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ASSESSING PARENTAL AWARENESS, KNOWLEDGE, AND PERCEPTIONS OF IONIZING RADIATION RISKS IN PEDIATRIC MEDICAL IMAGING IN THE HOSPITAL OF KARACHI

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Abstract

With the advancement in medical imaging, radiological applications in the pediatric population have also increased. Children, generally more radiosensitive, have a higher risk of developing certain malignancies. Therefore, this may result in uneasiness among parents and caretakers when their children need to undergo a medical imaging examination. Hence, the study aims to evaluate parental knowledge regarding medical radiation and associated risks in pediatric medical imaging. A descriptive cross-sectional quantitative research design was employed. The research was carried out within the radiology units of a chosen hospital, among parents or guardians of children who are undergoing imaging tests that utilize radiation (e.g., X-rays or computer tomography scans). A convenience sampling method was used with a sample size of 150. Information was gathered through a structured, validated questionnaire which was pre-tested. Ethical approval was obtained from the IRB. Data were examined using SPSS, employing both descriptive and inferential statistics. Results show most parents showed limited awareness and understanding of the risks of ionizing radiation in pediatric medical imaging. While some had basic knowledge, many underestimated potential harms. Communication from healthcare providers was present but often unclear, leaving gaps in parental understanding. Overall, the findings highlight the need for improved education and clearer explanations to help parents make informed decisions. In conclusion, results will help improve communication between doctors and parents, raise awareness, and support safer imaging practices for children. It will also guide hospitals and policymakers in Pakistan to create better educational tools and safety guidelines, ultimately benefiting children, families, and healthcare workers.

INTRODUCTION

The term "paediatric radiosensitivity" describes how children's cancers react differently to radiation therapy, which is essential for successful paediatric oncology treatment (Zhang, 2025). The type of tumour, genetic composition, and the capacity to repair

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radiation-induced DNA damage all affect this sensitivity (Lin, 2025). Measuring and comprehending this radiosensitivity can result in more individualized treatment plans, which will ultimately improve young patients' results (Nuijens, 2025).Radiosensitivity in paediatric solid tumours varies significantly between and within tumour types (Zadeh, 2026)According to a study, 56% of paediatric patients were categorized as radiosensitive based on how they reacted to radiation, underscoring the necessity of customized treatment regimens (Hota, 2026).DNA double-strand breaks (DSBs) are recognized and repaired as part of the cellular response to radiation (Zhang, 2026).

Radiation exposure poses potential health risks, yet public awareness regarding its sources, effects, and safety measures remains inconsistent (Bera, 2026). Understanding the level of knowledge and perceptions about radiation risks is essential for developing effective educational strategies (Matsun, 2026).Medical imaging techniques such as X-rays and CT scans are commonly used in paediatric care (Irede, 2026). While these procedures are often necessary, they expose children to ionizing radiation, which carries potential long-term health risks such as cancer (Chen, 2025). Children are especially vulnerable due to their rapidly developing tissues and longer life expectancy (Sattorov, 2025). Despite this, many parents are not aware of the risks associated with radiation exposure or the protective measures available (Granata, 2025). In Pakistan, there is little to no formal system in place to educate parents or obtain informed consent regarding radiation exposure in pediatric imaging (Memon, 2025).

Diagnostic imaging, particularly computed tomography (CT) and radiography, is increasingly utilised in paediatric emergency departments (PEDs) for the diagnosis and management of patients (Freire, 2026). In emergency departments (EDs), where CT is frequently utilised for the evaluation of head injury, abdominal pain and patients with polytrauma, a fivefold increase in the use of CT has been reported over the last decade (Lee, 2026). This is of special concern, because CT involves much higher radiation doses than other diagnostic modalities (Kanwal, 2026). Children are more radiosensitive than adults (Mohan, 2026). Hence, the potential malignancy risk associated with exposure to ionising radiation may be greater among children (Zadeh, 2026). The variation in radiation dose might indicate a lack of knowledge or skills to manipulate imaging protocols (Melo, 2026) therefore, it is important for radiographers to have adequate knowledge about radiation dose optimization during examinations (EL Fahssi, 2026). Radiation safety precautions are required, especially with the increasing use of CT technology in clinical diagnosis (Janetzki, 2026). Assessing the level of knowledge is an important aspect in recognizing and resolving deficiencies for an optimal reduction of radiation hazards to all persons involved in the radiological examination.

Problem Statement:

Paediatric imaging procedures such as X-rays and CT scans are essential tools in the diagnosis and management of childhood illnesses (Irede, 2026; Pyar, 2026). However, these tests involve ionizing radiation, which poses a greater risk to children due to their growing tissues and increased sensitivity to radiation exposure (Zadeh, 2026). Furthermore, their longer life expectancy provides a greater window for radiation-induced diseases such as leukemia and thyroid cancer to develop (Hota, 2026; Polleri, 2026).

Despite this, many parents are unaware of the radiation risks involved in paediatric imaging. A study in Malaysia found that less than 50% of parents correctly identified CT scans as high-radiation procedures, and only 42% were aware that nuclear medicine and fluoroscopy involve ionizing radiation (Granata, 2025) . Studies show that 68% to 98% parents answered radiation-related questions incorrectly, regardless of whether their child had previously undergone such imaging (Wells, 2025; Häring, 2025) .

