Original Research

Assessing Parental Knowledge on Radiation Safety in Pediatric Imaging

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ABSTRACT

Medical imaging, while necessary for pediatric care, exposes children to ionizing radiation, which can pose serious dangers to their growing tissues. This study aimed to measure parental knowledge of radiation exposure, radiation safety, and pediatric imaging, emphasizing the impact of demographic profiles. Conducted in Barangay 674, Zone 73, Paco, Manila, this descriptive quantitative study surveyed 175 parents using a researcher-made questionnaire. The findings revealed that, while most respondents were aware of basic radiation dangers and safety procedures, there were knowledge gaps, particularly on the distinctions between ionizing and non-ionizing radiation and pediatric imaging safety protocols. The statistical study indicated no significant differences in knowledge based on age or sex. However, educational attainment had a considerable impact, with the higher purpose of this study being to measure parental knowledge on radiation exposure, radiation safety, and pediatric imaging.

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INTRODUCTION

Medical imaging is essential in diagnosing and managing pediatric health conditions. However, ionizing radiation in procedures such as X-rays and CT scans presents potential risks, especially for children, who are more sensitive to radiation due to their developing tissues and longer life expectancy. Excessive or inappropriate radiation exposure increase the likelihood of long-term health risks, including cancer (Brambilla et al., 2020). Despite these risks, there remains a significant gap in parental knowledge regarding radiation safety in pediatric imaging, which can result in unnecessary anxiety or over-reliance on imaging procedures.

Parental awareness is crucial in ensuring that children receive appropriate care while minimizing unnecessary radiation exposure. A study by Meulepas et al. (2021) found that many parents have misconceptions about radiation exposure risks, with some overestimating or underestimating the dangers involved. This knowledge gap emphasizes the importance of targeted educational interventions to

help parents make better informed decisions. Currently, limited studies focus on assessing parental knowledge of radiation safety in pediatric imaging, particularly in community settings.

The study aims to assess parental knowledge regarding radiation safety in pediatric imaging, focusing on their awareness of radiation exposure, safety principles, and imaging modalities. It seeks to determine whether there is a significant difference between the demographic profiles of parents such as age, education, socioeconomic status and their level of knowledge about radiation risks. The findings will serve as a basis for developing educational initiatives, such as seminars and informational materials, aimed at enhancing community understanding of radiation safety in pediatric imaging. Ultimately, this research seeks to promote safer healthcare practices and better outcomes for pediatric patients by empowering parents with the necessary knowledge to make informed decisions.

METHODS

Research Design

This study used a descriptive quantitative research design. This design was appropriate because it aimed to systematically describe and quantify the level of knowledge of parents regarding radiation exposure, radiation safety, and pediatric imaging. The descriptive approach allowed the researchers to gather detailed information about the respondents' demographic profile and their understanding of key concepts related to pediatric imaging. The quantitative nature of the study ensured that the data collected was measurable, enabling statistical analysis to identify trends, patterns, and relationships between variables. Additionally, the study employed comparative analysis to determine whether there was a significant difference between the demographic profile of the respondents and their level of knowledge in radiation exposure, radiation safety, and pediatric imaging. This aspect of the research design helped in identifying which demographic factors might have influenced parental knowledge, providing insights for developing targeted educational programs.

Ethics Statement

This study followed strict ethical guidelines to protect participants' rights, privacy, and welfare. Informed consent was obtained to ensure participants understood the study's purpose and procedures. Participation was voluntary, allowing withdrawal without consequences; data from withdrawn participants was permanently deleted to ensure privacy.

Upon completion, data was securely stored and accessible only to authorized personnel. Findings were shared through academic presentations while preserving participant anonymity. Institutional review board approval ensured compliance with ethical regulations, safeguarding participants' autonomy and well-being.

Setting

This study was conducted in Barangay 674, Zone 73, Paco, Manila, an adopted barangay of Emilio Aguinaldo College (EAC) – Manila where the college regularly engaged in community outreach programs. The selected barangay was a focus area for EAC's initiatives led by the School of Radiologic Technology, making it an appropriate research locale for this study. The established partnership between EAC and the barangay provided a solid foundation for engaging with the community, facilitating the smooth conduct of the research

Participants

The population of this study comprised parents and guardians residing in Brgy. 674, Zone 73, Paco, Manila, the adopted barangay of Emilio Aguinaldo College (EAC) – Manila. It included parents and guardians who met specific inclusion criteria, ensuring that the respondents were directly relevant to the study's purpose. These criteria are:

1. Must be a parent or guardian residing in the adopted barangay of EAC.
2. Must have at least one child who has undergone or is likely to undergo a diagnostic imaging procedure involving radiation exposure (e.g., X-ray, CT scan, and fluoroscopy).
3. Must be willing to participate in the study and provide informed consent.

