ORIGINAL ARTICLE

Artificial Intelligence in Clinical Radiology: An Evaluation of Technology Readiness and Ethical Perspectives Among Future Medical Practitioners

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ABSTRACT

Introduction: Radiology stands at the forefront of artificial intelligence integration in medicine, with artificial intelligence algorithms demonstrating performance comparable to experienced radiologists in diagnostic imaging tasks. Medical students, as future clinicians and referring physicians, require adequate knowledge of and positive attitudes towards artificial intelligence-driven radiology. Despite growing global interest, data from South Asian medical education contexts remain critically scarce. **Aims:** To assess technology readiness, digital literacy, and ethical awareness regarding radiological artificial intelligence among medical students at a tertiary teaching hospital in Nepal. **Methods:** A cross-sectional survey was conducted among 227 consenting medical students using a structured, self-administered 41-item questionnaire with five-point Likert scale responses. Domain scores for knowledge, attitudes, and ethical perspectives were computed. Independent-samples t-tests and one-way ANOVA were used for group comparisons. **Results:** Of 227 participants (mean age 21.3±1.8 years; 55.9% male), 56.8% demonstrated adequate artificial intelligence knowledge. Mean domain scores were: knowledge 3.21±0.62, attitude 3.46±0.59, and ethical awareness 4.06±0.60 (out of 5). Among knowledge items, recognition of artificial intelligence assistance in radiological image interpretation was the highest-rated, with 57.2% of students in agreement. Students with formal artificial intelligence teaching had significantly higher attitude scores (3.64±0.68 vs 3.40±0.54; p=0.008). Only 25.1% had received formal artificial intelligence education. **Conclusion:** Medical students in Nepal show moderate artificial intelligence knowledge, positive attitudes, and high ethical awareness, with the strongest clinical artificial intelligence recognition centered on radiological applications. Radiology departments should lead the integration of structured artificial intelligence literacy programs into undergraduate medical curricula across South Asia, where ethical awareness is high but formal artificial intelligence education remains critically insufficient.

Keywords: Artificial Intelligence; Ethics; Medical Education; Nepal; Radiology; South Asia

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INTRODUCTION

Radiology is at the forefront of artificial intelligence (AI) driven transformation in medicine, with algorithms achieving performance comparable to experienced radiologists in chest radiography, mammography, and brain MRI interpretation.[1,2] AI, encompassing machine learning, deep learning, and natural language processing, has shown major clinical impact in diagnostic imaging, pathology, and decision support.[3,4] Medical students, as future clinicians and radiologists, represent a critical group for AI education because their preparedness will shape future healthcare delivery.[5,6] Studies worldwide show limited formal AI training despite widespread informal use, while curriculum integration improves knowledge and attitudes.[7,8] However, despite growing recognition of AI's opportunities and challenges in regional radiology practice,[9] empirical data on AI literacy among medical students from low- and middle-income countries, particularly South Asia, remain critically scarce.[10] Nepal's expanding medical education system and growing digital access provide a unique context for investigation. This study aimed to assess AI knowledge, attitudes, practice patterns, and ethical awareness among medical students at a tertiary teaching hospital in Nepal, with a specific focus on radiological AI applications, and to identify demographic and educational variables associated with domain scores. To our knowledge, this is the first study from Nepal to assess AI literacy with a specific focus on radiological applications, addressing a critical evidence gap in South Asian medical education.

METHODS

This was a cross-sectional, questionnaire-based study conducted at a medical college in western Nepal. The study period was from January 2026 to March 2026. Ethical approval was obtained from the Institutional Review Committee (IRC Ref. No. 47/082-83) before data collection. Medical students enrolled from the first year to the internship phase who consented to participate were included. Students who declined consent or did not complete the questionnaire were excluded. A total of 228 responses were received; one non-consenting response was excluded, yielding a final analytic sample of 227 participants.

A structured, self-administered questionnaire was developed and pilot-tested among 15 students who were not included in the main study, and minor revisions were made for clarity before final administration. The instrument comprised 41 items covering: (1) demographic and background characteristics (7 items); (2) AI knowledge (8 items, including a dedicated item on AI assistance in radiological image interpretation); (3) AI attitudes (8 items); (4) AI practice patterns (4 items); and (5) ethical perspectives on AI (8 items). Knowledge, attitude, and ethics items were measured on a five-point Likert scale: Strongly Disagree (1) to Strongly Agree (5). Internal consistency was assessed by Cronbach's alpha before the main study. The Cronbach's alpha values were 0.78 for the knowledge domain, 0.81 for the attitude domain, and 0.84 for the ethical perspective domain, indicating acceptable internal consistency. For the purpose of classification, participants with a mean knowledge domain score of ≥3.5 out of 5 were categorized as having adequate AI knowledge.

