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Knowledge And Perception Assessment On Safety And Hazards Of Diagnostic Radiation : An Institutional Study In Bengaluru

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Abstract:
Background: *Ionizing radiation is used in diagnostic imaging as a part of patient workup in various medical specialties. However, it constantly imposes radiation exposure risk to both patients and healthcare professionals. Therefore, this study focused at evaluating the level of knowledge of patients toward radiation exposure hazards and radiation dose.*
Methodology: *The study was a cross-sectional study with non-probability sampling. An offline, self-developed questionnaire was distributed to the general population based on inclusion criteria . Data was represented in terms of frequencies and valid percentages for categorical variables. A one-way analysis of variance test was used to compare numerical variables between subgroups.*
Results: *The mean knowledge score was below average (5.43 ± 3.12.). Patients with a medical background, better educational status and married as well as non-medical professionals advised about the hazards of radiation showed a significantly higher mean scores.*
Conclusion: *Although the awareness and level of knowledge of the general population toward risks and hazards of radiation exposure has improved over the years, few lacunae still exist and there is scope for improvement . Further research is recommended on a national level. Campaigns for awareness as well as physicians guidance should be encouraged to improve the knowledge, attitude and practices towards radiation exposure.*
Keywords: *knowledge , perception, hazards, ionizing radiation.*

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I. Introduction

Diagnostic imaging using ionizing radiation is considered a non-invasive intervention that aids in the decision making of management strategies. Ionizing radiation is used in various techniques, such as Radiography, Computed Tomography (CT) scan and special investigations like barium studies & hysterosalpingography (all of which involve the use of X-rays). Healthcare professionals and patients are at the highest risk of exposure to ionizing radiation during diagnostic/therapeutic interventions[1]. Even though the radiation dose used is relatively low, there are known adverse effects classified broadly as the stochastic(non-deterministic) and non-stochastic(deterministic) effects.

Healthcare professionals working in radiological specialties, owing to their training, are known to have good knowledge in radiation hazards and safety measures implemented[2,3]. However, the same is not applicable to the rest of the population, including health care workers from non-radiological specialties, hence making it of paramount importance in order to increase the awareness regarding the hazards of radiation exposure as well as subsequently eliminate myths around it.

In addition, we are constantly exposed to a baseline radiation that comes from many natural sources including more than 60 naturally-occurring radioactive materials found in soil, water and air ; Radon being the main source of natural radiation which emanates from soil and rock in its gaseous form. Every day, people inhale and ingest radionuclide from air, food and water , further necessitating the understanding of radiation and its hazards[4,5].

The presence of hazards of radiation exposure , but the lack of adequate awareness has long been an established fact in the field of medicine.

In a study done by Quinn A D et al in 1997, they had shown that the majority of clinicians (non-radiologists)themselves had not received adequate radiation protection teaching and that even after they had attended courses, the overall knowledge was still poor and further proposed the inclusion of formal compulsory teaching at undergraduate level to correct this in the future[6].

Subsequently , further studies done over the next two decades showed an improvement in knowledge amongst the medical fraternity, however that of the non-medical community continued to be lesser.

Shastri D D et al (2021) showed that in their study involving medical students alone,87.5 % considered radiation knowledge important. Rule of 10 based question was correctly answered by 83.1% students and question on Radiation exposure to patients during diagnostic radiology question was correctly answered by 84.6%[7].

However, Sharma et al in 2019 showed that in a study involving the non-medical population only 14.4% had knowledge of the risks and hazards associated with radiation and Bastiani et al in 2021 also concluded that patients have an overall limited knowledge about medical radiation and hence better patient awareness of radiation risks related to medical exposures may be beneficial[8,9].

This warrants for the continuum of regular assessment of the population in this matter.

II. Materials And Methods

Source of data: An offline ,self-developed questionnaire was distributed to the general population in BGS Global Institute of Medical Sciences.

Study design: Cross sectional study

Sample size: There are 14.4% of the non-medical population had knowledge of the risk and hazards associated with radiation[8].Assuming the absolute precision is 10% and 95% confidence interval, the minimum required sample size is 86.

