Awareness and Knowledge Towards Ionizing Radiation Hazard Among Medical Students, Interns and Residents in Al-Madinah Al-Munawarah, KSA.

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Abstract: The aims of this study were to assess the awareness of medical student and newly graduated doctors towards ionizing radiation hazards in Almadinah, KSA.A cross sectional survey was conducted during the period of January through March 2013 among final year medical students at Taibah University and newly graduated doctors working at Almadinah hospitals, KSA. The study recruited 190 participants. An anonymous self administered questionnaire and 20 items multiple choice questions was used. Appropriate statistical tests were used with p value $\leq$ 0.05 was used as an indicator of significant difference. This study found that the response rate was 90.5% (190 out of 210). Overall Knowledge and awareness on radiation hazards is inadequate, 98% had low scores on all items regarding all aspects of radiation hazards. Strong evidence of association was found between awareness on radiation hazards, having exposed to previous course on radiation hazards, knowledge on radiology and medical physics ($p \leq$ 0.001). Weak evidence was found between awareness on radiation hazards and gender in all aspects of radiation hazards with higher mean rank among females ($p \leq 0.05$). No evidence of association was found between awareness on radiation hazards among medical students, interns and residents across gender (p value was 0.08 for medical students, 0.58 for interns and 0.48 for residents). The results indicate that awareness of medical students on ionizing radiation is inadequate. A formal course on radiation hazards and radiation protection should be introduced in medical school curricula.

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1. Introduction

Medical exposure account 15% of radiation dose to the public which is 2.5mSv per year (Wootteon 1991 & NRPB 1990). Over the past two decades there was an increase in demand for radiologic imaging procedures in health care services to help in medical design making (Schauer & Linton, 2009). It is reported that about 30-50% medical decisions depend on x-ray imaging results. A recently released American study showed that the amount of radiation the U.S. population is exposed to as a result of diagnostic medical imaging increased by a factor of six between 1980 and 2006 (Herrman et al, 2012).

The alarming increase in patient exposure to medical radiation is currently a hot topic. The concerns are mainly: Firstly, the danger of radiation that induced burn, driven by the increase in complex interventional fluoroscopy procedures which have led to long exposure times and direct skin damage and secondly, the long-term danger of radiation elevating a person's lifetime risk of cancer. (Gibson et al, 2010), especially for pediatric patients which is highly associated with potential increase lifetime risk of cancer (Brenner et al.2007, Desmond et al, 2008). Cardis and et al reported that 16% of the patients who have received cumulative effective dose greater than 75mSV will expected to have a 7.5% increase in mortality from cancer (Cardis et al, 2007).

King and his colleagues reported that medical doctors and health professionals, to comply with international legislation of radiation protection required being aware with basic knowledge of radiation protection and its effect, so that to optimize requesting for x-ray examinations, imply imaging properly efficiently and reduce unnecessary radiation dose to the patients, in accordance with the ALARA principle (As Low As Reasonable Achievable), (Kings et al. 2002). There is also a recommendation from international radiation protection authorities to minimize excessive use of radiation (NCRP report No.191987, NCRP, 1989).

There are many studies worldwide, conducted to assess the awareness of physician with radiation risk and radiation dose of medical examination and the

result showed a lack of awareness among these studies population (Shiralkar et al; 2003, Kings et al. 2002; Jacob et al, 2004).

It has been shown that the increasing awareness of radiation hazard among doctors and clinicians can be improved by increase knowledge of radiation hazards to medical students. (Singh et al, 2008). It was reported that medical students worldwide have not had adequate of knowledge with regard to ionizing radiation, diagnostic imaging, and radiation safety. (Sarah et al 2011).

In Saudi Arabia, although there are few studies that assessed awareness on radiation hazards among medical students, they were not considered the progress of knowledge acquired after graduation, during their interns or residence practice in hospitals (Sarah et al 2011). Thus, the aim of this study is to assess awareness and knowledge towards ionizing radiation hazard among medical students, at Taibah University, compared to interns and residents practices at Al Madinah hospitals, KSA.

