European Journal of Biomedical Research
Vol 4 | Issue 2 | September 2025
ISSN 2796-0056

RESEARCH ARTICLE

A Study on Patient Awareness Regarding Radiation Risks Associated with Chest X-Rays

Nafisa Tasnim Neha[1], Momtaheena Chowdhury[2], Md. Abu Obayda[3,*], and Md. Abul Fayez[3]

ABSTRACT

Chest X-rays are a common diagnostic test; however, patient education about the associated radiation risks is minimal, especially in poorly developed nations such as Bangladesh. This study aimed to assess the level of awareness of radiation exposure from chest X-rays in patients and how demographic and experiential factors influence their perceptions. A descriptive cross-sectional survey of 110 adult patients from five private medical centers in Dhaka was conducted from November 2024 to April 2025. Data were collected through structured questionnaires and face-to-face interviews. The majority of the participants (98.2%) had already had a chest radiograph, yet only 43.6% were told about the risks of radiation. Almost half (46.4%) were unconcerned about radiation, whereas 76.4% thought it might be harmful, mostly relating it to cancer and genetic damage. The Internet (47.3%) and medical professionals (30.9%) were the most important sources of information. Educational attainment and previous imaging experience affected awareness. Of note, 81.8% liked more information, and 93.6% preferred educational materials. Despite the extensive use of chest X-rays, awareness remains uneven, and many patients depend on nonprofessional sources. Education gaps were especially evident in individuals with lower levels of formal education. Enhancement of patient education by providing accessible resources and clear communication by medical practitioners is necessary to enhance informed decision making and limit inappropriate radiation exposure.

Keywords: Chest X-ray, patient awareness, radiation exposure, risk communication.

Submitted: June 19, 2025

Published: September 29, 2025

10.24018/ejbiomed.2025.4.2.115

[1]Department of Computer Science and Engineering, Ahsanullah University of Science and Technology (AUST), Bangladesh.
[2]Department of Computer Science and Engineering, BRAC University, Bangladesh.
[3]Department of Radiology and Imaging Technology, Bangladesh University of Health Sciences (BUHS), Bangladesh.

Corresponding Author:
e-mail: obaydaabu@gmail.com

1. Introduction

Chest radiography (CXR) is one of the most frequently used diagnostic imaging procedures worldwide. CXR is of pivotal value in the diagnosis of conditions such as pneumonia, heart failure, and lung cancer. Although of clinical significance, there are unavoidable risks associated with exposure to X-ray radiation. Studies indicate that while the individual risk from a single chest X-ray is low, cumulative exposure over time may increase this risk [1]. Patients need to be informed of these risks so that they can make informed choices regarding diagnostic imaging.

In recent years, there has been growing concern regarding the general public's awareness of radiation exposure from imaging. Patients underestimate the risks and overestimate their benefits, leading to unnecessary apprehension or inadequate preparation for the procedure [2]. Lack of proper awareness can also include patients who are less likely to challenge repeated imaging and, hence, expose themselves unnecessarily.

Educational programs for both healthcare professionals and patients have been proposed to increase awareness and communication regarding the dangers of radiation [3]. These kinds of programs can facilitate patients to make informed choices regarding their health, as well as make healthcare workers more attuned to the ethicalities involved in applying radiation for diagnostic purposes.

Despite the global debate on radiation safety, there has been a wide gap in studies on patient awareness within developing countries. Assessing the level of patients' knowledge of radiation risks concerning chest X-rays can assist in planning ways to enhance patient education and communication in health facilities [4].

In addition, this study aimed to determine potential inequalities in awareness levels based on demographic

determinants such as age, education, and previous exposure to medical imaging [5]. Determination of inequalities will help inform focused education so that vulnerable populations can learn the information necessary to understand the risks and benefits of chest X-rays.

Ultimately, patient education on radiation risks is instrumental in spurring collaborative decision making in medicine. This study aims to make significant contributions to the study of patient awareness in Bangladesh and hence promote evidence-based planning for enhanced patient education and advocacy [6].

2. Purpose of the Study

2.1. General Purpose

To quantify patients' knowledge of radiation dangers while receiving chest X-rays.

