Knowledge, Attitude, and Perceived Barriers among healthcare workers regarding the usages of Thermo-Luminescent Dosimeter Badge: A Cross-Sectional Survey

Abstract

Objective: Healthcare personnel are thought to be at significant risk of suffering the negative effects of ionizing radiation due to their high exposure. The main goal of this survey was assessing knowledge, attitude, and barriers in regard to using Thermo-luminescent dosimeter device among healthcare personnel for estimating radiation exposure dose**Methodology:** A structured questionnaire survey was utilized for conducting a cross-sectional study with. **Results:** A total of 93 participants were included in the current survey, the majority of them are technicians (46.2%), while 40.9% are radiology physicians and nurses constitute 4.6% of the sample. Across the entire spectrum, the low level of attitude toward adhering to radiation safety and protocols was noticed to be among nurses, followed by physicians, while good level of attitude towards using TLD badge was observed among technicians. On the other hand, the high level of knowledge towards radiation safety and usage of TDL badge was reported among physicians, followed by technicians and the low level of knowledge was among nurses. **Conclusion and Recommendation:** The current survey revealed a gap that the majority of radiology department's personnel had a low attitude regarding radiation safety and usages of TLD badge , although the majority of them were found to have excellent knowledge about it which crucially requires taking actions, in terms of enforcing protective strategies and clear protocols along with education strategies.

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Keywords: *Knowledge, Attitude, Healthcare workers, Radiation hazards, Thermo-luminescent dosimeter*

Introduction

In the health field, ionizing radiation has become an unavoidable instrument for diagnosing and treating a wide range of medical disorders. Consequently, radiation safety is a concern for, physicians, and other healthcare staff . Therefore, a basic understanding of the science underlying radiation's harmful effects is critical for evaluating the various solutions and strategies for protecting healthcare workers (HCWs)[1,2].

X-rays are composed of high-energy photons within the electromagnetic spectrum. It was reported that radiation from diagnostic imaging modalities, such as computed tomography, mammography, and nuclear imaging, are contribute to the cumulative dose exposures of HCWs[3]. Radiation exposure can cause biological consequences that are either dose-dependent or probability-dependent[4]. Numerous studies indicate that medical radiation may raise the incidence of cataracts, cancer, and possibly hereditary illnesses[5,6,7].

Physical radiation shielding can be accomplished with different forms of personal protective equipment (PPE)[8]. Radiation protection tries to limit needless radiation exposure while minimizing the adverse consequences of ionizing radiation[9]. Formal radiation protection training may help in reducing radiation over-exposure to HCWs. However, enforcing radiation safety guidelines can be an arduous process, and many interventionists do not receive formal training in either residency or fellowship on radiation dose reduction. In particular, clinicians or medical staff that use fluoroscopic imaging outside of dedicated radiology or interventional departments have low adherence to radiation safety guidelines[10,11].

Radiation monitoring and keeping their record is an integral part of radiology practice world-wide. For knowing whether HCWs are working within the safe prescribed dose limits, it is crucial to use a dose measuring devices[12].

Wide variety of detector devices and materials with different physical forms allow the determination of different radiation qualities at dose levels. There are three basic types of personal monitors namely film badges, Thermo-luminescent dosimeter Badge (TLD), and pocket ionization chambers. TLD is considered to be the most commonly used solid-state radiation detector for healthcare personnel monitoring. TLD badges or rings are passive radiation detection devices that used for personal dose monitoring and quantifying the absorbed radiation dose that a health care worker acquires while performing diagnostic or therapeutic procedures that require radiation use[13].

TLDs have number of advantages that make them easy to use and reproduce in clinical and research settings, including their small size, reusability, and the need for few correction factors among others[14].

Numerous studies concluded that, the awareness about radiation safety and radiation dose received from the particular medical imaging investigation is not satisfactory[14,15].