In Pakistan, the situation is even more concerning as radiology staff lacked sufficient knowledge of radiation protection protocols (Aziz, 2025; Wadood, 2025). Another study revealed that over 60% of general physicians misclassified ultrasound as a radiation-based test, showing widespread misinformation even

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among healthcare providers (Memon, 2025; Haziq, 2025) .

Therefore, there is an urgent need to explore and understand what Pakistani parents actually know and believe about radiation in medical imaging, and how healthcare providers can improve communication. This study addresses a critical public health issue by aiming to fill this knowledge gap, enhance parental awareness, and promote safer pediatric imaging practices.

Research Question: What is the association between parental knowledge of ionizing radiation risk in medical imaging and paediatric ionizing risks their children go through?

Research Objective: To access the relationship between parental knowledge of ionizing radiation risk in medical imaging and paediatric ionizing risks their children go through.

Hypothesis:

H0: There is no significant relationship between parental knowledge of ionizing radiation risk in medical imaging and paediatric ionizing risks their children go through.

H1: There is significant relationship between parental knowledge of ionizing radiation risk in medical imaging and paediatric ionizing risks their children go through.

Literature Review:

Theoretical Framework:

The theoretical framework of the research is based on Knowledge Attitude Practice Model (KAP).The Knowledge-Attitude-Practice (KAP) model, a fundamental behavioral theory used to evaluate health behaviours, Schwartz (1987) formalized its application for survey design, arguing that knowledge influences attitude, which then drives practice. It is frequently used in health education to comprehend the connections between gaining knowledge, developing attitudes, and subsequently altering behaviours (practices). Schwartz (1987) developed the KAP model as a structured survey method for quantitative research.

The Knowledge, Attitude, Practice (KAP) model is a public health framework that evaluates the relationship between a population's understanding (Knowledge), beliefs/feelings (Attitude), and behaviors (Practice) regarding a health issue. It aims to guide health education and interventions by assuming that knowledge influences attitudes, which then shape actions, though it acknowledges other factors (Alnuaimi, 2024). KAP surveys are used by researchers to monitor behavior change, discover misunderstandings, and uncover knowledge gaps in order to build focused solutions, such as better cancer prevention or chronic disease management (Khan, 2025).Although real-world application frequently exposes differences between reported attitudes and actual behaviors, the model suggests that improved knowledge leads to more positive attitudes, which in turn drives desired practices (Erhabor, 2025).

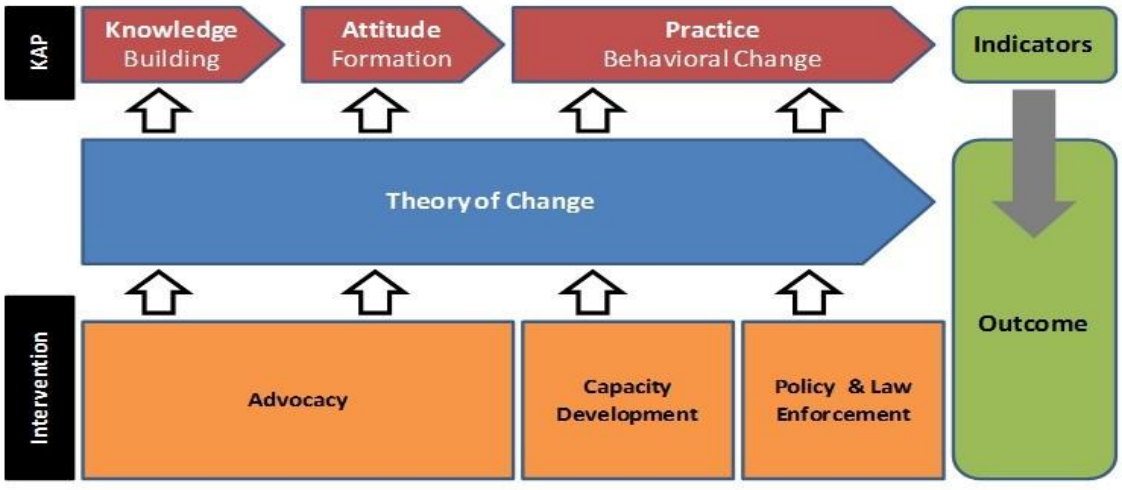

Fig 1: Knowledge Attitude Practice (KAP) Model

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Global Trends in Paediatric Imaging:

Over the past ten years, the field of pediatric imaging has changed dramatically due to improvements in imaging technology and a move toward non-ionizing modalities (Aziz, 2025). Growing knowledge of the radiation dangers connected to conventional imaging methods, especially computed tomography (CT), is reflected in this shift (Wells, 2025). Research shows a significant increase in the usage of ultrasound and MRI in Pakistan (Ullah, 2025). The use of MRI increased by 280%. MRI and ultrasound are now more common in emergency rooms than CT, which decreased from 3.9% to 2.9%.CT is still essential for certain evaluations, like lung and bone assessments, even if its use is generally declining (Na, 2025). The evaluation of paediatric cardiac problems has been improved by developments in echocardiography, such as tissue Doppler techniques and three-dimensional imaging (Ahmed, 2025). Beyond neurological uses, MRI is now used for cardiac and musculoskeletal assessments (Zaman, 2025). The need to reduce radiation exposure in children, particularly in light of the potential hazards associated with CT, is driving the transition towards non-ionizing imaging modalities.