Sampling Method: Non-probability sampling

Study place: Dept of Radio-diagnosis , BGS Global Institute of Medical sciences, Bangalore

Study period: 3 months **(**July 2023 to September 2023)

Method of collection of Data: An offline ,self-developed questionnaire was distributed to the general population , regardless of whether they underwent a diagnostic radiological procedure. The responses are divided into three sections: the first section includes questions on socio-demographic data. The second and third sections are based on general knowledge of radiation exposure, hazards and practicesof different diagnostic procedures.

Informed consent is taken and anonymity of each individual is maintained.

Inclusion criteria: All those above 18 years of completed age who have attempted all the questions of the questionnaire.

Exclusion criteria: Patients below 18 years of completed age.

The study did not require any investigations or intervention to be conducted on patients or other humans or animals. There were no financial implications of the study and prior ethical clearance was obtained from the institution for this study.

Statistical Analysis: The statistical analysis was performed by STATA 11.2(College station TX USA). Mann Whitney U test & Kruskal Wallis were used to find the significant differences in the mean knowledge score between various demographic variables. The knowledge of the population was evaluated by calculating the scores for correct answers. Each correct response was given one point. Demographic details like age, occupation, educational status, profession, marital status and knowledge on radiation exposure was expressed in terms of frequencies and valid percentages.

III. Results

Table 1: Demographic details of the study participants

		Frequency	Percent
Age Group	18-25	31	31
	26-35	23	23
	36-45	14	14
	46-55	13	13
	55-65	8	8
	>65	11	11

Educational Status	Illiterate	9	9
	Primary	8	8
	Secondary	21	21
	Graduate	37	37
	Post Graduate/ Higher	25	25
Profession	Medical	47	47
	Non - Medical	53	53
Marital Status	Single	39	39
	Married	53	53
	Divorced	1	1
	Widow	7	7

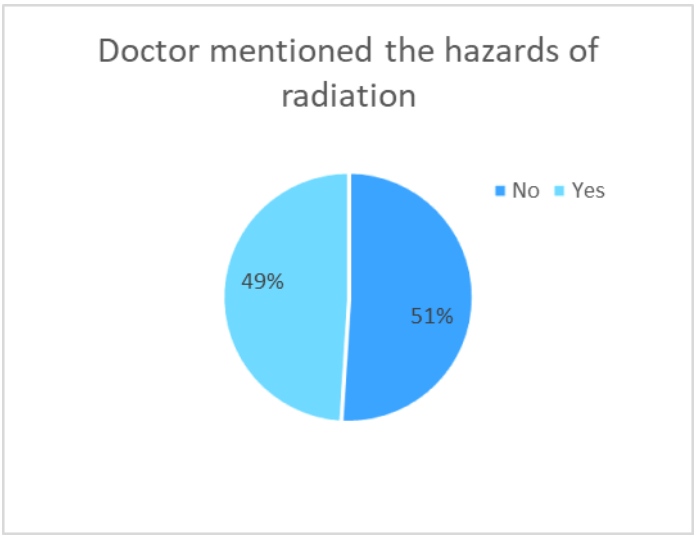

Figure 1: Information on hazards of radiation by doctor

Table 2: Knowledge on radiation exposure based on modality

Knowledge on radiation exposure – based on modality		Frequency	Percent
X RAY	Yes	82	82
	No	8	8
	I Don't Know	10	10
USG	Yes	24	24
	No	65	65
	I Don't Know	11	11
CT	Yes	64	64
	No	14	14
	I Don't Know	22	22
MRI	Yes	21	21
	No	55	55
	I Don't Know	24	24
Hysterosalpingography/ Barium studies	Yes	31	31
	No	18	18
	I Don't Know	51	51