Statistical Analysis

Data were analyzed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA). Descriptive statistics, including frequencies and percentages, were used to summarize categorical variables. Group comparisons were performed using independent-samples t-tests and one-way Analysis of Variance (ANOVA), with a p-value of < 0.05 considered statistically significant.

RESULTS

Demographic Characteristics

Of the 227 participants, 127 (55.9%) were male and 100 (44.1%) were female, with a mean age of 21.3±1.8 years (range 18–27 years). The majority were Nepali nationals (93.8%). First-year students constituted the largest group (30.4%), followed by third-year (26.4%) and second-year (24.7%) students (Table I). Only 57 (25.1%) had received formal teaching on AI, and 30 (13.2%) had attended an AI-related workshop or seminar. A large majority (94.3%) reported having used AI tools such as ChatGPT or Gemini for academic purposes.

Variable	Category	n (%)
Sex	Male	127 (55.9)
	Female	100 (44.1)
Year of Study	First Year	69 (30.4)
	Second Year	56 (24.7)
	Third Year	60 (26.4)
	Final Year	29 (12.8)
	Intern	13 (5.7)
Nationality	Nepali	213 (93.8)
	Foreigner	14 (6.2)
Age (years)	Mean ± SD	21.3 ± 1.8
Formal AI Teaching	Yes	57 (25.1)
	No	170 (74.9)
Attended AI Workshop	Yes	30 (13.2)
	No	197 (86.8)
Ever Used AI Tools	Yes	214 (94.3)
	No	13 (5.7)

Table I: Demographic and Background Characteristics of Participants (N=227)

Knowledge Domain

The mean knowledge score was 3.21±0.62 out of 5. Among the 227 participants, 129 (56.8%) were classified as having adequate AI knowledge. From a radiology standpoint, the most notable finding was that 57.2% of students agreed that AI can assist in radiological image interpretation the highest domain-specific awareness item in the knowledge domain, surpassing agreement rates for other clinical AI applications. The highest overall agreement was observed for understanding the basic concept of AI (65.2% agreed or strongly agreed) and for the statement that AI systems learn from large datasets (65.2%). Conversely, only 17.7% agreed that AI could function without human supervision, and 19.8% agreed that AI could replace doctors in some specialties, reflecting appropriately cautious perceptions regarding AI autonomy (Table II).

Attitude Domain

The mean attitude score was 3.46±0.59, indicating overall positive attitudes towards AI. Interest in learning about AI was the strongest attitude item, with 74.5% of students agreeing or strongly agreeing. Similarly, 64.3% believed AI would improve the quality of healthcare, and 58.6% supported AI inclusion in the medical curriculum. However, trust in AI-based clinical decision systems was notably low, with only 19.8% expressing agreement. Approximately 51.1% perceived a threat to the doctor-patient relationship from AI, highlighting important interpersonal concerns (Table II).

Statement	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)
Knowledge Domain					
Understands basic AI concept	12 (5.3)	4 (1.8)	63 (27.8)	122 (53.7)	26 (11.5)
AI can be used for disease diagnosis	9 (4.0)	28 (12.3)	76 (33.5)	95 (41.9)	19 (8.4)
AI assists in radiological image interpretation	5 (2.2)	22 (9.7)	70 (30.8)	107 (47.1)	23 (10.1)
AI can reduce medical errors	9 (4.0)	27 (11.9)	90 (39.6)	86 (37.9)	15 (6.6)
AI systems learn from large datasets	4 (1.8)	10 (4.4)	65 (28.6)	111 (48.9)	37 (16.3)
AI can function without human supervision	44 (19.4)	88 (38.8)	55 (24.2)	36 (15.9)	4 (1.8)
AI can replace doctors in some specialties	47 (20.7)	71 (31.3)	64 (28.2)	38 (16.7)	7 (3.1)
AI used for personalised treatment planning	20 (8.8)	40 (17.6)	71 (31.3)	79 (34.8)	17 (7.5)
Attitude Domain					
AI will improve quality of healthcare	8 (3.5)	9 (4.0)	64 (28.2)	124 (54.6)	22 (9.7)
AI should be in medical curriculum	10 (4.4)	10 (4.4)	74 (32.6)	109 (48.0)	24 (10.6)
Interested in learning about AI	4 (1.8)	7 (3.1)	47 (20.7)	120 (52.9)	49 (21.6)
Confident using AI tools for learning	6 (2.6)	15 (6.6)	77 (33.9)	102 (44.9)	27 (11.9)
AI will increase doctors' work efficiency	5 (2.2)	18 (7.9)	63 (27.8)	110 (48.5)	31 (13.7)
AI may reduce job opportunities in medicine	13 (5.7)	51 (22.5)	67 (29.5)	67 (29.5)	29 (12.8)
AI threatens doctor-patient relationship	13 (5.7)	36 (15.9)	62 (27.3)	78 (34.4)	38 (16.7)
Trust AI-based clinical decision systems	26 (11.5)	59 (26.0)	97 (42.7)	34 (15.0)	11 (4.8)

