A cross-sectional Study of Knowledge and Awareness of Radiation Exposure Risk in Makkah, Saudi Arabia

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Abstract

Background: Radiological procedures are being used much more these days. Patients must be given sufficient information, in a way that they can understand, to be able to make the right decisions about their care.

Objectives: To assess the awareness and associated risks caused by medical radiation among the general population of Makkah, Saudi Arabia.

Methods: A retrospective descriptive cross-sectional study among the general population of Makkah, Saudi Arabia, 2016.

Results: 400 subjects answered the questionnaires. 54% females and 46% male respondents; mean age were 26 years, ranged from 13 to 55. Of these, 64.8% had attended college, 30.3% had completed high school, and 4% completed intermediate school, and 1% completed primary school. 70.5% have experience with medical imaging. Education affect radiation knowledge significantly (P = 0.003). Seventy-four% and 35% were aware of the radiation exposure involved in plain X-ray and CT scans, respectively. Furthermore, 37.3% and 14% were not aware of the free nature of MRI and US from radiation, respectively. Further, 24.3% incorrectly thought that barium studies, do not involve radiation.

Moreover, 62.6% and 60.3%, think that they are not vulnerable to radiation on a plane and at home, respectively. 88.7% were told about the indication, and 11% told about the risks, and 10.3% were told the associated radiation dosage. 17% incorrectly thought that cancer risk does not increase with repeated radiation exposure.

Conclusion: Radiation awareness is poor among the general population. They need to be provided with the necessary information to improve their radiation awareness.

Key words: knowledge and awareness; radiation dose; patient; cross-sectional study; radiological imaging; Makkah; Saudi Arabia

{Citation: Nizar Almaghrabi. A cross-sectional study of knowledge and awareness of radiation exposure risk in Makkah, Saudi Arabia. American Journal of Research Communication, 2016, 4(10): 67-75} www.usa-journals.com, ISSN: 2325-4076.

Introduction

Radiological procedures are being used much more these days with the advance in technology. It helps in the diagnosis and management of many medical conditions. Requesting imaging modalities compose risk to the patients (ionizing radiation cancer-causing biological effects).

Every year there is increasing in the number of patients who stand for diagnostic radiology[1,2], Especially CT scanning. Radiation doses have increased up to 40% per scan during the last few years[3].Radiation exposure repeatedly increases the risk of cancer.

The lowest dosage of radiation for which there is a real proof of cancer-causing is around 10–50 mSv. The regular exposure dosage for one chest radiograph taken is around 0.02 mSv, and for an abdominal CT is around 9 mSv. The radiation from CXR is probably less than background radiation received in a whole year (0.01 mSv daily).Around0.015 mSv is received during a three-hour airline flight[4,5].

It is essential that doctors who request imaging to be well trained in determining whether diagnostic imaging is required, but also they need to be aware of the associated risk. It has appeared in different studies that medical professional's knowledge on radiation dangers and dosage is inadequate[6,7].

In 2006 a study published in the Pediatric Radiology Journal, 87% of pediatricians underestimated the radiation dosage from a chest radiograph and 94% underestimated the radiation dosage from a CT[8].

Not only doctors are inadequate in knowledge on radiation dosage and risks. A study in 2010 showed, half of the intern doctors and senior medical students underestimated the radiation doses from usually requested radiological procedures. Some of them incorrectly think that ultrasound and MRI produce ionizing radiation[9].

A study conducted in 2009 shows a significant proportion of physicians anticipate that informed consent should be obtained from patients undergoing radiological exams and the information about cancer-related risks involved should be provided by the radiological department[10].

Most participants did not talk about the associated risks with patients. Patients must be given sufficient information, in a way that they can understand, to be able to make the right decisions about their care.

Few Projects are focusing on the patient's knowledge about radiation risk in the literature. Two recent studies demonstrated that the majority of patients (74%) would believe that having their condition diagnosed with CT is more important than worrying about radiation and patients had insufficient knowledge about radiation protection[7,11].

Surprisingly, a number of articles have appeared in the literature that predict hundreds of cancers and cancers mortality per year in the U.S. and U.K. caused by ionizing radiation from medical imaging procedures. It was estimated 100-250 deaths occur per year from cancers directly related to exposure to medical radiation in U.K[12]. In U.S, the estimated number of fatalities attributable to CT was 700-1800 during a year[13].