2.Material & Methods:

A cross sectional survey was conducted to explore the knowledge on protection of radiation hazards during the period from January to March 2013. The study participants included final year medical students of 2013 batch, interns and residents of both sex working at King Fahad, Ohad, Maternity and children hospital and Al Ansar hospitals. Approval was obtained from Ethics Committee at Taibah University. Ethical consideration was considered to ensure confidentiality and privacy of the collected data.

A questionnaire that included personal data, the factors influencing ionization hazards was formulated and used and a 20 stem item of multiple choice questions with one best answer that formulated by Tavakoli et al.2003, was modified adopted and used as in appendix (1). The tool was pre-tested on a sample of 20 participants to ensure validity. The reliability of the questionnaire was assessed and alpha was 0.92

The multiple choice questions were grouped into three categories: basic knowledge on radiation protection hazards (8 items) basic principle of radiations (6 items), and particles aspect of radiation protection (6 items), as showed in appendix 1.

Data were entered and analyzed using SPSS version 16.0. One positive point was given for each correct answer and then according to the total number of items, there was 0 minimum score and maximum overall score of 20. Scores less than 50% of 20 scores were considered as poor, between 50% and 75% medium as and greater than 75% were considered as good. Q-Q Plot was done to test the normality of the measurement that showed skewed distribution. Median and inter-quartile range were measured for all items. Kruskal-Wallis test was used to compare the mean ranks of the three categories of the medical professional group with different shape of distribution (final medical students, internship and residents). Mann-Whiteny test was used to analyze, the differences between genders and all aspects of knowledge. *p*- value of 0.05 was considered as a cut of point for significance. Fisher's Exact Test was used to compare the association awareness and knowledge on radiation hazards between medical students, interns and residents across gender, *p*- value of 0.05 was considered as a cut of point for significance.

3. Results

The response rate for participation is 90.5% (190 out of 210). Females represented by 52.6% of study population and males by 47.4%, where 44% were at students at the final year (sub-interns), 37% interns and 18% residents, the mean age of the participants was 23.47±0.72 years. While all participants had a formal course on radiology during their undergraduate study in the medical school, only 8% (16 out of 190) had specialized module on radiation hazard (Table 1).

Table 1. Distribution of participants' characteristics by gender

Character	Males (N =90)	Females (N = 100)	Total (N = 190)	*p*-Value
Age in years Mean ± SD	23.3 ± 0.89	23.6 ± 0.49	23.47±0.72	0.01*
Professional level Clerkship Interns Resident	43 (52.1%) 30(42.9%) 17(47.2%)	41(48.8%) 40(57.1%) 19 (52.8%)	84(100%) 70(100%) 36(100%)	0.59**
Had training module on radiation hazard Yes No	5(0.06%) 85 (94.4%)	11(11%) 89 (89)	16 (8%) 157 (92%)	0.14**

Note: *= p-value calculated using Independent t test, **= p value using Chi- square test

Overall 98.4% of the participant achieved low score in total of all aspect of radiation protections items. Among the participants, 13.7% and 3.7% achieved high score in principle of radiation protection and practice aspect of radiation protection respectively. No high score was achieved in basic knowledge of radiation protection. Moderate scores were achieved by 24.2%, 9.0%, and 1 % in principle of radiation protection, practice aspects and basic knowledge respectively. In basic knowledge 99% of the participants achieved low score, while it was 62% in principle of radiation protection and 87% in practical aspect of radiation (Table 2).

Table 2: Distribution of participants score by aspects of radiation protection

	Low (%)	Moderate (%)	High (%)
Basic of radiation protection	188 (98.95)	2(1.05)	0
Principle of radiation protection	118 (62.1)	46(24.2)	26(13.7)
Practical aspect of radiation protection	166 (87.4)	17(9.0)	7(3.7)
Total score on assessment of knowledge on radiation protection	187 (98.4)	2(.01)	1(0.01)

The mean score of knowledge on ionizing radiation and radiation protection (included three categories: basic knowledge on radiation, principle of radiation and practicable aspect) was 5 out of total score of 20. The minimum score was 0 and the maximum was 13 with IQR of 3 (Figure 1).