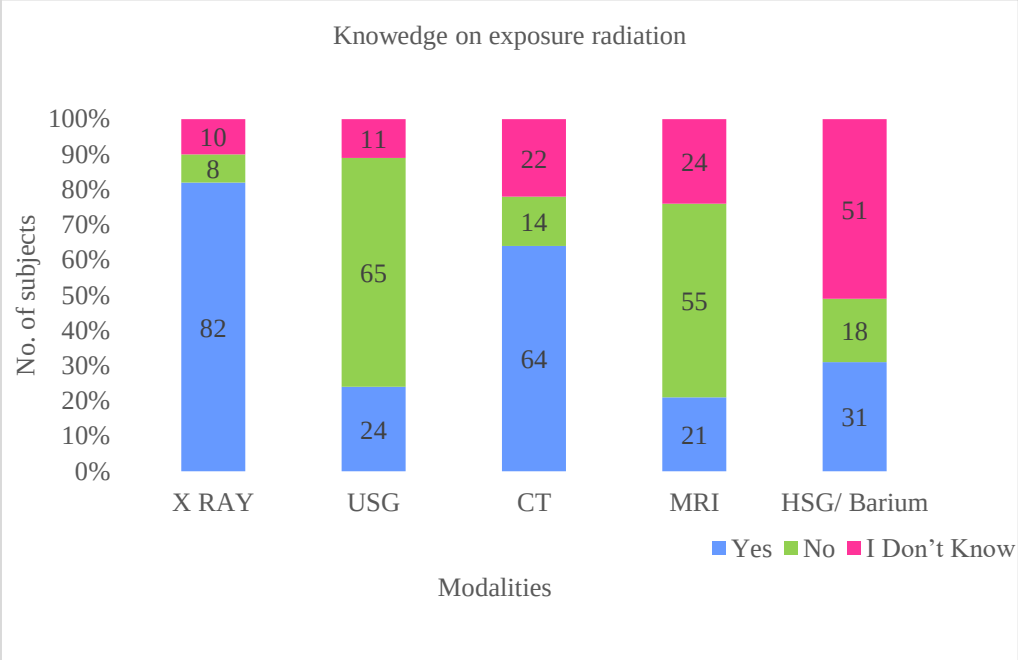

Figure 2: Knowledge on radiation exposure based on modality

Table 3: Knowledge on radiation exposure - risks

		Frequency	Percent
Radiation increases risk of cancer	Yes	76	76
	No	6	6
	I Don't Know	18	18
Repeated Radiation exposure leads to cumulative risk of cancer	Yes	48	48
	No	19	19
	I Don't Know	33	33
I am exposed to radiation at home	Yes	31	31
	No	50	50
	I Don't Know	19	19
I am exposed to radiation at airports	Yes	47	47
	No	26	26
	I Don't Know	27	27
Can a pregnant lady be subjected to chest X-RAY	Yes	24	24
	No	62	62
	I Don't Know	14	14
10 Day rule is applied for Hysterosalpingography procedure	Yes	20	20
	No	6	6
	I Don't Know	74	74
Do you think you should be told about the need for your X-RAY	Yes	29	56.9
	No	16	31.4
	I Don't Know	6	11.8
ALARA principle must be used followed during radiation exposure	Yes	29	61.7
	No	1	2.1
	I Don't Know	17	36.2

Table 4: Comparison of Knowledge on radiation exposure based on modality among medicals and non-medicals

Knowledge on radiation exposure – based on modality			Frequency	Percent
X RAY	Medical	Yes	47	100
	Non - Medical	Yes	35	66
		No	8	15.1
		I Don't Know	10	18.9
USG	Medical	Yes	12	25.5
		No	34	72.3
		I Don't Know	1	2.1
	Non - Medical	Yes	12	22.6
		No	31	58.5
		I Don't Know	10	18.9
CT	Medical	Yes	39	83
		No	4	8.5
		I Don't Know	4	8.5
	Non - Medical	Yes	25	47.2
		No	10	18.9
		I Don't Know	18	34
MRI	Medical	Yes	11	23.4
		No	31	66
		I Don't Know	5	10.6
	Non - Medical	Yes	10	18.9
		No	24	45.3
		I Don't Know	19	35.8
Hysterosalpingography/ Barium studies	Medical	Yes	27	57.4
		No	8	17
		I Don't Know	12	25.5
	Non - Medical	Yes	4	7.5
		No	10	18.9
		I Don't Know	39	73.6

Table 5: Comparison of Knowledge on radiation exposure - risks medicals and non-medicals

Knowledge on radiation exposure - risks			Frequency	Percent
Radiation increases risk of cancer	Medical	Yes	46	97.9
		No	1	2.1
	Non- Medical	Yes	30	56.6
		No	5	9.4
		I Don't Know	18	34
Repeated Radiation exposure leads to cumulative risk of cancer	Medical	Yes	29	61.7
		No	13	27.7
		I Don't Know	5	10.6
	Non- Medical	Yes	19	35.8
		No	6	11.3
		I Don't Know	28	52.8
I am exposed to radiation at home	Medical	Yes	15	31.9
		No	29	61.7
		I Don't Know	3	6.4
	Non-Medical	Yes	16	30.2
		No	21	39.6
		I Don't Know	16	30.2
I am exposed to radiation at airports	Medical	Yes	29	61.7
		No	11	23.4
		I Don't Know	7	14.9
	Non-Medical	Yes	18	34
		No	15	28.3