Parental Knowledge and Perception of Risk

Parents' judgments on paediatric imaging procedures are greatly influenced by their perceptions and understanding of radiation hazards (Memon, 2025). It is important to comprehend these aspects since they can either help or hinder children's access to critical medical interventions (Eaton, 2025). A lot of parents don't know enough about the dangers of pediatric imaging (Mussmann, 2025).A survey revealed that 75.34% of parents were not aware of the dangers associated with ionizing radiation in Jordan. (Hazaymeh, 2025).Parents are more inclined to consent to imaging procedures when they are informed about the risks associated with radiation, according to educational interventions (Larsen, 2025). In general, parents have a great deal of faith in the medical professionals who treat their children (Sajjad, 2025). A more positive attitude toward essential imaging can result from this trust, which helps allay worries about radiation exposure.

Socio-Clinical Context of Pakistan

Pakistan's health literacy rate is still extremely poor, which has a substantial impact on patients' capacity to make wise medical decisions (Malik, 2025). This insufficiency results in a lack of knowledge about wellness and disease prevention, poor treatment adherence, and delayed illness presentation (Hamza, 2025). One possible way to improve health literacy among the general public is to integrate media and mobile technology for the distribution of health information (Taufek, 2025). According to a survey, 86.7% of participants acknowledged the value of laboratory testing for early diagnosis, yet only 26.4% had recently had one. With 33.2% of people not knowing their blood type, there is a clear lack of basic health knowledge. Because they find it difficult to successfully manage their health, persons with low health literacy are more likely to be hospitalized and use emergency care. Preventive care is less common among patients with inadequate health literacy, which results in worse health outcomes and higher medical expenses (Ferreira-Alfaya, 2025). In Pakistan, doctors continue to practice paternalistic medicine, which involves making choices with little input from patients or their families (Akhtar, 2025). This method, which has its roots in cultural and religious beliefs, places a strong emphasis on protecting patients from upsetting information and places the doctor and family at the centre of medical decision-making. The Pakistani model incorporates the family and religious views into the decision-making process, with the doctor frequently viewed as an authoritative figure similar to a family member, in contrast to Western models that place an emphasis on patient autonomy (Jawwad, 2025). In Pakistan, family members frequently make the majority of medical decisions, particularly when a patient has a fatal condition (Mann, 2025). The family may decide to keep upsetting facts from the patient in order to preserve hope, but the doctor is expected to provide guidance (Nikoloudi, 2025). The decision-making process is influenced by the conviction that God ultimately controls life and death, and

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families frequently respect the doctor's judgment while upholding their religious beliefs. Patient autonomy is typically given top priority in Western nations, where legal frameworks uphold patients' rights to make knowledgeable decisions about their care, even in situations where their disease is fatal (Eryani, 2025).In Western cultures, the transition from paternalism to shared decision-making is indicative of a larger cultural trend toward informed consent and individual liberty. The necessity of striking a balance between patient autonomy and professional guidance is becoming more widely acknowledged (Olorunfemi, 2025).

Research Methodology:

Research Design: A descriptive cross-sectional quantitative research design was employed to evaluate parents' awareness, knowledge, and perceptions of risks of ionizing radiation from paediatric imaging. The research was carried out within radiology units of chosen hospitals, among parents or guardians of children who are undergoing imaging tests that utilize radiation (e.g., X-rays or computer tomography scans).

Study Setting: This study was conducted at the Radiology Department of Indus University Hospitals and Health Network Karachi. The hospital serves as a tertiary care centre and caters to a large and diverse paediatric patient population in Karachi.

Inclusion Criteria:

- Parents or legal guardians of children aged 0–17 years undergoing any radiological imaging procedure (e.g., X-ray, CT, fluoroscopy, radiotherapy) during the data collection period.
- Individuals who provide informed written consent.
- Participants who can understand and respond to the questionnaire in either English or Urdu, or translators could be arranged for them.

Exclusion Criteria:

- Parents of critically ill children requiring emergency imaging
- Parents/guardians unwilling to participate or unable to provide informed consent
- Individuals with professional medical training in radiology or imaging (to avoid knowledge bias in general population assessment)
- Participants who are not able to understand and respond to the questionnaire in either English or Urdu, or a translator was not available at the moment.

Sampling Technique:

A non-probability, convenience sampling method was employed, as time and resource constraints were anticipated. It is a suitable method for exploratory, hospital-based studies where access to the general population is limited. Parents or legal guardians of paediatric patients who are receiving medical imaging procedures within the radiology departments were included for data collection. A statistically determined sample size was employed to provide sufficient power and precision. Based on calculator.net for sample size, 95% confidence level, 5% margin of error, and an assumed awareness rate of 50% (max variability), the sample size is 251 for a population size of over 720 is calculated, out of which 150 is finalized. This figure guarantees statistical significance while factoring in time and resource limitations in a hospital-based cross-sectional survey.

Data Collection Instrument:

Data were gathered via a designed, self-created questionnaire specifically constructed to measure parental knowledge of radiation risks in pediatric imaging. This study was conducted after the IRB approval. Hardcopy questionnaires were distributed to parents and caretakers who visited the Radiology Department. Data in this quantitative research was gathered through a structured self-administered questionnaire to measure parental knowledge, awareness, and perceptions of risks associated with ionizing radiation in paediatric medical imaging. The questionnaire consisted of closed-ended items and Likert-scale questions on important areas such as: Knowledge about radiation-based imaging procedures (X-ray, CT, etc.), Awareness of risks due to radiation in children, perceived safety and appropriateness of imaging tests, Sources of information (e.g., physicians, media, internet). The questionnaire

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was created using available validated instruments and vetted by subject matter experts for content validity. A pilot study was carried out on a small sample to evaluate clarity, reliability, and uniformity. Participants (parents or legal guardians) were approached in radiology departments of the shortlisted hospitals employing a non-probability, convenience sampling method. All responses were kept anonymous and stored safely.