The study employed purposive sampling as the sampling technique. This non-probability method was considered suitable because it enabled the researcher to deliberately select participants who met the pre-established criteria.

Data Collection

Data collection was carried out through house-to-house visits, where the researchers used a validated researcher-made questionnaire that assessed their demographic profile and knowledge of radiation exposure, safety, and pediatric imaging. Along with a barangay official, researchers personally approached residents who met the inclusion criteria.

The purpose of the study was clearly explained to each respondent, ensuring they understood their role in the research, the voluntary nature of their participation, and the confidentiality of their responses. Only those who voluntarily agreed to participate and provided informed consent were included in the study. After the completion of the house-to-house visits, the collected data was reviewed for completeness and accuracy before proceeding with data encoding and statistical analysis. This systematic procedure ensured the collection of meaningful and reliable data, which was crucial in assessing parental knowledge of radiation exposure, radiation safety, and pediatric imaging.

Data Processing and Analysis

This study used a descriptive quantitative research design. This design was appropriate because it aimed to systematically describe and quantify the level of knowledge of parents regarding radiation exposure, radiation safety, and pediatric imaging. The descriptive approach allowed the researchers to gather detailed information about the respondents' demographic profile and their understanding of key concepts related to pediatric imaging. The quantitative nature of the study ensured that the data collected was measurable, enabling statistical analysis to identify trends, patterns, and relationships between variables.

Additionally, the study employed comparative analysis to determine whether there was a significant difference between the demographic profile of the respondents and their level of knowledge in radiation exposure, radiation safety, and pediatric imaging. This aspect of the research design helped in identifying which demographic factors might have influenced parental knowledge, providing insights for developing targeted educational programs.

By combining descriptive and comparative methods,

this research design ensured a comprehensive analysis of parental knowledge while offering data driven recommendations for improving community awareness and informed decision-making regarding pediatric imaging procedures.

Statistical methods

The responses collected through the questionnaire were analyzed using appropriate statistical methods to address the research objectives comprehensively. Descriptive statistics and inferential statistics were employed to summarize the data and determine relationships between variables, ensuring reliable and meaningful insights.

Descriptive Statistics

This method helped determine the average level of knowledge across each area, offering an overall view of how well-informed the respondents were about these topics.

- Frequency counts and percentages: Used to describe the distribution of each demographic profile of the respondents in terms of age, sex, educational attainment, occupation, and monthly income.
- Mean and Standard Deviation (SD): Employed to assess the level of knowledge of respondents regarding radiation exposure, radiation safety, and pediatric imaging.
- Ranking: Applied to identify which specific knowledge statements received the highest and lowest scores.

Inferential Statistics

By applying these tests, the study was able to identify whether specific demographic factors significantly influenced parental knowledge levels regarding radiation exposure, radiation safety, and pediatric imaging.

- Mann-Whitney U Test: Used to compare differences between two independent groups (e.g., male vs. female respondents).
- Kruskal-Wallis H Test: Used to assess the differences among more than two groups (e.g., different age brackets or educational levels).\

By using a combination of descriptive and inferential statistics, this study provided a comprehensive analysis of the collected data, enabling the researchers to draw valid conclusions and formulate actionable recommendations for community-based educational initiatives.

RESULTS

The study surveyed 175 parents and guardians in Brgy. 64, Zone 73, Paco, Manila. The results indicate a general competence in basic radiation safety but highlight significant gaps in technical knowledge.

Table 1. *Demographic Profile of the Respondents*

Variable	Category	Frequency	Percentage
Age	26-35 years old	66	37.71%
Sex	Female	132	75.43%
Education	College Graduate	80	45.71%

Occupation	Employed	73	41.71%
Monthly Income	Below ₱10,000	76	43.43%

*Data collected via house-to-house in the adopted barangay

As seen in Table 1, majority of respondents were aged 26–35 (37.71%), indicating that most participants were young to middle-aged adults actively involved in child rearing and healthcare decisions. A large proportion were female (75.43%), reflecting the dominant role of mothers in managing children's health. In terms of educational attainment, most respondents were college graduates (45.71%), currently employed (41.71%) and 75.43% had a monthly income below ₱10,000, suggesting that a significant portion of the population belonged to lower-income households.

Table 2. Mean Level of Parental Knowledge by Domain

Knowledge Domain	Mean Score	Verbal Interpretation	Categorical Response	Rank
Radiation Safety	3.24	Agree	Knowledgeable	1
Pediatric Imaging	3.17	Agree	Knowledgeable	2
Radiation Exposure	3.12	Agree	Knowledgeable	3

*Based on a 4-point Likert scale where 2.52-3.27 is Agree (Knowledgeable).

Table 3. Specific Knowledge Gaps in Pediatric Imaging

Knowledge Statement	Mean Score	Rank
Awareness of most common imaging procedure	3.20	1
Awareness of lower doses for pediatric imaging	3.18	2
Knowledge that CT Scans involve higher radiation than x-ray	3.09	3

*Lower mean score indicates a specific area where parental education is most needed.

