



Knowledge of radiation safety among the non-radiology health professionals: A cross-sectional study in a tertiary hospital

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ABSTRACT

Background: The goal Knowledge and awareness about the hazards of radiation is an important subject not only for those who are occupationally situated in radiation zones but also for other healthcare professions as well as those visiting healthcare and diagnostic services. The main objective of the study was to assess the Knowledge of radiation safety among non-radiology healthcare professionals in tertiary hospital.

Methodology: A total of 196 participants responded to self-administered questioner. The study revealed that there was poor knowledge about radiation hazard and safety among the healthcare professionals. Very few healthcare workers correctly answered the radiation protection for patients.

Result: The mean and standard deviation for assessing the knowledge of radiation hazards among the patients was 5.719±2.271. Only 7.65 % received formal training 7.14 % were educated by means of tutorial, 13.77 % learned from different sources and 21.93% participants had no training and learned from other source. 51.53 % could correctly identify the radiation symbols. 87.75 % of wants to be trained in radiation hazards and safety.

Conclusion: There is a need for training among the healthcare professionals and awareness program need to be exercised for the public.

Keywords: Radiation safety, Non-Radiological Professionals, Health Care workers, Radiation protection

BACKGROUND:

Ionizing radiation used in diagnostic imaging is a great advantage and asset to medical science. As we know, the evolution of radiology in the field of medicine, both in diagnostic and therapeutic practices. The advancements in ionizing radiation-based modalities like the multidetector CT (computed tomography) has resulted in the multiplication of diagnostic imaging examinations which has been reported to account for about 50% of the total radiation burden regarding medical purposes.(1,2) The use of Ionizing Radiation has increased in the recent years, with the advancements in diagnostic technology in the field of Radiology. Exposure to radiation is hazardous to both healthcare worker and patients.(2–5) Ionizing radiation has various disadvantages and detrimental effects as well depending on the dose and duration of the exposure. In numerous recent reports, the conditions of the knowledge of healthcare professionals who work with ionizing radiation have been brought to the attention.(6–11) Many researchers reports revealed that there is insufficiency in knowledge about radiation safety among the respondents working with ionizing radiation and poor knowledge about doses that the patients received in common radiological examinations. A number of research reports have found that knowledge on radiation safety is low amidst those working in the healthcare profession (HCP) that use ionising radiation as part of their profession.(5–7,12–14)

The knowledge of ionizing radiation exposure risks among the medical staff is essential for planning diagnostic procedures and therapy, as well as the necessary measures that are to be taken in common radiological examinations is very important. This will aid the healthcare providers to plan the procedures and protocols using ionizing radiation and to also protect patients better as well as themselves. If there is a lack in knowledge about radiation protection amongst the medical professionals working with ionizing radiation, then they put themselves in a position where they cannot protect themselves effectively as well as others. According to our knowledge there are very few studies reported on the knowledge and awareness of radiation safety among the non-radiological staffs. Evaluation of the knowledge of radiation safety during diagnostic procedures among the medical staff are necessary. Our study aim was to evaluate the knowledge of radiation safety among the non-radiology healthcare professionals, who work in different departments those who do not use ionizing radiation, regarding radiation awareness and radiation safety.

MATERIALS & METHODOLOGY:

The cross-sectional questionnaire-based survey study was conducted in a tertiary care healthcare setting among non-medical imaging professionals at NIMS Hospital, Jaipur, Rajasthan. A total of 196 participants responded to the questionnaire's healthcare professions mainly non-medical imaging professionals participated in the survey. The minimum eligibility of the participants was

that they should be Health care workers and not working in the Radiology department. Each of the participants were given self-administered questionnaire, which was earlier validated by three subject expertise.

Ethical clearance and informed consent: The study approval was given by the ethical committee Nims University, Jaipur and participants were provided with participants information sheet. The participant's identity was kept anonymous and informed consent was obtained from each participant.

Data Collection Tool: The questionnaire consisted of 11 questions about the awareness of radiation safety, use of ionising radiation in medical imaging and common radiation protection devices which are used in hospital, correct radiation symbol, which examination and modality will contribute to highest radiation dose to the body. Out of 11 questioner 3 questions were about if radiation protections equipment's were available in the hospital, if the healthcare worker had undergone radiation safety training or lectures, and if the respondent wants to undergo training in radiation safety. The self-administered questions were made in a simple easy manner to the participants, and it was distributed among them offline.