Ethical Considerations

This study was conducted in strict accordance with the British Educational Research Association (BERA) Ethical Guidelines and local institutional requirements. The following key ethical principles were observed:Participation in the study was entirely voluntary. All participants were given clear and comprehensive information sheets describing the nature and purpose of the study, their right to refuse or withdraw at any point without any consequences. Pseudonyms were used in transcripts and reports to ensure anonymity. Audio recordings and transcripts were securely stored in password-protected devices and only accessible to the researcher. All data were securely stored in line with data protection laws (e.g., GDPR-equivalent local policy). Audio files were deleted after transcription and analysis. Hard copies and digital files were retained for a period specified by the institution and then permanently deleted. Formal ethical approval were obtained from the Institutional Review Board (IRB)/Ethical Committee of the Indus Hospital and Health Network prior to data collection

Data Analysis: Data was analysed by using IBM SPSS (Statistical Package for the Social Sciences), version 22. Descriptive and inferential statistics were calculated. For descriptive, means, medians, modes, frequencies and standard deviations were calculated. Measures of associations were found by running correlational tests on SPSS. For inferential statistics, correlational tests were applied after checking assumptions of the test.

Results: This chapter presents the findings of the study on parents' and caretakers' awareness regarding medical imaging-related radiation exposure in children. Out of 251, a sample size data was collected from 150 respondents, all of whom provided complete responses. Descriptive and inferential statistical analyses were performed to interpret the findings.

Table 1: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Gender	150	1	2	1.49	.502
Ethnic group	150	1	5	2.58	1.302
Occupation	150	1	5	3.28	1.286
Education Level	150	1	5	1.94	1.286
B1	150	7.00	22.00	15.6733	2.81295
B2	150	8.00	23.00	13.9667	3.15041
Valid N (listwise)	150				

Table 1 shows the descriptive statistics of the data which says that the study sample consisted of 150 participants with no missing data across the primary variables. B1 refers to parental knowledge of ionizing radiation and B2 denotes the paediatric ionizing risks their children go through. Demographic analysis indicated a nearly equal gender distribution (M = 1.49, SD = .502) and a diverse range of ethnic backgrounds (M = 2.58, SD = 1.302). Participants reported a mean education level of 1.94 (SD = 1.29) and a mean occupational status of 3.28(SD = 1.29). Regarding the primary study measures, variable B1 yielded a mean score of 15.67 (SD = 2.812), while variable B2 yielded a slightly lower mean score of 13.97 (SD = 3.15). Both B1 and B2 exhibited a similar range of scores, with observed values spanning from 7.00 to 22.00 and 8.00 to 23.00, respectively.

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Table 2: Correlations

			B1	B2
Spearman's rho	B1	Correlation Coefficient	1.000	.190*
		Sig. (2-tailed)	.	.020
		N	150	150
	B2	Correlation Coefficient	.190*	1.000
		Sig. (2-tailed)	.020	.
		N	150	150

*. Correlation is significant at the 0.05 level (2-tailed).

The association between parental awareness of ionizing radiation risk in medical imaging (B1) and the perceived pediatric ionizing dangers parents encounter (B2) was evaluated using a Spearman's rank-order correlation.N = 150 was the sample size used in the analysis. The findings showed that the two variables had a weakly positive, statistically significant correlation r_s(148) =.190, p =. 020.Perceived paediatric ionizing hazards (B2) somewhat rise in tandem with parental awareness of ionizing radiation dangers (B1). The null hypothesis is rejected since the p-value (p =.020) is smaller than the alpha threshold of.05, indicating that the association is not the result of chance.Although the relationship was significant, the strength of the association was weak, suggesting that B1 accounts for approximately 3.6% of the variance in B2.

In summary, the results show that parents and caretakers have inadequate awareness and understanding of medical imaging-related radiation exposure. Although trust in physicians remains high, the communication between doctors and parents is limited, and knowledge about radiation safety and health risks is poor. Most respondents were unaware of the potential long-term effects of radiation and protective measures such as shielding. However, the overwhelming willingness of participants to receive further education demonstrates a positive attitude toward learning and improving awareness. These findings underscore the need for targeted educational interventions and improved communication strategies between healthcare providers and parents to enhance radiation safety awareness in pediatric imaging.

Discussion

The results show that parents and caretakers have inadequate awareness and understanding of medical imaging-related radiation exposure and the results are consistent with numerous studies that have shown that parents and caregivers' knowledge and comprehension of radiation exposure connected to medical imaging is noticeably lacking. The surveys show that there is a substantial knowledge gap on the dangers of ionizing radiation, especially in paediatric groups where children are more vulnerable to the effects of radiation (Taliaferro, 2025). According to a Malaysian study, only 40.5% of parents correctly answered more than half of the knowledge-based questions, and over 40% of parents were unable to identify dose-saving imaging techniques (Ng et al., 2022).According to the study 75.34% of parents in Togo were ignorant of the risks connected to radiological imaging, with cancer being the most well-known risk at 63.64%.75.6% of caregivers in India were ignorant of ionizing radiation, with radiographers providing the majority of the information (Singh & Naagar, 2023).