2.2. Specific Purpose

1. To find out the demographic characteristics of the patients who receive chest X-rays and their relationship with radiation awareness.
2. To determine the sources of data employed by the patients regarding radiation from medical imaging.
3. To explore the respondents' perceptions of risks and benefits associated with chest X-rays.
4. To identify how much the past history of chest X-rays influences patients' concern and impression regarding radiation risks.

3. Research Methodology

This was a descriptive cross-sectional study to evaluate the awareness of radiation hazards in patients who underwent chest X-rays in Dhaka, Bangladesh. A total of 110 adult patients who had undergone chest radiography in the past month were enrolled from five private medical centers in Dhaka. The study will run for six months, from November 1, 2024, to April 30, 2025.

Participants will be recruited using a questionnaire-based method, and face-to-face interviews will be conducted to confirm their answers. The inclusion criteria were adults older than 18 years, and informed consent was mandatory. Those who could not read the questionnaire or had multiple X-rays within a short period were excluded.

Data will be gathered using a structured questionnaire developed systematically on knowledge, information sources, and perceptions of radiation safety. The questionnaire will be personally administered by trained research assistants, with an explanation when necessary.

For analysis, data were entered into statistical packages. Descriptive statistics will summarize demographic and awareness information, and inferential statistics will examine the relationships between the variables. The results are displayed as graphs and tables. To ensure data quality, training sessions for data collectors and routine monitoring of the collection process were established. Such processes are used to minimize errors and uphold research standards. Overall, the goal is to deliver insightful results that can lead to improved patient education and safety with regard to radiation exposure.

4. Results

In the following sections, we present a detailed breakdown of our findings, shedding light on the complexities of patient awareness, beliefs, and the pressing need for enhanced communication with healthcare providers.

Table I shows that the study involved a total of 110 participants, with the majority being in the 18–30 years age group, which was 43.6% of the total sample. The next largest age group was 31–45, making for 30.9% of the participants. A smaller portion (10.9%) was aged 46–60, while 9.1% were above 60 years. The youngest age group, below 18 years of age, was just 5.5%.

Regarding gender, 70.9% of the sample was male, constituting the majority. Of these, 28.2% were female and a small percentage (0.9%) belonged to another.

Fig. 1 indicates that regarding the educational attainment of the participants, the most populous category, standing at 42.7%, possessed a university or college degree. Secondary education holders accounted for 28.2% of the sample. A lower percentage (18.2%) had achieved a postgraduate degree, whereas 6.4% had no education. Finally, 4.5% of the participants indicated that they had only a primary education. The above statistics demonstrate the range of education included in the study population.

Fig. 2 shows that regarding participants' occupations, the majority (66.4%) were working, comprising a large portion of the sample. 22.7% of them were students, and 6.4% belonged to 'Other' occupation. The percentage of unemployed and retired individuals was 2.7% and, 1.8%. This indicates that most of the participants were working or studying.

Table II shows that the medical history of the participants demonstrated that a high percentage (98.2%) had undergone a chest X-ray before, whereas only 1.8% reported not having had any prior experience with X-ray examinations. Among the group that had undergone a chest X-ray, 47.3% showed that they had undergone the process just once, whereas 30.9% had undergone two to

TABLE I: Sociodemographic Distribution of the Respondents (N = 110)

Variable	Number of participants	Percentage (%)
Age		
Under 18	6	5.5%
18–30	48	43.6%
31–45	34	30.9%
46–60	12	10.9%
Over 60	10	9.1%
Mean ± SD = 34.8 ± 13.8 years		
Gender		
Male	78	70.9%
Female	31	28.2%
Other	1	0.9%

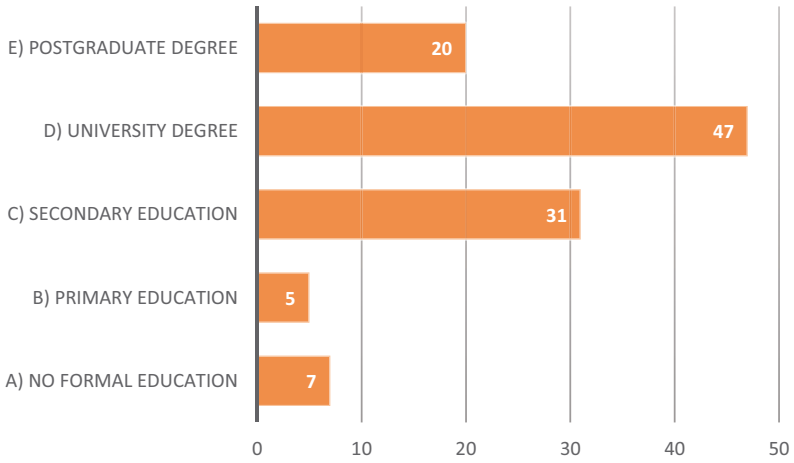

Fig. 1. Education level of the patients.

