H4 while the lowest was in H1. It was also noted that H2 received the highest score for the seven questions while the lowest score was for H1. Since p <0.01, it was found that a significant difference among hospitals was existing.

In each hospital, the frequency of the correct responses through 125 and the total responses that are correct in answers for the four hospitals through 500 are represented in Table 4.

A strong correlation was found between the patients receiving radiation awareness and examination information and their radiation questions' score (Fig. 1).

Fig. 2 shows the correlation between participants' radiation questions' score and experience were not existing. Similarly, in Fig. 3 there was no correlation between medical jobs and their radiation questions' score.

Table 3. Radiation awareness and examination information scores for patients in the four selected hospitals

Variable		Hospital				*P*-Value
		H1	H2	H3	H4	
Provided Information	**Yes**	54	77	69	60	0.02
	No	71	48	56	65	
Radiation awareness score		3.86* ± 0.25•	4.24* ± 0.09•	4.12* ± 0.23•	3.90* ± 0.18•	< 0.01

** Average. • Standard error.*

Table 4. Illustrate the list of right answers for questions in different hospitals

Questions No.	H1	H2	H3	H4	Total
1	42	61	45	61	209
2	65	72	95	56	288
3	96	81	64	82	323
4	95	84	96	87	362
5	55	73	42	41	211
6	38	70	82	72	262
7	91	89	91	89	360

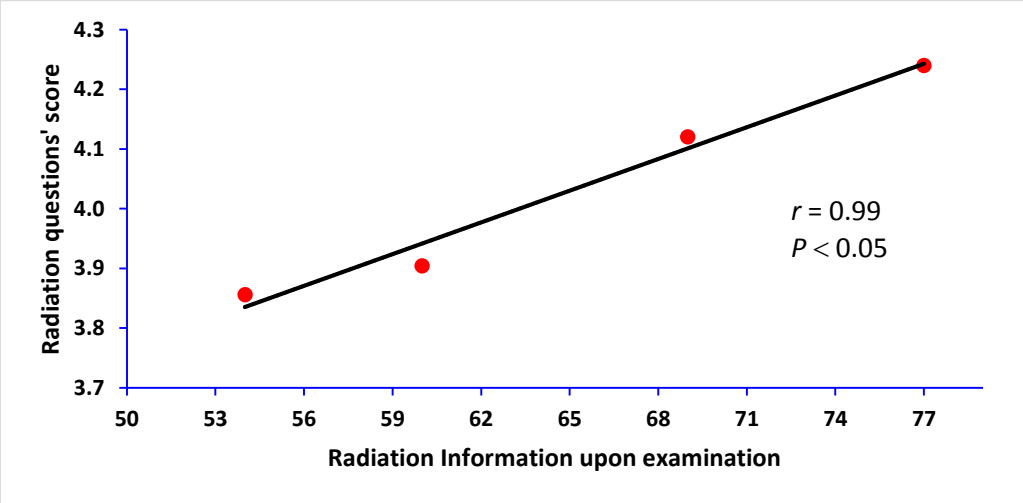

Fig. 1. Correlation between the average radiation questions' score and the information of radiation at the examination

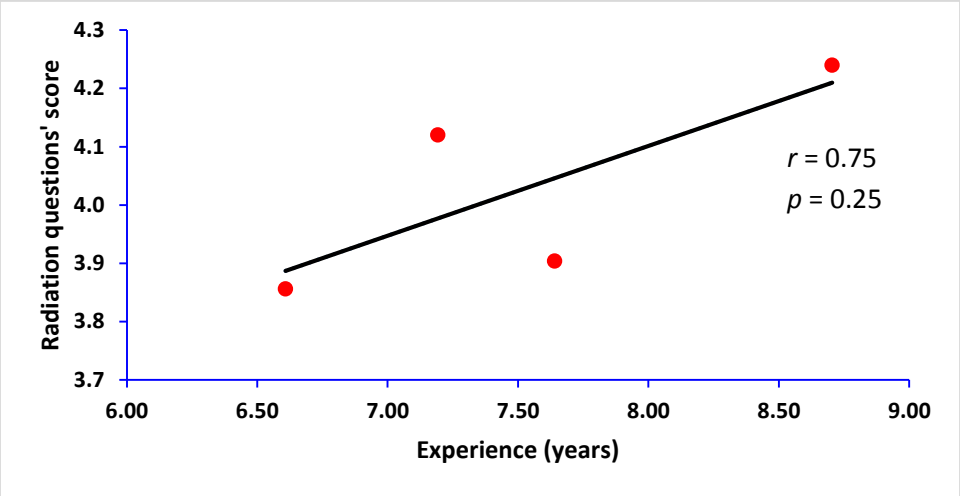

Fig. 2. Correlation between the average radiation questions' score and the experience