Regarding the Knowledge of CT vs. X-ray dosage, the mean was only 0.77 (SD=0.95), suggesting that a large number of parents are not aware that CT scans require higher radiation doses than typical X-rays. Compared to ordinary X-rays, CT scans expose children to much higher radiation doses, which many parents are still unaware of. According to research, caregivers are worryingly ignorant about the dangers of ionizing radiation from medical imaging, especially CT scans (Eaton, 2025). Given that children are more vulnerable to the impacts of radiation, this ignorance may have detrimental effects on their health (Cousins, 2025). According to a study, parents

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gave false answers when asked about radiation exposure from CT scans. Less than half of paediatricians were aware of the ALARA (As Low as Reasonably Achievable) radiation protection principle (Elmehdi et al., 2020). A conventional chest X-ray has an effective dose of about 0.02 mSv, but a chest CT scan has an effective
dose of 5-10 msv (Nasir, 2025).

Despite making up fewer than 5% of all X-ray operations, CT scans contribute over 40% of the radiation dosage from medical X-rays (Badran, 2025).CT scans may raise the risk of cancer, according to epidemiological research, especially in children who are more radiosensitive.

Since children have a longer time to experience radiation-related consequences, the growing use of CT scans in paediatric care raises concerns regarding long-term health outcomes.

Clinical communication was shown to have a major gap. Before the operation, only around 5% of parents said their doctor had discussed the particular type of imaging (e.g., MRI vs. CT) ($M=0.05, SD=0.212). With a mean score of just 0.26 (SD=0.650), information about possible radiation dangers was rarely conveyed. Clarity: On a 1–5 scale, participants gave clinicians' explanations of scans and risks a low clarity rating (M=1.77, SD=1.477). 94% of parents (M=0.94, SD=0.238) said they would like to receive more information on radiation safety from their healthcare providers, demonstrating the overwhelming demand for greater knowledge. Radiation concerns related to diagnostic imaging, especially CT scans, are frequently not adequately communicated, which leaves patients with substantial gaps in their knowledge. Studies show that although patients express a need for information about radiation exposure, healthcare practitioners often fall short in providing this vital information.

According to a study, even though 94.3% of patients wanted to know about the dangers involved, only 7.2% of patients were told about the radiation dose before a CT scan (Alrasheed & Al-Ammar, 2024). According to 58.5% of patients in emergency rooms, doctors failed to convey possible radiation hazards, which increased patients' worry (Alsubaie & Abujamea, 2024).Patients may undertake operations without fully comprehending the potential long-term implications, which presents ethical difficulties when radiation hazards are not adequately communicated. This disparity puts healthcare providers at danger of legal ramifications in addition to undermining informed consent.

The results point to a contradictory link between clinician communication and parental trust. There is a serious flaw in the informed consent procedure, even though parents generally accept their doctors' advice (M=3.52). The majority of parents are not informed about the particular kind of scan or the radiation hazards involved (M=0.05 and 0.26, respectively).Additionally, a significant opportunity for healthcare providers to implement better educational interventions and communication strategies to reduce parental anxiety and improve health literacy regarding pediatric imaging is highlighted by the low awareness of the difference between CT and X-ray radiation (M=0.77) and a very high demand for more information (M=0.94).

Conclusion

The findings suggest a conflicting relationship between parental trust and clinician communication. Even while parents typically follow their doctors advise (M=3.52), there is a significant problem with the informed consent process. Most parents are unaware of the specific type of scan or the radiation risks associated with it (M=0.05 and 0.26, respectively). Additionally, the low awareness of the distinction between CT and X-ray radiation (M=0.77) and the high demand for additional information (M=0.94) highlight a significant opportunity for healthcare providers to implement better educational interventions and communication strategies to reduce parental anxiety and improve health literacy regarding paediatric imaging.

This study reveals that parents and caretakers in our institution generally have limited awareness of radiation exposure related to medical imaging. Although communication between healthcare providers and parents does occur, it often lacks clarity and effectiveness, which may contribute to a poor understanding of radiation risks. Doctors and radiographers need to dedicate more time to explaining radiation safety, potential risks, and benefits to parents and

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caretakers before performing paediatric imaging procedures. In addition to verbal explanations, educational brochures should be provided in radiology departments as helpful reading material while parents wait for their child's examination. To further enhance safety and transparency, implementing a radiation exposure tracking program is highly encouraged. Such a program would help record and monitor the type and dose of radiation each pediatric patient receives over time a measure that received strong support from respondents in this study.

Key findings show that over 40% of parents and caretakers were unable to identify imaging modalities that use ionizing radiation or dose-saving techniques. Only 40.5% achieved a satisfactory knowledge score regarding radiation-related risks and safety. There was also a significant link between the respondents' role and their level of knowledge. More than 70% of the respondents understood that pregnant women are not allowed to accompany their children during the radiography procedure. The presence of warning signboards displayed on on each x-ray and CT room in this centre helps remind the parents and caretakers. Interestingly, while more than 80% of participants reported receiving explanations about their child's imaging procedure, this did not significantly improve their understanding of radiation exposure. Nonetheless, most parents expressed willingness to support the introduction of a radiation tracking program for paediatric patients. In conclusion, parents and guardians must be better informed about the imaging procedures their children undergo and the associated radiation risks. Strengthening communication, education, and tracking practices will not only enhance safety but also build trust between families and healthcare providers.

