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Original Article

KNOWLEDGE, ATTITUDE, AND PRACTICE (KAP) TOWARD RADIOLOGICAL IMAGING IN OPHTHALMOLOGY AMONG MEDICAL AND PARAMEDICAL STUDENTS: A CROSS-SECTIONAL STUDY

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ABSTRACT

Background: Radiological imaging is essential in ophthalmology for diagnosing retinal disorders, optic nerve pathology, and orbital trauma. Medical and paramedical students are future imaging users, yet their knowledge, attitude, and practice (KAP) in this area are often limited.
Objective: To assess KAP regarding ophthalmic imaging among medical and paramedical students.
Methods: A cross-sectional online survey was conducted from November 2025 to February 2026 among 480 students in medical, radiography, optometry, and ophthalmic technology programs. A validated questionnaire assessed knowledge (15 items), attitude (10 items, 5-point Likert scale), and practice (10 items). Data were analyzed using descriptive statistics, t-tests, and ANOVA, with $p < 0.05$ considered significant.
Results: Mean age was 22.4 ± 2.1 years; 58.3% were female. Overall knowledge was moderate (62.5 ± 14.8%), highest for OCT (78%) and lowest for CT (42%). Medical students scored higher than paramedical students (68.3 ± 12.1% vs. 57.6 ± 13.9%, $p < 0.01$). Attitudes were positive: 85% recognized imaging's diagnostic value, but 68% expressed concern over radiation. Practical exposure was limited: 37% observed procedures, 28% interpreted images, and 15% requested imaging under supervision. Academic program significantly influenced KAP scores ($p < 0.01$).
Conclusion: Students show moderate knowledge, positive attitudes, but limited practical experience in ophthalmic imaging. Structured training, supervised rotations, and interdisciplinary education are recommended to bridge gaps between theory and clinical practice while ensuring radiation safety awareness.

Keywords: Ophthalmic imaging, radiology, medical students, paramedical students, knowledge, attitude, practice

INTRODUCTION

Advances in radiological imaging have transformed the way ophthalmic diseases are diagnosed and managed. From simple orbital X-rays to high-resolution optical coherence tomography (OCT) and magnetic resonance imaging (MRI), imaging technologies now provide clinicians with detailed anatomical and pathological insights that were previously unattainable. These modalities play a crucial role in detecting retinal disorders, evaluating optic nerve pathology, assessing orbital trauma, and guiding surgical planning, ultimately improving visual outcomes and patient safety. [1,2] Among the various imaging tools used in ophthalmology, ultrasonography remains indispensable in cases of opaque ocular media, while computed tomography (CT) is frequently employed for orbital fractures, foreign bodies, and sinus-related complications. MRI offers superior soft-tissue contrast and is preferred for optic nerve and intracranial involvement, whereas OCT has become the gold standard for retinal and macular assessment due to its non-invasive nature and micrometer-level resolution. [3,4] The appropriate selection and interpretation of these modalities require foundational knowledge and clinical awareness, particularly among healthcare trainees. Medical and paramedical students represent the future workforce responsible for diagnostic decision-making and patient care. Their understanding of radiological principles, attitudes toward imaging safety, and practical exposure during training significantly influence clinical competence and interdisciplinary collaboration. Previous studies have shown

that insufficient exposure to imaging during undergraduate education can result in uncertainty regarding modality selection and delayed referrals in clinical practice. [5,6] The concept of Knowledge, Attitude, and Practice (KAP) provides a structured framework for evaluating awareness levels, perceptions, and behavioural patterns related to healthcare interventions.