Our aim of this study is to assess the awareness of radiation danger and associated risks among the general population. It's hoped that the results of our study would prove that patient education is necessary these days.

Material and methods

Our study is a cross-sectional questionnaire study conducted in Makkah, Saudi Arabia, 2016. We required a sample size of 385 subjects to accomplish the objectives of our study at a 95% confidence level. The subjects were given an online questionnaire randomly. They were stratified by age, sex, and education. The online questionnaire was in Arabic, multiple choice format and consisted of 19 questions. Divided into three sections inspecting demographic information, radiation knowledge/awareness, and expectations. In producing the questionnaire, we drew much inspiration from Robert H. Corbett's pilot study[14].

Firstly, the subjects asked about his demographic and if they had any medical imaging before. If they answer yes, they asked about which imaging modality they were received and which part of their body examine and whether the doctor had explained to them the reason for performing the test, and the associated radiation dose and risk.

In the second section, which examined knowledge, there were ten questions. All subjects answer this part, whether they had medical imaging before or not. All of these were multiple choice questions. This assures all answers were either right or wrong, and there would be no ambivalence in assessing subjects knowledge. The answers to questions were based on the citedreferences[4,15].

Finally, in the last section, patient's expectations were examined. The subjects were asked whether or not they expect that point to be explained.

Results

A total of 400 subjects answered the online questionnaires. The age of subjects ranged from 13 to 55. The mean was26 and median 24. The standard deviation was 8. A good balance of the sexes was achieved, with 216 of the subjects being female and 184 males.

The study population represents a highly educated group of people, with 259 (64.8%) having attended university or college, 121 (30.3%) having completed high school and 16 (4%) completed intermediate school and 4 (1%) completed primary school.

Seventy point five% have experience with medical imaging. Most subjects underwent X-rays (233), MRI (78), US (67), CT (55) and others (8), (Figure1).

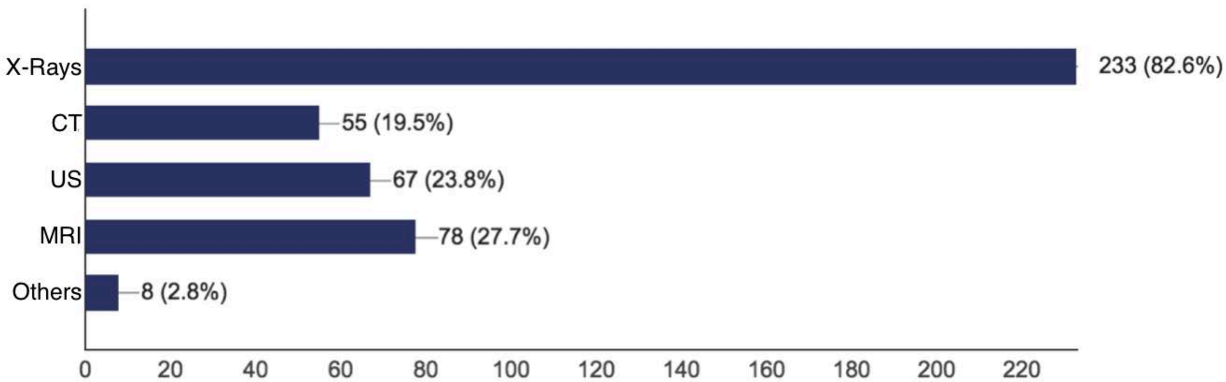

Figure1: This figure reflects the experience of the subjects with radiology department, as we can see most of the subject underwent X-Rays.

A purpose of this study is to assess the target population's knowledge on radiation associated with medical imaging. Thus, 10 questions were devised to accomplish this task (correct answers are marked with ✓). A score of 1 was given to a correct answer and 0 otherwise. For each subject, a maximum score of 10 was calculated. The mean was 5.3 and median was 5 scores for all subjects. With a standard deviation of 1.7.

Seventy-four% and 35% were aware of the radiation exposure involved in plain X-ray and CT scans, respectively. Furthermore, 37.3% and 14% were not aware of the free nature of MRI and US from radiation, respectively. Further, 24.3% incorrectly thought that barium studies, do not involve radiation.