Recommendations

1. Hospitals and universities should develop simple, easy-to-understand educational materials (brochures, posters, videos) to teach parents about radiation safety and imaging benefits.
2. Radiologists and technologists should receive training on how to clearly explain radiation risks and benefits to parents, especially in pediatric settings.
3. Standardized consent forms should be introduced, ensuring parents understand the reason, safety measures, and possible risks before their child undergoes any imaging procedure.
4. National-level awareness programs can help correct common misconceptions about radiation and its medical uses.

Further Research: Future studies need a mixed-method approach in diverse hospitals to pursue triangulation.

REFERENCES

Ahmed, A., Gul, J., Jan, M. A., Karim, S. A., Waqas, M., & Ikram, M. (2025). Prevalence and Management of Congenital Heart Diseases in Pakistan: A Comprehensive Cross-Sectional Study. *Journal of Health, Wellness, and Community Research*, e75-e75.

Akhtar, M. U., Bhatti, M. E., & Fredericks, S. (2025). What factors influence patient autonomy in healthcare decision-making? A systematic review of studies from the Global South. *Nursing ethics*, *32*(3), 875-891.

Alnuaimi, A. S., Syed, M. A., Zainel, A. A., Mohamed, H. A., Bougmiza, M. I., & Syed, M. A. (2024). Cultural & region-specific adaptation of KAP (Knowledge, attitude, and practice) tool to capture healthy lifestyle within primary care settings. *PloS one*, *19*(12), e0312852.

Alrasheed, A. A., & Al-Ammar, E. A. (2024). *What Patients Want to Know About CT Radiation Exposure Harm and What Doctors Actually Tell Them: A Gap in Patient-Doctor Communication*. https://doi.org/10.21203/rs.3.rs-3956987/v1

Alsubaie, F. H., & Abujamea, A. H. (2024). Knowledge and Perception of Radiation Risk From Computed Tomography Scans Among Patients Attending an Emergency Department. *Cureus*. https://doi.org/10.7759/cureus.52687

Frontier in Medical & Health Research

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Aziz, M. M., Onyejesi, C., Pyala, R., Alattar, O., Abdul, A. A., Alagarswamy, K., ... & Alsabri, M. (2025). Reducing radiation exposure in pediatric CT imaging: strategies and alternatives in emergency medicine—a narrative review. *Journal of Emergency and Critical Care Medicine*, *9*.

Aziz, R., & Aman, N. (2025). Assessment of Awareness and Practice of Radiation Protection among Healthcare Professionals of a Developing Country. *Pakistan Journal of Radiology*, *35*(3).

Badran, H. M., Mourad, M. M., & Sharshar, T. (2025). Effective Shielding Elements and Oxides for Medical X-ray Applications. *Applied Radiation and Isotopes*, 112402.

Bera, M., & Nag, P. K. (2026). Global research trends on climate change-induced heat stress and its impacts on health and productivity of outdoor workers: a systematic review. *Theoretical and Applied Climatology*, *157*(1), 1.

Chen, J., Zheng, J., Zhang, Q., Zhang, J., Dai, Q., & Zhang, D. (2025). Radiation exposure in recurrent medical imaging: identifying drivers and high-risk populations. *Frontiers in Public Health*, *13*, 1626906.

Cousins, E. M. (2025). Strategic science performance and the illusion of consensus about Fukushima's health effects. *Science as Culture*, *34*(2), 245-267.

Eaton, J., Simcock, I., Anderson, A. M., Arthurs, O. J., & Simpson, A. (2025). Caregiver experiences during their child's medical imaging examinations and potential preparatory interventions: A mixed methods systematic review. *Radiography*, *31*(5), 103013.

EL Fahssi, M., Ahyayouch, O., Bensalhi, O., Fathi, H., Semghouli, S., Amaoui, B., ... & Jroundi, L. (2026). Local typical dose estimates based on dose area product and associated cancer risk for conventional radiography in Northern Morocco. *Egyptian Journal of Radiology and Nuclear Medicine*, *57*(1), 3.

Elmehdi, H. M., Dalah, E. Z., & Zgallai, W. (2020). *Pediatricians Awareness of Radiation Protection, Relative Effective Dose and Inherent Risk in Computed Tomography Imaging: UAE Case Study*. https://doi.org/10.1109/ASET48392.2020.9118373

Erhabor, N. I., & Erhabor, G. A. (2025). Environmental Knowledge, Attitudes, and Behaviors of Forest Guards: A Knowledge, Attitude, and Practice (KAP) Model Approach to Forest Ecosystem Protection. *Forest Science*, 1-25.

Eryani, S., Samosir, T. R. A., & Sudaryat, S. (2025). The Impact of Health Law Reforms on Patient Rights and Medical Professional Accountability Worldwide. *Jurnal Ar Ro'is Mandalika (Armada)*, *5*(2), 342-352.

Ferreira-Alfaya, F. J., Zarzuelo-Romero, M. J., & Cura, Y. (2025). Alignment of patient information leaflets with the health literacy skills of future end-users: are we on the same page?. *Health Communication*, *40*(7), 1157-1168.

Freire, G. C., Diong, C., Gandhi, S., Saunders, N. R., Neuman, M. I., Freedman, S. B., ... & Cohen, E. (2026). Low-Value Computed Tomography for Children in the Emergency Department: A Repeated Cross-Sectional Study. *Pediatric Emergency Care*, *42*(1), 13-21.