KAP studies have been widely used to assess preparedness among students and professionals across multiple disciplines, including radiology and ophthalmology. [7] Adequate knowledge ensures correct utilization of imaging resources, positive attitudes encourage responsible clinical engagement, and sound practice reflects confidence gained through hands-on experience. Despite the increasing reliance on imaging in ophthalmic care, several reports suggest that students often possess fragmented knowledge regarding radiation risks, imaging indications, and interpretation skills. Concerns related to radiation exposure, particularly with CT scans, frequently influence decision-making, sometimes leading to underutilization of appropriate diagnostic tools. [8] Additionally, limited clinical exposure and minimal interaction with radiology departments may restrict students' ability to translate theoretical concepts into practical competence. [9] Paramedical students, including those in radiography, optometry, and ophthalmic technology programs, play an equally vital role in imaging workflows. Their technical expertise, patient positioning skills, and understanding of modality-specific protocols directly impact image quality and diagnostic accuracy. However, disparities in educational curricula and clinical training opportunities can lead to inconsistent knowledge and practice levels among these groups. [10]

In developing healthcare systems, these challenges are further compounded by high patient loads, limited access to advanced imaging equipment, and variations in institutional training standards. Strengthening undergraduate education through structured imaging modules and interdisciplinary learning has been recommended as a strategy to bridge these gaps and promote collaborative care models. [11] Given the growing importance of radiological imaging in ophthalmology and the critical role of students in future service delivery, evaluating their KAP is essential for identifying educational shortcomings and guiding curriculum reform. This study therefore aimed to assess the knowledge, attitude, and practice toward radiological imaging in ophthalmology among medical and paramedical students, providing evidence-based insights to enhance training strategies and optimize patient-centered care. [12]

METHODS AND MATERIALS

Study Design and Duration: A cross-sectional, questionnaire-based observational study was conducted over a period of three months, from 3 November 2025 to 2 February 2026. The study aimed to evaluate the knowledge, attitude, and practice (KAP) toward radiological imaging in ophthalmology among medical and paramedical students.

Study Population and Sample Size: The study included a total number of 480 participants, comprising undergraduate medical students and paramedical students enrolled in radiography, optometry, and ophthalmic technology programs. Eligibility criteria included students currently in clinical or final academic years who had prior exposure to ophthalmology or radiology-related coursework. First-year students and those unwilling to provide informed consent were excluded.

Data Collection Tool: Data were collected using a structured, self-administered questionnaire developed after reviewing relevant literature and validated by subject experts from the departments of radiology and ophthalmology. Each correct knowledge response was awarded one point. Attitude and practice responses were scored from 1 (strongly disagree) to 5 (strongly agree). The questionnaire consisted of four sections:

1. **Demographic information:** age, gender, course of study, and academic year
2. **Knowledge domain:** 15 multiple-choice questions addressing basic principles of ophthalmic imaging modalities including X-ray, ultrasonography, CT, MRI, and OCT
3. **Attitude domain:** 10 statements rated on a five-point Likert scale assessing perceptions regarding imaging usefulness, radiation safety, and clinical relevance
4. **Practice domain:** 10 items evaluating clinical exposure, participation in imaging interpretation, and confidence in imaging-related decision-making

Data Collection Procedure: Participants were invited to take part in the study through institutional communication platforms during scheduled academic periods and clinical postings. The purpose of the study was explained on the introductory page of the Google Form, and electronic informed consent was obtained before participants could proceed. The questionnaire was distributed using a Google Forms link, and responses were collected within a predefined timeframe to minimize response bias. Participation was entirely voluntary, and anonymity was maintained by not collecting any personally identifiable information.

Ethical Considerations: Ethical approval was obtained from the Departmental Scientific Committee and all study procedures followed the Declaration of Helsinki (2013 revision).

Statistical Analysis: Collected data were entered into Microsoft Excel and analyzed using SPSS version 26. Descriptive statistics were expressed as frequencies, percentages, means, and standard deviations. Independent t-tests and one-way ANOVA were applied to compare mean knowledge scores among different academic groups. Associations between demographic variables and KAP scores were evaluated, with a p-value of less than 0.05 considered statistically significant.

RESULTS

Participant Demographics: A total of 480 students participated in the study during the three-month survey period. The mean age of respondents was 22.4 ± 2.1 years. Female participants constituted 58.3% (n = 280), while males accounted for 41.7% (n = 200) illustrated in **figure-1**.