		I Don't Know	20	37.7
Can a pregnant lady be subjected to chest X-RAY	Medical	Yes	20	42.6
		No	27	57.4
	Non-Medical	Yes	4	7.5
		No	35	66
		I Don't Know	14	26.4
10 Day rule is applied for Hysterosalpingography procedure	Medical	Yes	19	40.4
		No	3	6.4
		I Don't Know	25	53.2
	Non-Medical	Yes	1	1.9
		No	3	5.7
		I Don't Know	49	92.5

Table 6: Comparison of Knowledge score on socio demographic variables

		N	Mean	Std. Dev	Test statistic	p-value
Profession	Medical	47	7.15	2.45	519	0.001*
	Non - medical	53	3.91	2.87		
Age Group	18-25	31	4.94	2	5.69	0.337
	26-35	23	6.09	2.84		
	36-45	14	4.71	3.6		
	46-55	13	6.31	3.33		
	55-65	8	4.25	4.17		
	>65	11	6.18	4.4		
Educational Status	Illiterate	9	1.44	2.07	50.2	0.00*
	Primary	8	1.38	1.06		
	Secondary	21	3.95	2.13		
	Graduate	37	6.49	2.19		
	Post Graduate/ Higher	25	7.84	2.53		
Marital Status	Single	39	5.85	2.25	10	0.019*
	Married	53	5.64	3.49		
	Divorced	7	1.86	2.48		
	Widow	1	3	-		
Did doctor mention about the hazards of radiation	No	51	3.9	3.02	547	0.00*
	Yes	49	7.02	2.36		

* p value is significant

IV. Discussion

A significant advancement of radiological investigations has occurred over the past few decades owing to ionizing radiation[3]. Although rare , adverse effects prevail due to its use, hence it is crucial to understand them[10,11].

In the present study, the level of knowledge of the population in Bengaluru toward radiation was evaluated. It revealed that the range of total knowledge score varied from 0 to 11, with a mean of 5.43 ± 3.12.

A group of 100 subjects were included in the study. From table 1, it is evident that majority (31%) of them were in the age group of 18-25 years of age . The population was fairly balanced, with 53% of them being non - medical professionals. Marital status of 53% of the study group was "married" .

Table 6 shows that, significant differences exist in the mean knowledge score among those with varied professional, educational and marital status demographics. People who work in the medical field were found to have higher knowledge on radiation exposure as compared to non- medical professionals. 49% of the subjects stated that their doctor had mentioned about the hazards of radiation while not so in 51% (figure 1). The subjects who were priorly informed about the radiation hazards showed a significantly higher mean score.

Among the 51 who were uninformed, 29 of them felt that they should be told about the need for investigations utilizing ionizing radiation, while 16 didn't feel the need.

Similarly, a study done by Alshammari et al showed that the mean score for the knowledge section was below average (5.08 ± 2.952) and also revealed that patients who received advice from doctors regarding the hazards of exposure to ionizing radiation, had the highest mean in the entire sample population[1].

From table 2 and figure 2, it can be inferred that, most of the general population is aware of the modalities that cause exposure to ionizing radiation. However, a significantly large proportion(69%) is unaware about the ionizing radiation-laden nature of barium investigations / hysterosalpingography. This is probably owing to the relatively less use of these investigations in comparison to Radiography and CT. In addition , table 4 clearly demonstrated the comparison between the knowledge of medical and non-medical subjects which showed that it was higher among the medical population.

Regarding knowledge on risks of radiation, table 3 depicts that the majority of the population agreed that radiation increases the risk of cancer. However, a significant proportion of the study subjects seem to be grossly misinformed/unaware about the other aspects such as radiation exposure at home and airports, chest X-ray for pregnant women and 10 day rule for hysterosalpingography procedure. This disparity is further heightened between medical and non-medical professionals as evidenced by table 5, which shows that the subjects with a medical background have more knowledge about these risks and practices. However , even within the medical professionals, a group of them do not know about the prevailing practices and rules regarding radiation risks and safety ; only ~43% agreed that a pregnant lady can be subjected to a chest radiograph and ~62% that ALARA principle must be followed during radiation exposure.