Granata, C., Sofia, C., Francavilla, M., Kardos, M., Kasznia-Brown, J., Nievelstein, R. A., ... & Apine, I. (2025). Let's talk about radiation dose and radiation protection in children. *Pediatric radiology*, *55*(3), 386-396.

Hamza, M. A., Ullah, S., Ahsan, H., Ali, W., Masud, M., & Ahmed, A. (2025). Health literacy, illness perception, and their association with medication adherence in end-stage renal disease. *International Urology and Nephrology*, 1-16.

Häring, C., Jerković, T., Maier, L., Renner, S., Wachenfeld-Schell, A., & Wieners-Schlupkothen, S. (2025). What does Germany think about radiation?: Survey 2024.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Hazaymeh, H. M., Obeidat, N., Ghawanmeh, R. A., Anagreh, M. H., & Abu alkheir, K. S. (2025). Assessment of Jordanian's Knowledge of the Risks of Radiation Exposure. *Nuclear Medicine and Molecular Imaging*, *59*(4), 261-268.

Haziq, U., Uddin, J., Rahman, S., Yaseen, M., Khan, I., Khan, J., & Jung, Y. (2025). Improving lung cancer detection with enhanced convolutional sequential networks. *Scientific Reports*, *15*(1), 32099.

Hota, A., & Mandal, B. K. (2026). Unveiling the hidden harms: a review on the deeper exploration of side effects of oncotherapy. *Medical Oncology*, *43*(2), 75.

Irede, E. L., Aworinde, O. R., Lekan, O. K., Amienghemhen, O. D., Okonkwo, T. P., Onivefu, A. P., & Ifijen, I. H. (2026). Medical imaging: a critical review on X-ray imaging for the detection of infection. *Biomedical Materials & Devices*, *4*(1), 1-45.

Janetzki, J., Arruzza, E., Blefari, C., Petito, E., Guerrero, K., & Ward, M. (2026). Perceptions of pharmacology education and assessment among medical radiation science students at one Australian university: A cross-sectional survey. *Radiography*, *32*(2), 103306.

Jawwad, A., Sajid, A., Ramani, S., Popeijus, H., & Govaerts, M. (2025). Active Patient Involvement in Healthcare Education in the Global South: Perspectives From Pakistan. *The Clinical Teacher*, *22*(5), e70184.

Kanwal, S. (2026). Types of Imaging and Radiology Procedures. *Allied Healthcare in Practice: An Introduction to Integrated Patient Care*, 14.

Khan, M. M., Masum, A. A., & Hossain, M. A. (2025). Earthquake preparedness perception among youth: Assessing through knowledge, attitude and practice (KAP) framework. *Journal of Human Behavior in the Social Environment*, 1-15.

Larsen, J. B. S., & Jensen, C. S. (2025). Children and adolescents' experiences of active participation in radiological examinations-a qualitative study. *Radiography*, *31*(1), 6-11.

Lee, H. B., & Choi, J. H. (2026). Improving patellofemoral pain assessment with weight-bearing computed tomography and machine learning using three-dimensional knee joint metrics. *The Knee*, *58*, 104290.

Lin, J., Yang, H., Huang, R., & Xu, T. (2025). Discovery of a DNA repair-associated radiosensitivity index for predicting radiotherapy efficacy in breast cancer. *Frontiers in Oncology*, *15*, 1439516.

Malik, R. M., Naveed, M. A., & Rafique, G. M. (2025). Effect of Information Literacy Skills on Clinical Decision-Making among Nurses. *Journal of Information Management and Practices*, *5*(1), 29-47.

Mann, N. A., Khan, Z. A., Asghar, S., Rani, A., Hussain, N., Akhtar, S. S., ... & Anwar, M. (2025). Patterns of Health Services and Medicine Utilisation by First-Generation Pakistani Immigrants in New Zealand. *Health Expectations*, *28*(1), e70169.

Matsun, M., Pramuda, A., Hadiati, S., & Pratama, H. (2026). Enhancing critical thinking in physics education: developing an Arduino-based GMC as an innovative learning tool. *Journal of Education and Learning (EduLearn)*, *20*(1), 578-589.

Melo, S. L. S., Fayad, M. I., Gohel, A., Johnson, B. R., Kalathingal, S., Mahdian, M., ... & Makins, S. R. (2026). AAE and AAOMR Joint Position Statement: Use of Cone-Beam Computed Tomography in Endodontics 2025 Update. *Oral surgery, oral medicine, oral pathology and oral radiology*, *141*(1), 126-135.

Memon, J. A., Memon, Z. A., Shah, M. S., Chandio, M. S., & Baloch, A. (2025). Examining the role of radiation risk perception in patient decision-making for diagnostic imaging procedures: Insights from a multi-centre study across diverse populations. *Radiography*, *31*(5), 103005.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Mohan, D. K., Velmurugan, J., Raavi, V., & Perumal, V. (2026). Organ dose and lifetime attributable risk of cancer in children undergoing computed tomography scan. *Journal of Medical Imaging and Radiation Sciences*, *57*(1), 102134.

Mussmann, B., List, H., Hardy, M., Al-Rikabi, Z. S., Vinter, H., & Jensen, J. (2025). Radiographers' emotional reactions to suspected child abuse. *Radiography*, *31*(1), 306-312.

Na, F., Wang, Y., Tian, C., Zhang, H., Jing, Y., Ke, X., ... & Liu, J. (2025). Diagnostic accuracy of various imaging modalities for children with pneumonia: a systematic review and network meta-analysis. *European Respiratory Review*, *34*(178).