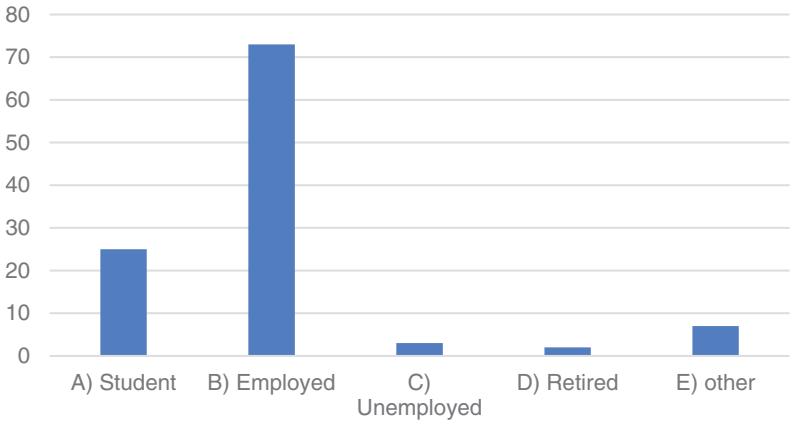

Fig. 2. Occupation level of the patients.

TABLE II: Medical History of the Patients

Questions	Variable	Number of frequencies	Total number of frequencies
Have you undergone a chest X-ray before?	Yes	108 (98.2%)	110 (100%)
	No	2 (1.8%)	
If yes, how many times have you had a chest X-ray?	Once	52 (47.3%)	110 (100%)
	2–5 times	34 (30.9%)	
	More than 5 times	24 (21.8%)	
Do you have a history of any radiation-related procedures	Yes	60 (54.5%)	110 (100%)
	No	50 (45.5%)	
How long ago did you have a chest X-ray?	1 week ago	27 (24.5%)	110 (100%)
	2 weeks ago	7 (6.4%)	
	3 weeks ago	12 (10.9%)	
	4 weeks ago	12 (10.9%)	
	Over 4 weeks ago	52 (47.3%)	

five X-rays. A smaller portion (21.8%) had undergone the process more than five times.

Of the radiation-related studies, 54.5% had a history of such studies and 45.5% did not have any such exposure.

When asked when they had their last chest X-ray, 24.5% had it within the last week. A smaller percentage (6.4%) had it two weeks ago, and 10.9% had it three or four weeks ago. The highest percentage (47.3%) had their last chest X-ray more than four weeks ago.

Table III indicates that information about participants' knowledge regarding the dangers of radiation represents their heterogeneous knowledge of the subject. Prior to receiving a chest X-ray, only 43.6% of the participants indicated that they were informed about potential exposure to radiation, 50.9% indicated that they were not informed, and 5.5% could not recall.

When they were asked how familiar they were with radiation exposure on a scale of 1 to 5, the majority (46.4%) were not familiar at all. Conversely, 25.5% responded with a score of 2, whereas 21.8% stated that they were fairly familiar. Only 4.5% of the participants responded that they were familiar.

Most participants (76.4%) believed that chest X-ray radiation could be hazardous to health. For particular hazards, 61.8% were associated with a risk of cancer and 50.9%