Therefore, this article aimed at assessing knowledge, attitude, and perceived barriers among HCWs regarding the usages of TLD badge.

Methodology

Study design, area, and duration

An institutional-based cross-sectional study design was performed from January to May 2024. A convenient sampling technique (CST) was utilized for this study that was conducted at Najran hospitals. 110 healthcare professionals in radiology departments were contacted and requested to join this survey from 3 different hospitals to participate in the current study.

Comment [2D]: Where are these hospitals? How many are they?

Inclusion criteria

Healthcare workers who are currently working with patients in radiological departments and had frequently involved in radiation zones (physicians, technicians, and nurses).

Exclusion criteria

Other healthcare workers who had not frequently involved in dealing with patients in radiation zones (administrators, pharmacists, laboratory professionals …..ect) were excluded.

Sample size, sampling procedure, and technique

The actual sample size for the study was calculated using the single population proportion formula $\{n = [(z\alpha/2)^2\, p(1-p)]/d^2\}$, n = sample size, $z\alpha/2$ = 95% confidence level, p = the proportion of knowledge of healthcare workers towards TLD badge which is unknown but assumed to be (50%) was used. d = margin of error (0.05). A total of 110 individuals were initially contacted and asked to participate. Of these, eleven persons declined to participate, resulting in a response rate of 90% (n = 99). After data cleaning, six incomplete or incorrectly completed questionnaires were excluded from the analysis, leaving a final sample size of 93 individuals The actual participated HCWs were 93 individuals (38 physicians, 43 technicians and 12 nurses) as displayed in figure (1).

Data collection tools and materials

The English version of the self-administered questionnaire was used to collect the data. The questionnaire consisted of three main divisions for collecting data. Division one for socio demographic characteristics of the respondents, division two for assessing knowledge, and division three for assessing respondents' attitudes towards using TLD badge.

Participants' responses to the 8 statements utilized for assessing knowledge of radiation hazards were scored and graded (1-0). One point was awarded for a correct response, while wrong response or no response given zero point. This gives a minimum score of '0' and a maximum score of '8' points. Participants that scored ≥5 out of 8 points were considered as having 'good' knowledge, while those that scored < 5 points were graded as having 'poor' knowledge.

Similarly, participants' attitudes towards Personal Protective Devices (PPDs) was scored and graded on a 5-item scale. One point was awarded for a correct response, while wrong or no response scored as zero point. This gives a minimum score of '0' and a maximum score of '5' points. Participants that scored ≥ 3 out of 5 points were considered as having 'good' attitude, while those that scored <3 out of 5 points were graded as having 'poor' attitude.

The questioner was distributed electronically via social media platforms (such as WhatsApp and Facebook). The link was only shared with eligible participants who met the inclusion criteria.to each study participant. 2 weeks prior to data collection, two professional experts (one from the English language and one from the medical field) validated the tool and confirmed its reliability (Cronbach alpha of 0.88). A pilot study was performed on 8 participants (excluded from the main sample) to ascertain the instruments' clarity and applicability. Accordingly, the necessary changes were undertaken.

Statistical analysis

Before analyzing the data, it was cleaned up and cross-checked. The data were entered into Epi Data version 4.4.0.2 and exported to Statistical Package for Social Science (SPSS) version 24 for further analysis. A binary logistic regression model was used to estimate the associated factors of all independent variables. All independent variables with a *p*-value of <0.05 from a bivariate logistic regression analysis were considered for fitting into a multivariable logistic regression analysis to control the possible effect of confounders. Mean, median, and standard deviation were used for descriptive data.

Ethical considerations

The research purpose and nature were explained to the students to obtain informed consent in electronic form. Data records were safely preserved without obtaining any personal identification information. The collected data were only used for research.