Nasir, U. M., Tijjani, A. M., Mohammed, G., Basheer, H. M., Yusuf, U., Abdulkadir, A., ... & Aminu, D. (2025). Quantifying Radiation Dose and Risk in Diagnostic X-ray and Computed Tomography Imaging Procedures. *Gombe Journal of Administration and Management (GJAM)*, *8*(4B), 63-75.

Ng, C. G., Manan, H. A., Zaki, F. M., & Zakaria, R. (2022). A Survey of Awareness of Parents and Caretakers on Diagnostic Radiological Examination Related Radiation Exposure in a Tertiary Hospital in Malaysia. *International Journal of Environmental Research and Public Health*, *19*(7), 3898. https://doi.org/10.3390/ijerph19073898

Nikoloudi, M., Thanasko, F., Tsatsou, I., Mantoudi, A., & Mystakidou, K. (2025). Exploring hope and expectations amidst the shadows: Navigating through the hearts of cancer patients admitted to a palliative care unit. *Palliative & Supportive Care*, *23*, e26.

Nuijens, A. C., Oei, A. L., Franken, N. A., Rasch, C. R., & Stalpers, L. J. (2025). Towards personalized radiotherapy in pelvic Cancer: patient-related risk factors for late radiation toxicity. *Current Oncology*, *32*(1), 47.

Olorunfemi, O., & Olaseeni, M. O. (2025). Principlism theory in nursing practice: Resolving the autonomy-caregiver paradox. *BLDE University Journal of Health Sciences*, *10*(1), 3-9.

Polleri, M. (2026). *Radioactive Governance: The Politics of Revitalization in Post-Fukushima Japan*. NYU Press.

Pyar, K. (2026). Transfer Learning-Based Segmentation of Pneumonia from Chest X-Rays Images. *Journal of Applied Informatics and Technology*, *8*(1), 255530-255530.

Sajjad, S., Barolia, R., & Gul, R. B. (2025). Living With Cancer: Child–Parent Dyads' Perspectives and Experiences From a Private Tertiary Care Hospital in Pakistan. *Qualitative Health Research*, *35*(2), 174-189.

Sattorov, Y., Izzatullayeva, Z., & Bakhtiyorova, D. (2025). The Effects Of Radioactive Radiation On Living Tissues. *International Journal of Artificial Intelligence*, *1*(4), 1976-1980.

Schwartz, S. H., & Bilsky, W. (1987). Toward a universal psychological structure of human values. *Journal of personality and social psychology*, *53*(3), 550.

Singh, P. P., & Naagar, J. K. (2023). Evaluation of awareness and knowledge of ionizing radiation-related hazards and protective measures among patient's accompanying persons/caretaker in bundelkhand region of central india in a tertiary level teaching hospital in bundelkh and a medical college, sagar (madhya pradesh). *Asian Journal of Pharmaceutical and Clinical Research*, 131–134. https://doi.org/10.22159/ajpcr.2023.v16i6.48328

Taliaferro, L. P., Buchsbaum, J. C., DiCarlo, A. L., Dixon, C. A., Macchiarini, F., Satyamitra, M. M., ... & Rudokas, M. W. (2025). Understudied Populations in Radiation Exposure Research: Needs, Challenges, and Mitigation Strategies. *Radiation Research*, *204*(2), 154-171.

Frontier in Medical & Health Research

ISSN: (e) 3007-1607 (p) 3007-1593

Taufek, N. H. M. (2025). Global initiatives for improving health and medication literacy. In *Health literacy in medicines use and pharmacy*. Academic Press,289-305.

Ullah, F., Rehman, A. U., Khan, R. D., & Khan, A. (2025). The Future of Cardiac Imaging: Innovations in MRI, CT, and Ultrasound Technologies. *Indus Journal of Bioscience Research*, *3*(5), 159-164.

Zaman, M. (2025). Abstracts presented at 41st Annual Conference of Radiology Society of Pakistan (Dec 12-14, 2025; Lahore, Pakistan). *Pakistan Journal of Radiology*, *35*(4).

Wadood, A., Salam, A., Malik, A., Khan, M., Ashraf, S., Ehsan, H., & Ahmadi, M. (2025). Knowledge and awareness of radiation hazards and protection among radiology staff: a multicenter questionnaire study. *Chinese Journal of Academic Radiology*, 1-9.

Wells, J. L. (2025). Care Innovation in Pediatric Radiology. *A Clinical Lens on Pediatric Engineering: Pioneering Science and Technology for Cutting-Edge Patient Care*, 167.

Zadeh, P. T., Mahmoudi, F., Rezaeian, A., & Gholami, M. (2026). Over-scanning in pediatric head CT: prevalence, dosimetric impact, and associated cancer risks. *European Journal of Radiology*, *194*, 112471.

Zhang, H., Wong, K., Olch, A., Han, H. R., Chau, B., Lukas, L., & Chang, E. L. (2025). Initial experience of spatially fractionated lattice radiation therapy for palliative treatment of pediatric bulky tumors. *Frontiers in Oncology*, *15*, 1648847.

Zhang, S., Ao, P., Chen, S., Liao, X., Chen, M., Ruan, L., & Wei, L. (2026). Laminaria japonica Polysaccharide Alleviates Radiation-Induced Salivary Gland Injury by Promoting DNA Damage Repair. *International Dental Journal*, *76*(1), 109312.