TABLE III: Awareness of Radiation Risks for Patients

Questions	Variable	Number of frequencies	Total number of frequencies
Before undergoing a chest X-ray, were you informed about the radiation exposure associated with the procedure?	Yes	48 (43.6%)	110 (100%)
	No	56 (50.9%)	
	Not sure	6 (5.5%)	
On a scale of 1 to 5, how familiar are you with the concept of radiation exposure?	1 (Not familiar at all)	51 (46.4%)	110 (100%)
	2	28 (25.5%)	
	3 (Somewhat familiar)	24 (21.8%)	
	4	2 (1.8%)	
	5 (Very familiar)	5 (4.5%)	
Do you believe that radiation from a chest X-ray can pose health risks?	Yes	84 (76.4%)	110 (100%)
	No	9 (8.2%)	
	Not sure	17 (15.5%)	
If yes, what type of risks do you think are associated with radiation exposure from chest X-rays?	Increased cancer risk	68 (61.8%)	110 (100%)
	Genetic mutations	56 (50.9%)	
	Immediate health effects	7 (6.4%)	
	No significant risks	11 (10%)	
	Other	13 (11.8%)	
Do you think that repeated exposure to X-rays increases the risk of health problems?	Yes	67 (60.9%)	110 (100%)
	No	18 (16.4%)	
	Not sure	25 (22.7%)	
Do you know if the amount of radiation from a chest X-ray is considered high or low?	High	13 (11.8%)	110 (100%)
	Low	20 (18.2%)	
	Not sure	77 (70%)	
Have you ever refused a chest X-ray due to concerns about radiation exposure?	Yes	20 (18.2%)	110 (100%)
	No	90 (81.8%)	
Would you ask for alternative imaging methods if you were concerned about radiation exposure?	Yes	25 (22.7%)	110 (100%)
	No	34 (30.9%)	
	Not sure	51 (46.4%)	
Do you think healthcare providers should always inform patients about the radiation risks before performing a chest X-ray?	Yes	85 (77.3%)	110 (100%)
	No	7 (6.4%)	
	Not sure	18 (16.4%)	

reported genetic mutations. A small percentage (6.4%) believed that there may be direct health consequences and 10% believed that there were no significant hazards. Furthermore, 11.8% of the respondents listed other hazards.

Regarding repeated exposure, 60.9% felt that it contributed to the risk of health problems, 16.4% did not think so, and 22.7% were unsure. When asked if they knew the level of radiation exposure from chest X-rays, 70% were unsure, 18.2% felt that the exposure was low, and 11.8% felt that it was high.

Only 18.2% refused chest radiography due to radiation exposure. However, 22.7% of those who answered stated that they would ask for other imaging methods if they were concerned, and 46.4% were not sure. Finally, the majority (77.3%) believed that medical practitioners should always inform patients of the radiation risk before taking a chest radiograph, while 6.4% disagreed and 16.4% were unsure.

Table IV indicates that the respondents cited a range of sources of information regarding the risks associated with exposure to radiation. The most prevalent source was the Internet, from which 47.3% of the participants acquired information about radiation risks. Medical practitioners and media sources, including television, radio, and printed materials, furnished information to 30.9% of the participants. Additionally, 17.3% obtained information from family members or friends and 20% obtained information from school. However, 15.5% of participants indicated that they were not provided with any information regarding the matter.

When queried whether they wished to receive additional information regarding the risks of radiation from medical imaging, most of them (81.8%) were interested in knowing more. A few (8.2%) were not interested in receiving more information, and 10% were not sure.

Fig. 3 indicates that when the respondents were queried about their concerns over radiation exposure from medical imaging, nearly half (46.4%) responded that they had no concern at all. Another 32.7% had a low level of concern, and 13.6% had a moderate level of concern. A few (4.5%) indicated that they were highly concerned, and only 2.7% had an extreme level of concern regarding the danger involved. This indicates that, although the majority of the respondents expressed low to moderate anxiety, a few expressed greater fear regarding radiation exposure.

Fig. 4 indicates that when the respondents were questioned regarding their perceptions of whether the benefits of a chest X-ray were greater than the risks of radiation exposure, an overwhelming majority (66.4%) answered affirmatively. However, 16.4% believed that the risks were greater than the benefits, while 17.3% were undecided. This indicates a very strong perception among the respondents that the benefits of obtaining a chest X-ray generally outweigh the potential risk of radiation exposure.