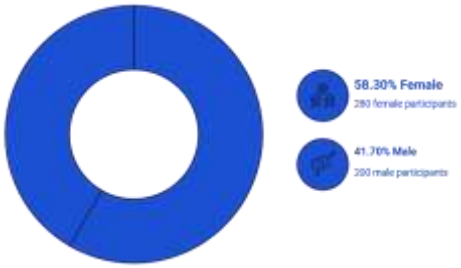


Figure:1. Gender Distribution of Study Participants

Regarding academic background, 41.7% (n = 200) were medical students, followed by 29.2% (n = 140) optometry students, 20.8% (n = 100) radiography students, and 8.3% (n = 40) ophthalmic technology students illustrated in **figure-2.**



Figure: 2. Academic Background of Participants

Knowledge Toward Radiological Imaging in Ophthalmology: The overall mean knowledge score among participants was 62.5 ± 14.8%, indicating a moderate level of understanding. Knowledge regarding optical coherence tomography (OCT) was highest, with 78% correctly identifying its application in retinal and macular diseases. Awareness of ultrasonography for evaluating ocular conditions in the presence of opaque media was reported by 65% of students. However, only 42% accurately recognized indications for computed tomography (CT) in orbital trauma, and 55% identified the role of MRI in optic nerve and soft tissue pathologies. Medical students demonstrated significantly higher knowledge scores (68.3 ± 12.1%) compared to paramedical students (57.6 ± 13.9%, $p < 0.01$).

Table 2. Knowledge of Ophthalmic Imaging Modalities

Imaging Modality	Correct Responses (%)
Optical Coherence Tomography (OCT)	78
Ultrasonography (USG)	65
Magnetic Resonance Imaging (MRI)	55
X-ray	60
Computed Tomography (CT)	42

Attitude Toward Radiological Imaging: Participants generally expressed a positive attitude toward radiological imaging in ophthalmology. Approximately 85% agreed that imaging is essential for accurate diagnosis, while 74% felt that imaging education should be strengthened during clinical training. Despite this positive outlook, 68% expressed concern about radiation exposure, particularly related to CT imaging. Encouragingly, 80% reported confidence in understanding basic imaging reports following academic instruction.

Table 3. Attitude Responses Among Participants

Statement	Agree/Strongly Agree (%)
Imaging improves diagnostic accuracy	**85**
Imaging should be integrated into clinical teaching	**74**
Concerned about radiation exposure	**68**
Confident in basic report interpretation	**80**

Practice Patterns Related to Ophthalmic Imaging: Practice scores revealed limited hands-on exposure among students. Only 37% reported observing imaging procedures during clinical postings, while 28% had participated in case-based image interpretation discussions. Merely 15% indicated involvement in requesting imaging studies under supervision. Over half of the participants (52%) acknowledged the need for additional practical training. Medical students demonstrated significantly higher participation in imaging-related activities compared to paramedical students ($p < 0.05$).

Table 4. Practice Behaviours Toward Radiological Imaging

Practice Item	Yes (%)
Observed ophthalmic imaging procedures	37
Participated in image interpretation	28
Requested imaging during postings	15
Desire more hands-on training	52

Association Between Academic Program and Knowledge Scores: One-way ANOVA revealed a statistically significant association between program of study and mean knowledge scores ($F = 6.82$, $p < 0.01$). Medical students achieved the highest scores, followed by radiography and optometry students, while ophthalmic technology students demonstrated comparatively lower scores.