Where does this come from? :[3D]Comment Not identified in the Methods section

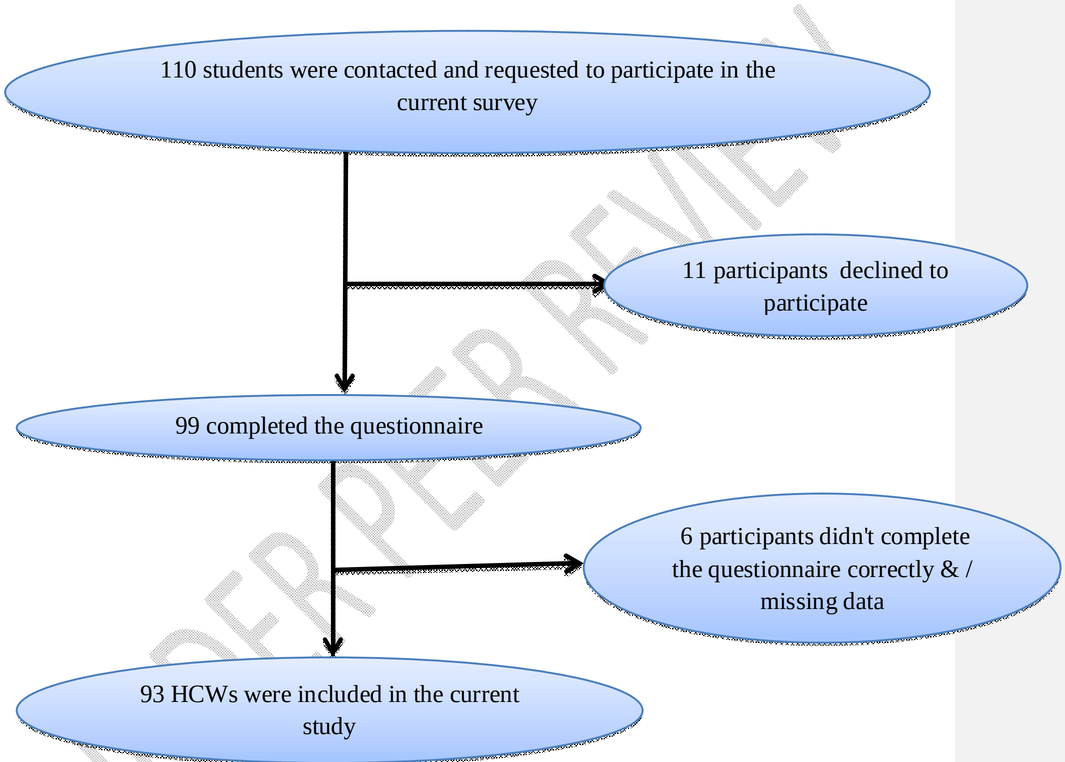


Figure (1): participants' recruitment flowchart

Results

A total of 93 participants were included in this survey with the following characteristics and findings:

Socio-demographic characteristics of the studied sample (n = 93)

Table (1) shows that the majority of study participants (54.8%), were between the age of 21–40 years old and their mean age was 28.3 ± 13.6 years. More than half of the participants were classified as married (55.9%), while 33.3% were single, and 10.8%

were separated, divorced, or widowed. In regard to sex, males predominated in the sample (57%). In terms of professions, 38(40.9%) are radiology physicians, 43(46.2%) are technicians, while 12(12.9%) are nurses. When comes to working experience, the majority of them (43%) have 6-10 years respectively.