TABLE IV: Sources of Information for Patients

Questions	Variable	Number of frequencies	Total number of frequencies
Where did you learn about the risks associated with radiation exposure?	Healthcare providers	34 (30.9%)	110 (100%)
	Internet	52 (47.3%)	
	Family/Friends	19 (17.3%)	
	Media (TV, radio, newspapers)	34 (30.9%)	
	Educational institutions	22 (20%)	
	I have not received any information	17 (15.5%)	
Would you like to receive more information about the risks associated with radiation from medical procedures?	Yes	90 (18.8%)	110 (100%)
	No	9 (8.2%)	
	Not sure	11 (10%)	

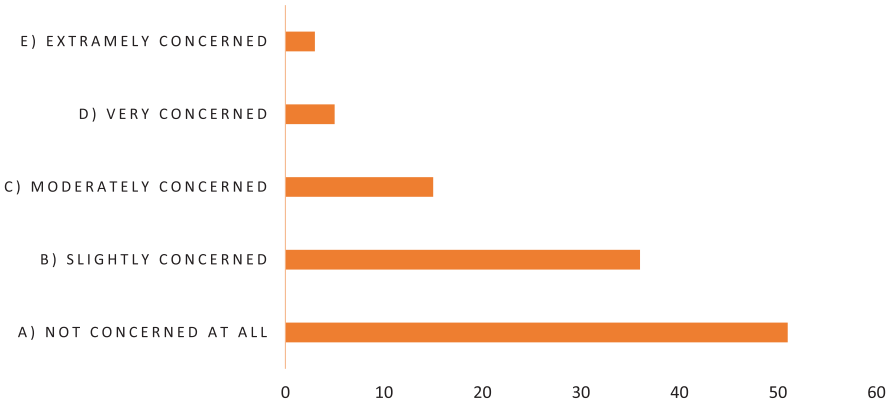

Fig. 3. Patient concern levels regarding radiation exposure from medical imaging.

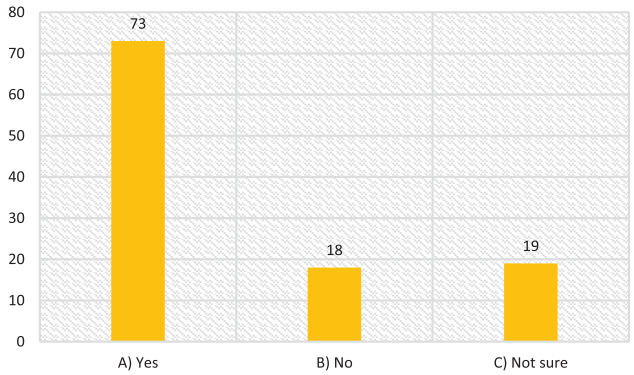

Fig. 4. Patient perceptions on whether the benefits of chest X-rays outweigh the risks of radiation exposure.

Table V reveals that under patients' perceptions and behaviors, 38.2% of the participants reported that the increased knowledge of the risks of radiation would affect their choice to undergo chest radiography in the future. Conversely, 17.3% reported that the information would not affect their decision, while 44.5% were unsure.

Regarding confidence in healthcare providers, most of them (80%) were confident that their healthcare provider would order a chest X-ray only if necessary. Few (7.3%) were not confident and 12.7% were unsure.

There was a keen interest in knowing more about radiation safety, as indicated by 93.6% of the group who preferred learning materials, including brochures and videos, whereas only 6.4% did not express a desire for these media.

5. Discussion

This study aimed to evaluate the level of patient awareness of the radiation hazards of chest X-rays in a representative sample from Dhaka, Bangladesh. These results have important implications in terms of demographic trends, knowledge deficits, and attitudes that can influence patient behavior and healthcare communication policies.

An interesting observation from the demographic data is that a large percentage of respondents belonged to the younger age bracket (18–30 years, 43.6%) and an overwhelming majority were male (70.9%). Levels of educational attainment showed an encouraging trend, with 42.7% of the respondents reporting college or university education, and 18.2% possessing postgraduate degrees. Despite this relatively well-educated group, knowledge of radiation risks was found to be in limited supply, suggesting a disconnect between overall education level and expert knowledge of medical imaging safety. Almost all (98.2%) had previously been exposed to chest X-rays, with one in five individuals (21.8%) having experienced more than five exposures. However, only 43.6% said they were informed of radiation risks prior to exposure, and 46.4% had no understanding of radiation exposure when asked directly on a 1–5 scale.