To assess HCW's knowledge about ionizing radiation safety and related health hazards, knowledge score was calculated by using point Likert scale, 1 point to each correct answer and 0 to incorrect and unknown or un-answer questioners. The total knowledge score ranged from 0 to 9. The average score was level to be 5 and score below 5 was level poor knowledge, participants with more then or equal to 5 were considered good knowledge.

Data Analysis: The data was analysed using descriptive statistics, quantitative variables were summarized as means and standard deviation; categorical variables were processed as percentages. The 'correct answers' was computed summarizing the positive answers to the items about the knowledge and comparing to the total of the possible correct answers. Frequency and percentage were used to represent discrete variables. Differences in knowledge between different groups of healthcare workers were investigated. For the quantitative variables unpaired t test. A p value ≤ 0.05 was considered significant, at 95% confidence interval. The p-value were obtained from ANOVA taking each score as dependent variable, age group, and Profession as independent variable. The responses were analysed using SPSS 23.0.

RESULT:

A total of 323 healthcare professions mainly non-medical imaging professions were requested to participate in the study by distributing questionnaire through offline mood. 196 participants responded to the questionnaires with a response rate of 60.68% by willingly giving their consent, majority of them had undergraduate qualifications from different medical, paramedical and management trades, including ward boys. N=13(6.63%) had post graduate qualifications, but none of them had radiology or medical imaging background. (Table 2)

	Average age	Age (years)	Minimum score	Maximum score	Mean \pm SD
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Overall response rate	23	17-46	1	10	5.719±2.271
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Table 1. Overall response of participants on the knowledge of radiation safety.

Profession		No of participants (n=196)	Percentage %
Allied Health Science	PG Allied Health Science	13	6.63
	Medical Lab Technology	30	15.3
	Cardiac perfusion	10	5.1
	Operation Theatre Technology	09	4.5
	Optometry	06	3.06
	Physiotherapy	22	11.22
Nursing	Nursing	65	33.16
Managements	Management	14	7.14
Medical Doctors	Medical Doctors	20	10.20
Pharmacy	Pharmacist	07	3.57

Table 2. Demographic Variable of the participants.

Profession	Mean±SD
Medical Lab Technology	5.36±2.12
Cardiac Perfusion	5.9±1.81
Nursing	5.6±2.28
Optometry	5.8±1.21
Pharmacy	6.1±3.07
Physiotherapy	5.31±2.45
Operation Theatre Technology	8.22±1.48
PG Allied Health Science	6.07±2.10
Doctors of different departments	6.45±2.37

Management staff	4.35±1.34
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Table 3. Mean & SD of knowledge among different healthcare professionals.

Q1. Do you have any training in radiation safety? If yes that what type of training, you delivered?		
A	Formal lectures about radiation safety.	n= 29 (15%)
B	Brief lectures or tutorial	n = 28 (14%)
C	Self-directed learning	n = 54 (27.6%)
D	Other	n = 85 (43%)

Table 4. Participants who learned radiation safety from different sources.

	Question	Correct Response %
Q1	Which of the following investigations do not contain a risk of ionizing radiation?	56.632%
Q2	Which of the following investigations contain highest risk of ionizing radiation?	47.959%
Q3	What are the radiological investigation contraindicated in pregnant women?	51.530%
Q4	Are you aware about the use of red light outside the radiation imaging room?	55.6122%
Q5	By which thing we can protect us from radiation?	51.020%
Q6	Is there any effect of distance on the effect of radiation?	50%
Q7	Is there any effect of time on the effect of radiation?	56.122%
Q8	Which one is the sign of ionising radiation?	51.530%
Q9	Is there any radiation monitoring device in hospital by which we can measure radiation dose?	63.775%
Q10	Do you want any training programme about the radiation safety in future in your hospital?	87.755%

Table 5. Correct response rate to questionnaire.