Table (1): Socio-demographic characteristics of the studied sample (n = 93)

Variable	Description	Frequency	%
Sex	Male	53	57%
	Female	40	43%
Age in years	≤ 20	9	9.7%
	21- 40	51	54.8%
	≥ 41	33	35.5%
Profession	Physicians	38	40.9%
	Technicians	43	46.2%
	Nurses	12	12.9%
Working experience in years	≤ 5	24	25.8%
	6- 10	40	43%
	≥ 11	29	31.2%
Marital Status	Married	52	55.9%
	Single (not married)	31	33.3%
	Separated, divorced, or widowed	10	10.8%

Table (2): Logistic regression analysis for factors associated with good knowledge in regard to TLD Badge and radiation protection among participants (n=93)

Variables	Category	Knowledge		COR (95%) CI	AOR (95%) CI	*p*-Value
		Adequate	Poor			
Sex	Male	46	7	1.00	1.00	0.001*
	Female	29	11	1.92 (1.24, 4.92)	1.79 (1.445, 3.24)	
Age in years	≤ 20	3	6	1.00	1.00	
	21- 40	42	9	0.481 (0.43, 0.91)	9.24 (.65, 30.9)	0.900
	≥ 41	30	3	2.84 (1.19, 5.10)	12.18 (11.01, 15.50)	0.041*
Profession	Physicians	35	3	1.00	1.00	
	Technicians	35	8	2.44 (1.17, 4.47)	5.13 (2.23, 7.32)	0.043*
	Nurses	5	7	2.92 (1.054, 4.28)	6.445 (1.35, 8.66)	0.106
Working experience in years	≤ 5	11	13	1.00	1.00	
	6- 10	37	3	0.62 (0.74, 1.91)	3.24 (0.66, 16.00)	0.111
	≥ 11	27	2	6.23 (2.92, 9.25)	5.72 (1.42, 10.27)	0.011*
Marital Status	Married	41	11	1.00	1.00	
	Single (not married)	27	4	1.54 (0.66, 5.03)	0.98 (0.07, 13.74)	0.992
	Separated, divorced, or widowed	7	3	0.65 (0.31, 0.89)	9.24 (.65, 30.9)	0.080

- ✓ AOR= adjusted odds ratio; 1.00= reference; COR= crude odds ratio; CI= confidence interval.
- ✓ p-Value at <0.05, is considered significantly associated with healthcare workers toward TLD badge.
- ✓ Total score ranged from 0 to 14. A score of ≤10 was set for poor knowledge and ≥11 for good knowledge regarding TLD badge.

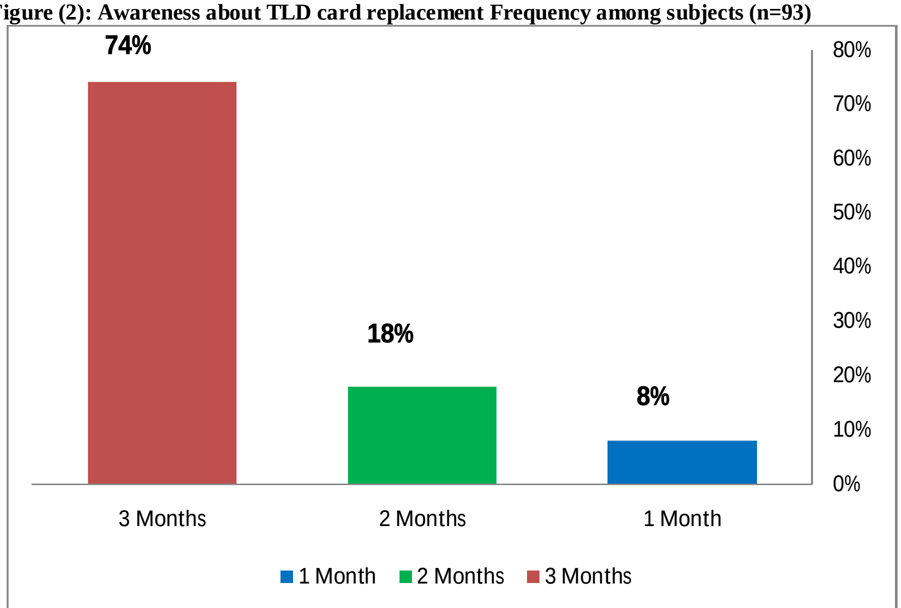
Table (2) shows that the majority of respondents 75 (80.6%) were having adequate knowledge in regard to exposure to ionizing radiations could cause health problems and the importance of wearing (TLD) dosimeter as the device for measuring radiation exposure. Interestingly, age, and more working experience in the field have significant roles regarding knowledge about TLD, it shows that older aged participants with long working experiences have adequate knowledge (P- value < 0.05) respectively.