This lack of knowledge could reflect poor communication of information by health professionals or lack of easily accessible public health education programs. Interestingly, 76.4% of interviewees believed that chest X-rays might have health consequences, 61.8% were associated with cancer, and 50.9% had genetic mutations. This disparity, characterized by scant information but high concern

TABLE V: Patient Perception and Behavior

Questions	Variable	Number of frequency	Total number of frequencies
Would knowing more about radiation risks influence your decision to undergo a chest X-ray in the future?	Yes	42 (38.2%)	110 (100%)
	No	19 (17.3%)	
	Not sure	49 (44.5%)	
Do you trust that your healthcare provider will only recommend a chest X-ray if it is necessary?	Yes	80 (80%)	110 (100%)
	No	8 (7.3%)	
	Not sure	14 (12.7%)	
Would you be interested in educational materials (e.g., brochures, videos) about radiation risks and safety?	Yes	103 (93.6%)	110 (100%)
	No	7 (6.4%)	

levels, can be attributed to the presence of incomplete or untested sources of information, as evidenced by the fact that 47.3% of them received radiation-related information mainly from the Internet, whereas only 30.9% were informed by medical practitioners. In addition, 15.5% said they received no information.

When evaluating the concern levels, nearly half (46.4%) showed no concern over radiation exposure, while 32.7% showed only minimal concern. These figures suggest some desensitization or misinformation on the part of the population, even though 60.9% admitted that repeated exposure might result in cumulative health hazards. The difference in beliefs and concern levels might be due to the finding that 70% of respondents were unclear about what actual dosage of radiation is received during a chest X-ray.

The balance of benefits over risks was in strong favor of endorsing chest X-rays, as 66.4% of the sample confirmed that benefits outdid potential risks. However, 38.2% conceded that a greater awareness of radiation-induced harm would influence future X-ray decisions, highlighting the necessity for structured patient education campaigns. Furthermore, the findings revealed that a mere 18.2% had ever declined an X-ray, indicating that awareness in certain instances does not necessarily lead to responsible behavioral change.

Trust in healthcare providers was also high (80%), suggesting that patients had confidence in doctors to order imaging only when required. This trust can be an effective conduit for sharing correct information. Promisingly, 93.6% of respondents were keen on educational materials, such as brochures and videos, demonstrating a high level of demand for patient education.

The relationship between levels of awareness and history suggests that previous exposure to several chest X-rays has not been used to significantly increase the level of knowledge regarding radiation risks. This indicates a missed opportunity in which regular contact with healthcare services may have been used for patient education. Furthermore, individuals with a history of imaging might assume an attitude of passive compliance, which is inherently dangerous unless supplemented by informed consent and knowledge. Lastly, the study revealed three principal concerns: (i) a wide existing lack of knowledge about radiation, despite numerous incidents of exposure to imaging; (ii) dependence on non-medical sources of information about health; and (iii) a great patient desire to learn more. These results emphasize the need to incorporate systematic patient education into diagnostic procedures and improve communication among healthcare providers. By solving these deficiencies, one can facilitate better imaging protocols and enable patients to actively engage in healthcare decisions.

Conflict of Interest

The authors declare that they do not have any conflict of interest.

References

[1] Brower C, Rehani MM. Radiation risk issues in recurrent imaging. *British J Radiol*. 2021;94(1126):20210389.
[2] Demir MC, Akkas M. Awareness of risks associated with the use of plain X-Ray, computed tomography, and magnetic resonance imaging among emergency physicians and comparison with that of other physicians: a survey from Turkey. *Med Sci Monitor: Int Med J Exp Clin Res*. 2019;25:6587.
[3] Bastiani L, Paolicchi F, Faggioni L, Martinelli M, Gerasia R, Martini C, *et al.* Patient perceptions and knowledge of ionizing radiation from medical imaging. *JAMA Netw Open*. 2021;4(10):e2128561.
[4] Sweetman SJ, Bernard J. Patient knowledge and perception of radiation risk in diagnostic imaging: a cross-sectional study. *J Patient Exp*. 2020;7(1):110–5.
[5] Takakuwa KM, Estepa AT, Shofer FS. Knowledge and attitudes of emergency department patients regarding radiation risk of CT: effects of age, sex, race, education, insurance, body mass index, pain, and seriousness of illness. *Am J Roentgenol*. 2010;195(5):1151–8.
[6] Kazdin AE. Evidence-based treatment and practice: new opportunities to bridge clinical research and practice, enhance the knowledge base, and improve patient care. *Am Psychol*. 2008;63(3):146.