DISCUSSION:

In every diagnostic or therapeutic procedure involving ionizing radiation, the topmost priority is the safety of the patients as well as the staff who are operating and performing the procedure. The deficiency in the level of knowledge amongst healthcare professionals has been reported in many previous studies. Numerous studies performed by Yurt and colleagues, Faggioni *et al*, Pratap *et al*, Szarmach *et al*, and Zekioglu (4,8,15) and fellow researchers all showed that the level of knowledge and awareness about these issues amongst medical staff were not satisfactory. In the present study we have examined health professionals and non-healthcare professionals of different departments like Nursing, Physiotherapy, Medicine, Pharmacy, Ward boys, Management staff who are non-radiology staff healthcare workers. The knowledge and awareness were assessed in 196 participants with response rate of 60.68%.

M.W.McCusker's *et al*. reported that overall knowledge was poor, 99% had answered incorrectly about the dose level used in the barium study, 90% in the CT and 42 % of the respondents knew the use of ionizing radiation in PET scan But in our study it was found that most of the participants had good knowledge by 68.87%, 15% of the participants had training in radiation safety which is more than that of the M.W.McCusker's *et al*. study. M.W.McCusker's study also had larger sample size than the current study, with over 73 more respondents. On the other hand this study also found over 15% participants who have been trained in radiation protection whereas by only 1% formal training had been attained by the participants in M.W.McCusker's *et al* report. Keeping in mind the profession and education level we expect the medical students and Doctors to have better knowledge but these may be purely due to lack of academics related training and unaware of the radiation safety guidelines(16).

Aysu Zekioglu's *et al* reported that overall knowledge to be good in their study by 98% than the present study, this may be because the participant included the healthcare workers who are working directly in ionizing radiation, who may have had regular radiation safety programs quarterly. 31.3% were provided with the radiation safety training and 60.4% indicated that they had periodic training program in radiation safety in their hospital premises. (17) In the present report, we excluded Aysu Zekioglu's *et al*. inclusion criteria and included only the healthcare professionals who are not working directly in the ionizing radiations, and we also noted that they lacked in the radiation training programs. Arkadiusz Szarmach *et al* conducted a study to assess the radiation safety awareness among the medical staff they characterized the respondents by their work experience, and they reported that respondents having experience of 1-5 years had the good knowledge (73%), we assumed that 11-15 years' experience have good knowledge, but it is surprising that they had the least knowledge (14%). And also found that Nurses group had the poor knowledge, participants of the Radiation Imaging Department and Emergency Department have the good knowledge.(4) On the other hand in our study Nurses had good knowledge as compare to the Arkadiusz Szarmach *et al* study.

Francesca Campanella *et al*. to assess the Physicians knowledge about radiation protection, they performed a crosssectional study with the help of questionnaire, 419 participants completed questionnaire with a response rate of 10.5%. 48.2% had formal training in radiation protection during their course and 22.91% doctors were interested in radiation protection training program. Most of the participants 94.75% and 86.63% correctly answered about the use of the ionising radiations in Ultrasound and MRI (Magnetic Resonance Imaging)(18). On the other hand in our study response rate is greater and 15% pf the participants had radiation safety training which is very less than that of the Francesca Campanella *et al* study. F. Ria *et al* conducted a study to

assess the awareness of medical radiation exposure among the patients. 737 participants participated in the study. 56.4% respondents didn't know about the use of ionizing radiation and 70.1% were not aware of the professional with whom they can discuss the use of radiation for medical imaging (19). As in our study 56.63% were aware about the use of ionizing radiation but we included the health professionals and F. Ria et al included the general public so health professional were expected to have good knowledge, it can be achieved by the radiation protection training program. 56.63% had the knowledge about the use of ionizing radiation, 51.53% answered correctly that radiological examinations contraindicated during pregnancy, 55.61% are aware of the use of red light outside the radiation imaging room, 51.02% answered correctly about the radiation protection devices, 50% and 56.12% answered correctly about the effect of distance and time on the radiation exposure, 63.77% were aware of that we use radiation monitoring devices in hospital and 87.75% respondents want radiation safety program in hospital so that they can prevent themselves as well as other people's inside the hospital.

CONCLUSIONS:

Patient safety is a priority in any medical investigation or intervention. There is insufficient knowledge among the healthcare professionals regarding the issues of radiation hazards and radiation protection. There were only few participants who were able to achieve the full score and few scoring the lowest which indicated unsatisfactory levels of awareness. There is a need for training and education on the hazards of radiation and radiation safety for all the healthcare professionals of the healthcare facilities. Towards this end, it may well be prudent to introduce lectures regarding radiation protection, integration of radiation awareness and radiation protection to healthcare workers.

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