The analysis was done by using SPSS 24 (SPSS Inc., Chicago, IL, USA). A one-way analysis of variance was conducted to evaluate the null hypothesis that there is no relationship between the level of education or gender on the awareness and the knowledge about the medical risks of exposure to radiation (N = 400). Gender and education achieved P = 0.388 and 0. 003 respectively. Therefore, there's was no significant differ between male and female P >.05.

Education achieved statistical significance with $P = 0.003$. The dependent variable included four groups: primary school (M = 4.50, SD = 1.73, n = 4), intermediate school (M = 4.63, SD = 1.93, n = 16), high school (M = 4.97, SD = 1.60, n = 121), and college (M = 5.57, SD = 1.74, n = 259).

The assumption of normality was evaluated using histograms (Figure2) and found tenable for all groups. The supposition of homogeneity of variances was tested and find defensible using Levene's Test, $F(3, 396) = .83$, $p = .477$. The ANOVA was significant, $F(3.396) = 4.72$, $p = .003$. Thus, there is significant evidence to reject the null hypothesis and conclude there is a significant differ between the level of education and the extent of awareness and knowledge about the medical risks of exposure to radiation.

Post hoc comparisons to evaluate pairwise differences among group means were conducted with the use of Tukey HSD test since equal variances were tenable. Tests revealed significant differences between the average scores of the participant at the college level of education and participant with the high school, $p < .05$. The participant with the primary school do not significantly differ from the other three groups, $p > .05$, also the participant with intermediate school do not significantly differ from the other three groups, $p > .05$.

General knowledge on radiation was unsatisfactory, 62.6% and 60.3%, think that they are not vulnerable to radiation on a plane and at home, respectively.

17% incorrectly thought that cancer risk does not increase with repeated radiation exposure. 88.7% of subjects told of the reason for their being subjected to radiological imaging, and 11% told about the risks, and 10.3% were told the Associated radiation dosage.

Sixteen point five% of the subject think that it’s not necessary to be told about the radiation dosage. 50.3% of the subjects agreeing that their doctor should tell them about the radiation dosage while 45.6% thought the radiographer should tell them the radiation dosage and 4.1% thought the nurse should tell them that.

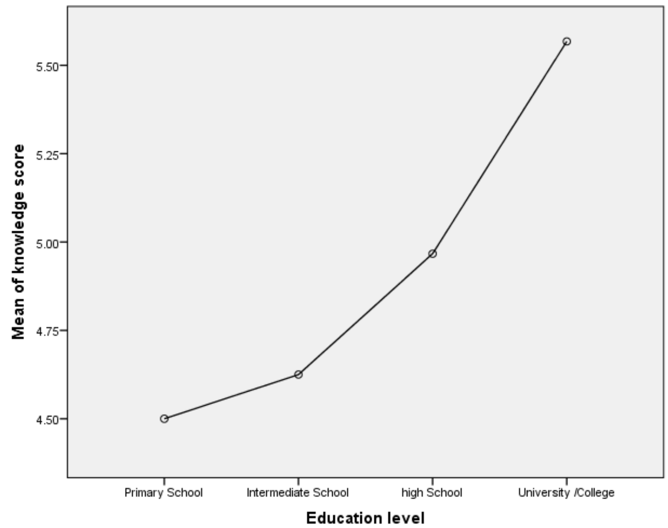

Figure2: This histogram reflects the statistical differences among each group. As the level of education increases the knowledge of the subjects also increased. University/college has the height mean among all the others.

Discussion

Our sample population represents a highly educated group, and may not necessarily be representative of the target population. This study has limitations regarding generalization. Regardless of the above limitations, this study shows that general population awareness is unsatisfactory on radiation.

Radiation is the primary risk involved in most diagnostic imaging. Patients need to be provided with the necessary information to increase their radiation awareness.

Besides, there is a clear mismatch between actual practice and patient expectation. Patient education about radiation should be part of the responsibility of healthcare providers. All health providers should equip themselves with the appropriate information about ionizing and non-ionizing radiation.

Conclusion

Radiation is the primary risk involved in most diagnostic imaging. Radiation awareness is poor among the general population. The patients need to be provided with the necessary information to increase their radiation awareness.

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