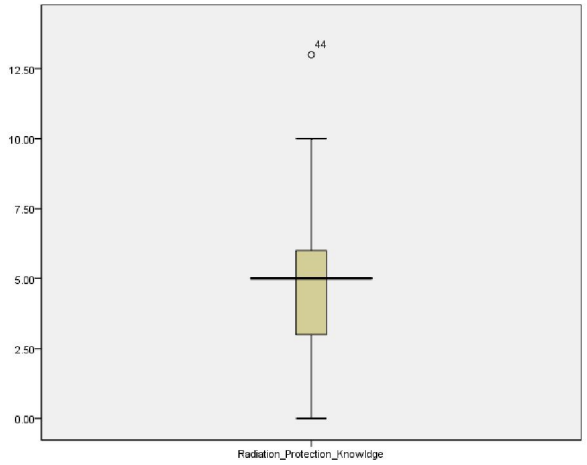

Figure 1. Median score on knowldges of radiation protection

Female participants' achieved median score of 5 out of 20 for the total score of knowledge (for the three items) with minimum of 0 and maximum score 0f 13, with inter-quartile range (IQR) of 4. Males with median score was 4 (minimum of 0 and maximum of 9 & IQR of 4, The difference was significant, the mean rank of knowledge among female was 102.78 compared to 87.41 for males, p = *0.053* (Figure 2 and Table 3).

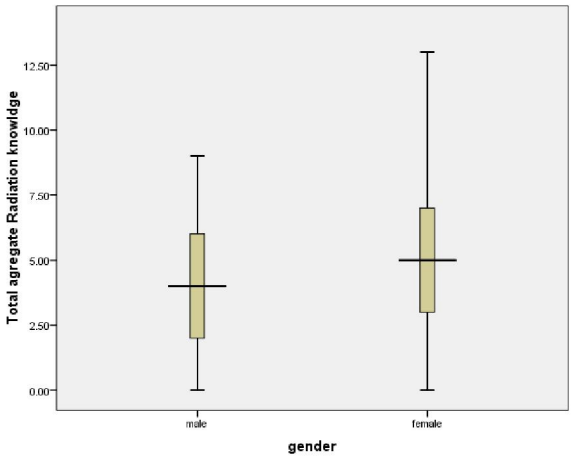

Figure 2 Distribution of awareness and knowledge towards radiation hazards by gender.

The median score of the total knowledge was 4 (minimum of 0 and maximum of 10) among the final year medical students and it increased to 5 (minimum of 0 and maximum of 9) among both interns and residents doctors. The difference is not significant, *p = 0.38*, (Figure 3 and Table 3).

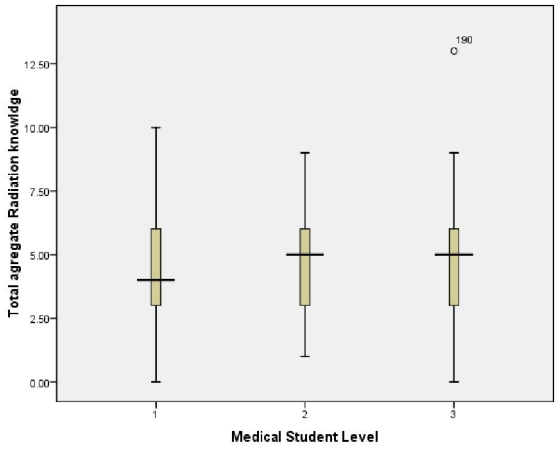

Figure 3 Distribution of awareness and knowledge towards radiation hazards by medical levels

Median score of knowledge among males' medical students was 4, it increased to 5 among males interns' level and 6 at the resident level, compared to females with median score of 5 at both, the final medical school and interns' level and decreased to 4 at resident level, the difference was not significant, *p* value was 0.08 for medical students, 0.58 for interns and 0.48 for residents comparing males and females (Figure 4).