Table 5. Mean Knowledge Scores by Program

Program	Mean ± SD (%)
Medical	68.3 ± 12.1
Radiography	61.5 ± 13.4
Optometry	58.2 ± 14.0
Ophthalmic Technology	54.6 ± 15.2

DISCUSSION

This study assessed the knowledge, attitude, and practice toward radiological imaging in ophthalmology among medical and paramedical students, revealing moderate knowledge levels, generally positive attitudes, and limited clinical practice exposure. These findings highlight important educational gaps that warrant attention as imaging continues to play a central role in ophthalmic diagnosis and management. The overall knowledge score of 62.5% indicates that while students possess basic awareness of ophthalmic imaging modalities, substantial deficiencies remain, particularly regarding computed tomography and magnetic resonance imaging. In contrast, higher familiarity with optical coherence tomography reflects its frequent use in retinal clinics and undergraduate teaching. Similar trends have been reported in previous studies, where OCT was better understood compared to cross-sectional imaging techniques, largely due to greater clinical visibility and accessibility during training. [1,2] The significantly higher knowledge scores observed among medical students compared with paramedical groups may be attributed to broader clinical exposure and curriculum structure emphasizing diagnostic reasoning.

Attitude toward radiological imaging was largely positive, with most participants recognizing its importance in improving diagnostic accuracy. This aligns with earlier reports demonstrating strong acceptance of imaging technologies among healthcare trainees. [3] However, more than two-thirds of respondents expressed concern regarding radiation exposure, particularly from CT scans. While awareness of radiation risks is essential, excessive apprehension may lead to underutilization of appropriate imaging modalities. This finding underscores the need for structured education on radiation safety principles, dose optimization, and justification criteria to foster balanced clinical decision-making. [4]

Practice-related findings revealed limited hands-on experience, with fewer than half of participants having observed imaging procedures or participated in interpretation discussions. Only a small proportion reported requesting imaging during clinical postings, highlighting restricted engagement in real-world imaging workflows. These results mirror observations from earlier educational studies indicating that theoretical knowledge often outweighs practical exposure in undergraduate training. [5] Clinical involvement has been shown to significantly enhance confidence and competence in imaging utilization, suggesting that current teaching strategies may not adequately prepare students for future responsibilities. [6] The disparities observed across academic programs further emphasize the need for standardized interdisciplinary training. Paramedical students, particularly those in ophthalmic technology programs, demonstrated lower knowledge scores and reduced clinical participation. Given their essential role in imaging acquisition and patient positioning, strengthening imaging education within paramedical curricula is crucial for improving diagnostic quality and workflow efficiency. [7] Collectively, these findings highlight a disconnect between positive attitudes and actual clinical practice, likely stemming from limited structured exposure to ophthalmic imaging. Integrating case-based learning, supervised imaging rotations, and collaborative teaching between ophthalmology and radiology departments may help bridge this gap. Previous interventions incorporating simulation-based training and multidisciplinary workshops have demonstrated improvements in imaging literacy and clinical confidence among students. [8,9]

CONCLUSION

This study highlights that while medical and paramedical students demonstrate generally positive attitudes toward radiological imaging in ophthalmology, their knowledge levels remain moderate and practical exposure is limited. Familiarity with commonly used modalities such as optical coherence tomography and ultrasonography was satisfactory; however, significant gaps were observed in understanding the indications and applications of

computed tomography and magnetic resonance imaging. The findings emphasize a clear disconnect between theoretical awareness and clinical practice. Limited hands-on experience and minimal involvement in imaging interpretation may hinder students' readiness for real-world ophthalmic care. Furthermore, concerns regarding radiation exposure, though reflective of safety awareness, underline the need for balanced education on radiation principles and appropriate imaging utilization.

DECLARATION

Ethical Approval and Consent to Participate: Ethical approval for this study was obtained from the Departmental Scientific Committee. All participants were informed about the study's purpose and procedures, and electronic informed consent was obtained prior to participation.

Consent for Publication: Not applicable. No identifiable individual data are included in this study.

Availability of Data and Materials: The datasets generated and analyzed during the current study are available from the corresponding author upon reasonable request.

Competing Interests: The authors declare that they have no competing interests.

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Authors' Contributions: All authors contributed equally to the conception, study design, data collection, analysis, and manuscript preparation. All authors read and approved the final manuscript.

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