Table (3): Binary logistic regression analysis association of attitude scores with different variables (n=93)

Variables	**Category**	**Attitudes**		
		B	***p*-Value**	**OR**
Sex	Male	-.566	0.011	0.409
	Female	Ref.		
Age in years	≤ 20	Ref.		
	21- 40	-.325	0.0667	1.761
	≥ 41	0.833	0.001	0.778
Profession	Nurses	Ref.		
	Technicians	-1.098	0.043	2.091
	Physicians	-0.899	0.556	0.667
Working experience in years	≤ 5	Ref.		
	6- 10	-0.967	0.111	0.894
	≥ 11	0.611	0.045	3.107
Marital Status	Married	Ref		
	Single (not married)	-0.718	0.533	0.711
	Separated, divorced, or widowed	-2.009	0.004	2.119

In terms of attitudes, a binary regression analysis revealed that a significant difference of attitude was observed according to gender (females were more positive),the older age and a profession as technicians were predictors of participants' positive attitude, while the male gender and separated, divorced, or widowed participants were predictors of a negative attitude as shown in table (3).

Figure (2): Awareness about TLD card replacement Frequency among subjects (n=93)



Regarding the awareness about TLD card replacement was adequate, figure (2) shows that the majority or participants (74%) are aware about the correct time frame to change the TLD card i.e. after three months. On the other hand, only 26% reported wrong answer (18% said that, it changed after two months, while only 8% said that it changed after one month respectively.

Discussion

Radiation is widely used in the medical science for variety of the purpose such as diagnostic as well therapeutic purpose also[10]. Advancements in medical technology enhance radiation exposure for both the general public and radiation experts. Radiation monitoring and record-keeping are part of slandered radiology practice, and they are also useful for future references in the event of any radiation-related disorders observed in radiation specialists. A range of instruments are available to track the radiation exposure of individuals in a specific location. The TLD Badge is the most practical radiation monitoring tool for radiation professionals, such as technologists and doctors, in the radiology department. The wearing of TLD badges is a major problem because people don't know how to utilize, store, or anything else.

The majority of radiation professionals have also been seen to refrain from wearing TLD Badges without a reason. On the data collected in this study, there are various levels of knowledge and attitudes towards TLD badge. In regard to the overall knowledge to change the TLD card is adequate that 74% of participants know the correct frequency to change the TLD card. Almost the same findings were reported by numerous of studies that participants had adequate knowledge about TLD and its usages[16,17,18].

In terms of attitudes, our study revealed that radiology technicians have high level of positive attitudes towards wearing TLD, followed by physicians and the least attitudes were reported among nurses who are working in radiology department, this result may be due to indirect contact of nurses with radiation, as it is out of their duties. On the other hand, numerous studies documented that radiology physicians have high level of attitudes towards using TLD Badge more than other radiology professions respectively[19,20,21].

CONCLUSION

Despite the participants' strong awareness of radiation hazards, this study showed inadequate radiation protection measures due to radiation exposure. To put it briefly, utilizing a TLD Badge is essential to radiology practice. However, the majority of professionals choose not to wear the emblem out of ignorance. It offers no radiation protection at all. The radiation worker needs to be made more conscious of wearing the badge. It can help raise awareness of health issues and enhance radiology practice.

Conflict of interest statement

The authors declare that the research was conducted in the absence of any commercial of financial issues that could be considered as a potential conflict of interest.

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Comment [4D]: Only 3 out of 23 references are of years 2020 to date. The rest are old references. This affaects the update of the whole write up

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