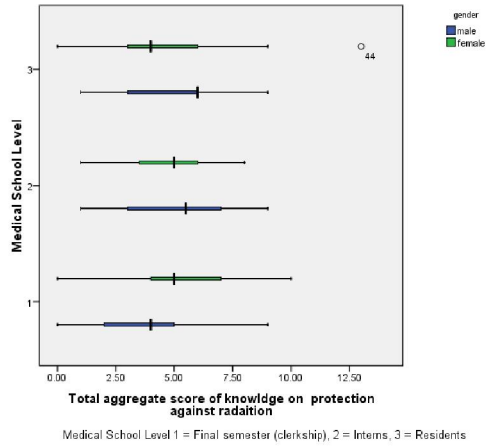

Figure 4. Distribution of awareness and knowledge towards radiation hazards by medical levels and gender. (*p = 0.08 for medical students; 0.58 for interns & 0,48 for residents)
***p was calculated using Fisher's Exact Test.**

Table 3. Mean ranks of Knowledge on radiation hazards and protection by associated factors

		N (190)	Mean rank	p-Value
Medical Student Level	Final student Interns Residents	84 70 36	89.60 101.71 97.19	0.38
Gender	Male Female	90 100	87.41 102.78	0.053*
Informal course on Radiation Protection	Yes No	016 175	181.94 87.55	<0.001**
Perceived level on knowledge on radiology	Excellent V. Good Good Moderate Low	15 08 77 83 07	182.33 167.75 129.17 49.20 5.43	<0.001**
Perceived level knowledge on medical physics	Excellent V. Good Good Moderate Low	40 33 46 31 40	169.71 134.95 93.02 58.19 20.50	<0.001**

*p-Value calculated using Mann-Whitenty Test; **p-Value calculated using Kurskalis-Wallis Test

Those who had exposed to informal course (not within medical school curriculum) on radiation hazards had higher mean ranks than those who did not attend any course on radiation hazards mean ranks of 181.94 compared to 87.55 respectively (Table 3).

Those with excellent knowledge on radiology and medical physics had higher mean marks on radiation protection knowledge(182.33 and 169.71 respectively) compared to lower level, the difference was significantly different, p <0.001, (Table 3).

4. Discussions

The result of this study, revealed that, despite the importance of radiation and its consequent hazards, only 8% of the participants of had exposed to informal course on radiation hazards (Table 1). The knowledge of the medical students, interns and residents was inadequate (overall low score achieved by 98.4%) and there was no significant difference between score means marks across categories of the particiapnts (clerkship, interns and residents) (Figure 3), similar results were obtained by Shiralkar et al, 2003, Kings et al. 2002, Jacob et al, 2004, Sarah et al 2011, Zewdneh et al, 2012, and Sarah. Hagi and. Khafaji, 2011).

The result of this study established significant differences in knowledge level among gender (mean rank of female was 102.78 compared to 87.41 for males, Table 2), this result is controversial with previous studies that reported by Tavakoli MR et al, with no significant difference between females and males in scores, but mean score in the category of practical aspects of radiation protection was significantly greater in female students in comparison with males students (Tavakoli et al, 2003). Arslanoglu et al, have found that female students had slightly lower knowledge with regard to ionizing radiation demonstrated in their overall score of 42%, while male students scored 57%.(Arslanoglu et al, 2007). Similarly, Sarah et al, conducted study confirmed that female students scored 43%, while male students 51% on the pre-lecture questionnaire.(Sarah et al 2011).

The result of this study indicated that awareness ionizing radiation hazards and radiation protection was improved by levels of education, training and experiences, those with excellent knowledge on radiology and medical physics had higher mean marks on radiation protection knowledge (Table 2), that agreed with the result reported by Jennifer and et al showed that medical students' awareness of radiation exposures in diagnostic imaging improved performance in final years in medical school after exposing to clinical clerkship rotation (Jennifer et al, 2011).

Limitation of this study may include studying all other level of medical students and other physician specialties. This study included only medical students, interns and residents from only one city, that a future research is needed to use a design that covers other cities to ensure generalizabilty of the results.

In conclusion, knowledge on radiation hazards and protection is not adequate. There are gender differences in knowledge. The knowledge improves by increasing level of education, training and experience

Declaration of interest:

The authors declare that they have no declaration of interest.

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