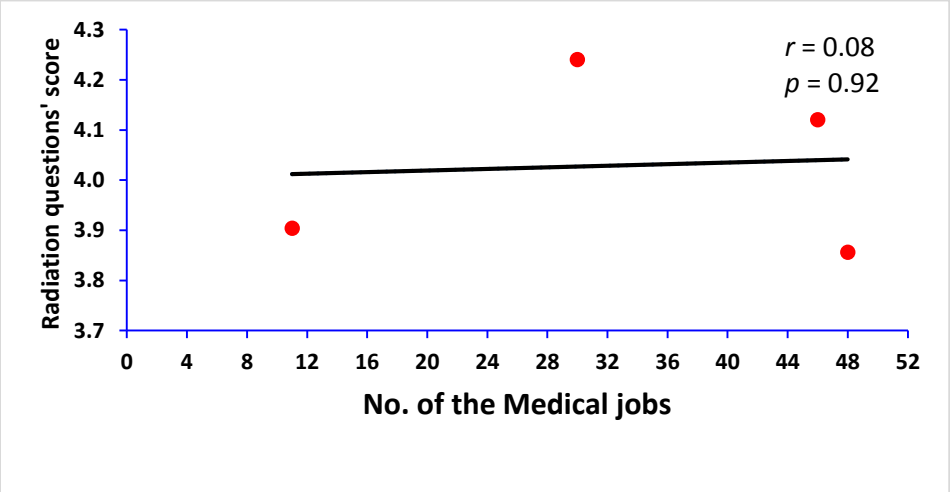

Fig. 3. Correlation between the average radiation questions' score and the No. of medical jobs

Most of the imaging methods used in radiology departments were identified in the questionnaire questions in this study. The questions were designed to fit the objectives of the current study and to measure the mechanism by which patients distinguish between different types and the nature of radiation.

A 52% of patients were provided the information about radiology examination, i.e., about half of the participants had a lack in knowledge of the possible related-radiation risks by exposed them to such hazardous radiology examinations.

The mean scores of questions ranged from 69% to 76%. So, there was a strong positive correlation between the radiology examination information received by patients and the radiation questions' score. It noted that the existence of the medically employed participants in the medical field affected the variation in the scores and the significant correlations for these variables were not existing.

Results showed there was a significant positive correlation between years of experience and the main score, but no significant correlation with the participant's job as cleared in Figs. 1, 2, and 3.

Patient awareness and education must be amended to minimize unwanted radiation exposure from imaging diagnoses. To achieve this objective the hospitals can apply medical imaging history cards that would be one of the methods that could contribute to increasing the patient's awareness and minimizing the related radiation risks [27].

It is suggested and recommended to provide the public, technologists, and physicians more information about radiation doses and their risks and then spread in the radiology departments and waiting rooms to growing the level of awareness [28].

Most of the literature that has been carried out on the level of general radiological awareness has been aimed at radiologists or pediatricians, and at the same time, sources of information from patients have been very scarce. All these studies were often limited to specific areas, such as computed tomography.

Our results are considered at the forefront of the results that indicate and report the radiation awareness level for patients in the various hospitals in Jeddah in particular and in the hospitals of the Kingdom of Saudi Arabia in general. This study is considered a starting stage for future explanations and studies related to the level of radiation awareness.

4. CONCLUSION

The present study demonstrated that the majority of patients who visited the radiology departments in Jeddah's hospitals did not receive sufficient information about radiation awareness when starting the radiology examination, which in turn reflects their level of general knowledge of radiation risks.

It was inferred that there is a strong relationship between receiving radiological information and the degree of radiation knowledge.

It is recommended, in future studies, to include more private and university hospitals and use similar considerations and criteria for more evaluations to the level of general radiological awareness, and at the same time compare those results with the results obtained in this study from public hospitals.

CONSENT AND ETHICAL APPROVAL

As per international standard or university standard written ethical approval has been collected and preserved by the author(s).

The survey is designed to include two main sections: an approval form that shows the project's objectives and consents to participate in the study, while the second section contains a multiple-choice questionnaire.

COMPETING INTERESTS

Author has declared that no competing interests exist.

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DOI: 10.1148/radiol.2312030767

Peer-review history:
The peer review history for this paper can be accessed here:
http://www.sdiarticle4.com/review-history/68223