Sin et al recruited 173 patients who underwent CT/MRI /PET-CT and evaluated the awareness of the patients towards risks of radiological diagnostic procedures , they concluded that the knowledge levels towards safety and risks were unsatisfactory. Similar to the current study, education level significantly affected their knowledge - many were not aware of the radiation-free nature of USG and MRI and were of the misconception that Barium studies do not involve radiation. Furthermore, they thought that they are free from radiation exposure at their homes and on aircrafts[12]. Due to recruitment of a larger sample size for the study, it increases the reliability of their outcomes.

V. Conclusion

Over the years, there has been an exponential rise in the awareness of the general population towards the risks and hazards of radiation exposure. However, this study has proved that deficiencies continue to persist and further action must be taken to tackle these shortcomings. National programs must be encouraged to increase awareness among the population and healthcare professionals must advise their patients regarding radiation hazards and its implications.

References

[1]. Alshammari Kh, Alramadan Le, Ali Jmh ,Farraj Mj , Alanazi Ka, Almurbat Awa.Knowledge And Perception Of Patients Towards The Hazards And Dose Of Diagnostic Radiation In Bahrain.International Journal Of Medicine In Developing Countries. 2019;3(12):1128–1134.

[2]. Al Mohiy H, Sim J, Seeram E, Annabell N, Geso M, Mandarano G, Et Al. A Dose Comparison Survey In Ct Departments Of Dedicated Paediatric Hospitals In Australia And Saudi Arabia. World J Radiol. 2012;4(10):431.

[3]. Al-Rammah Ty. Ct Radiation Dose Awareness Among Pediatricians. Ital J Pediatr. 2016;42(1):77.

[4]. Thakkar M, Wadhwa M, Desai B, Singh A, Panchal J, Shrivastava A, Meena M, Patel M. A Study On Radiation Safety Awareness Amongst The Healthcare Professionals Of Private Hospital In Vadodara. Indian Journal Of Science And Technology.2021;14(34): 2761-2765.

[5]. Who. Medica Center, Ionizing Radiation, Health Effects And Protective Measures. 2016.

[6]. Quinn Ad, Taylor Cg, Sabharwal T, Sikdart. Radiation Protection Awareness In Non-Radiologists. The British Journal Of Radiology.1997;70(829):102–106.

[7]. Shastri D D, Diwanji N S , Shastri M D , Desai E J, Patel P G , Kadwani N K .Awareness Of Source Of Radiation, Its Hazards And Protection Among Final Year Mbbs Students: A Cross-Sectional Observational Study.International Journal Of Anatomy, Radiology And Surgery. 2021; 10(2): 24-28.

[8]. Sharma Sr, Karjodkar Fr, Sansare Kp, Saalim M, Mishra Id, Johaley S, Goyal Sn. Attitude And Awareness Of General Population Towards Radiation Hazards And Safety: An Institutional Study. Indian J Dent Res. 2019 Jan-Feb;30(1):27-30.

[9]. Bastiani L, Paolicchi F, Faggioni L, Martinelli M, Gerasia R, Martini C, Cornacchione P, Ceccarelli M, Chiappino D, Della Latta D, Negri J, Pertoldi D, Negro D, Nuzzi G, Rizzo V, Tamburrino P, Pozzessere C, Aringhieri G, Caramella D. Patient Perceptions And Knowledge Of Ionizing Radiation From Medical Imaging. Jama Netw Open. 2021;4(10):E2128561.

[10]. Almohiy H. Multicenter Study Assessing Ophthalmologist's Knowledge Towards Radiation Dose When Prescribing Ct Scans For Pediatric Patients: A Saudi Arabian Perspective. J Radiat Res Appl Sci. 2016;9(1):96–100.

[11]. Almaghrabi N. A Cross-Sectional Study Of Knowledge And Awareness Of Radiation Exposure Risk In Makkah, Saudi Arabia. Am J Res Commun. 2016;4(10):67–75.

[12]. Sin Hk, Wong Cs, Huang B, Yiu Kl, Wong Wl, Chu Yc. Assessing Local Patients' Knowledge And Awareness Of Radiation Dose And Risks Associated With Medical Imaging: A Questionnaire Study. J Med Imaging Radiat Oncol. 2013;57(1):38–44.