Based on the results shown in Table 2 and 3, the respondents demonstrated a moderate understanding of radiation exposure (mean = 3.12), radiation safety (mean = 3.24), and pediatric imaging (mean = 3.17), with a verbal interpretation as "Agree" and categorized as "Knowledgeable."

Table 4. Test of Significant Difference Based on Age and Sex.

Variable	Knowledge Domain	P-value	Decision
Age (Kruskal-Wallis)	Overall Knowledge	0.275-0.753	Accept H_0
Sex (Mann-Whitney)	Overall Knowledge	0.281-0.907	Accept H_0

*P-value > 0.05 indicates no statistically significant difference.

Table 5. Test of Significant Difference Based on Educational Attainment, Occupation and Monthly Income

Variable	Knowledge Domain	P-value	Interpretation
Educational Attainment	Overall Knowledge	<0.002	Significant
Occupation	Overall Knowledge	0	Significant
Monthly Income	Overall Knowledge	0	Significant

*P-value < 0.05 indicates the null hypothesis is rejected.

Table 4 and 5 shows inferential testing using the Kruskal-Wallis and Mann-Whitney U Tests which confirmed that age and sex have no significant difference in knowledge levels (P > 0.05). However, educational attainment, occupation, and monthly income showed a significant difference with parental knowledge

DISCUSSION

The study found that while parents in Brgy. 674, Paco, Manila, are generally "Knowledgeable" about radiation safety, exposure and pediatric imaging, significant gaps exist regarding technical concepts like the ALARA principle and the higher risks of CT scans. Inferential analysis showed that knowledge levels are not influenced by age or sex (P> 0.05), but are significantly driven by educational attainment, occupation, and monthly income. These results highlight that socioeconomic status determines safety literacy, justifying the need for targeted community interventions like the proposed "Safe Imaging for Safer Kids" seminar to bridge information disparities.

The study's primary limitation is its emphasis on a single adopted community in Manila, which may introduce geographical bias and limit its relevance to rural or differently structured urban communities.

These findings are highly applicable to urban health centers and pediatric clinics, suggesting that communication must be tailored to the parent's educational level to be effective.

Future studies should track parental knowledge over time to see if repeated exposure to imaging procedures naturally increases awareness or if it remains stagnant without intervention. Integrating modern technology, such as mobile health applications

or digital patient portals, can significantly enhance the study's impact. Replacing traditional pamphlets with QR-code-linked digital resources allows parents to access interactive, real-time information about imaging procedures. Such advancements can fundamentally alter parental perceptions, reducing medical anxiety through increased transparency and the convenience of digital accessibility.

Expanding research to include diverse regions (e.g., rural areas) would provide a comprehensive national view of radiation safety literacy.

Future studies should track parental knowledge over time to see if repeated exposure to imaging procedures naturally increases awareness or if it remains stagnant without intervention.

The study underscores significant implications for policy development, education, and community engagement. It recommends establishing institutional policies that require accessible, language- appropriate radiation safety information and enhancing radiologic technology training programs to focus on effective communication across different socioeconomic groups. Furthermore, the findings advocate for public awareness initiatives to improve understanding of radiation risks and suggest that future research adopt longitudinal approaches and include rural populations to gain a more comprehensive and long-term perspective on radiation literacy.

CONCLUSION

The study concludes that while parents generally acknowledge radiation risks, their technical understanding is significantly influenced by educational and economic factors rather than age or sex.

The research questions were addressed by identifying that higher education and income levels correlate with better safety awareness, whereas critical gaps remain regarding high-dose modalities like CT scans.

The findings support the implementation of the proposed community-based interventional program to empower parents with the knowledge needed for informed medical decision-making

Author's Contributions

Clarisa M. Bignotea - Conceptualization and design of the study; development of the research instrument; data collection; data analysis and interpretation; drafting and revision of the manuscript; final approval of the version to be published.

Emerlinda M. Reyes- Supervision of the research process; critical revision of the manuscript for intellectual content; final approval of the version to be published.

Athea Yra N. Managbanag and Carlos III G. Leong- Assistance in study design; participation in data collection and data encoding; contribution to data analysis and interpretation

Ethics Approval Protocol Number

The study has undergone a thorough review and has been granted approval for ethics clearance by Jennifer S. San Luis (EACRER CHAIR) under the

protocol code EACRER 2025-014.

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Conflict of Interest

No potential conflict of interest relevant to this article was reported.

Declaration Concerning Generative AI

The writers did not use artificial intelligence to analyze data or derive insights; instead, AI was used merely to improve the manuscript's clarity and language quality.

Data Availability and Additional Supporting Documents

All raw and supplementary data associated with this study are available from the corresponding author upon request.

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