SD=Strongly Disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly Agree

Table II: Likert Response Distribution for Knowledge and Attitude Domain Items (N=227)

Practice Domain

Regarding AI practice, 94.3% of participants reported ever using AI tools for medical learning. Among users, the most common frequency was 'sometimes' (43.6%), followed by 'often' (40.4%) and 'very often' (14.6%). Studying and concept explanation were the predominant purposes of AI tool use. Clinical decision support use was markedly lower, with only 13.2% reporting prior use of AI for clinical decision-making, reflecting appropriate caution among students not yet in full clinical practice. Among those who used AI tools, the primary purposes were studying (reported by the majority), followed by exam preparation, case understanding, and research; writing assignments were the least common purpose.

Ethical Perspectives Domain

The ethical perspectives domain yielded the highest mean score of 4.06±0.60, indicating strong ethical awareness. A large majority endorsed that AI errors may cause patient harm (76.7%), that patients should be informed when AI is involved in diagnosis (74.5%), and that national regulation for medical AI is necessary (69.2%). Awareness of AI bias due to poor data quality was also high (61.2%). These findings suggest that despite modest formal AI training, students have well-developed ethical instincts regarding AI deployment in healthcare (Table III).

Statement	SD n (%)	D n (%)	N n (%)	A n (%)	SA n (%)
Ethical Perspectives Domain					
AI use may compromise patient privacy	9 (4.0)	15 (6.6)	77 (33.9)	104 (45.8)	22 (9.7)
AI can be biased due to poor data quality	3 (1.3)	9 (4.0)	76 (33.5)	114 (50.2)	25 (11.0)
Informed consent required when AI used in care	3 (1.3)	7 (3.1)	57 (25.1)	112 (49.3)	48 (21.1)
Patients should be informed when AI used in diagnosis	3 (1.3)	11 (4.8)	44 (19.4)	110 (48.5)	59 (26.0)
AI errors may cause patient harm	3 (1.3)	6 (2.6)	44 (19.4)	106 (46.7)	68 (30.0)
Doctors remain legally responsible for AI decisions	6 (2.6)	14 (6.2)	58 (25.5)	103 (45.4)	46 (20.3)
AI companies should share responsibility for harm	2 (0.9)	14 (6.2)	43 (18.9)	109 (48.0)	59 (26.0)
National regulation needed for medical AI	2 (0.9)	6 (2.6)	62 (27.3)	94 (41.4)	63 (27.8)

SD=Strongly Disagree; D=Disagree; N=Neutral; A=Agree; SA=Strongly Agree

Table III: Likert Response Distribution for Ethical Perspectives Domain Items (N=227)

Inferential Statistics

Independent-samples t-tests revealed no significant differences in knowledge (p=0.134), attitude (p=0.731), or ethics (p=0.367) scores

between male and female participants (Table IV). Students who had received formal AI teaching demonstrated significantly higher attitude scores compared to those without formal training (3.64±0.68 vs 3.40±0.54; t=2.691, p=0.008). No significant difference was found in knowledge or ethics scores with formal teaching. One-way ANOVA showed no significant variation in any domain score across years of study (Knowledge: F=0.422, p=0.793; Attitude: F=0.808, p=0.521; Ethics: F=0.330, p=0.857).

Variable	Category	Knowledge Mean±SD	Attitude Mean±SD	Ethics Mean±SD	Test Statistic	p-value
Independent Samples t-test						
Sex	Male (n=127)	3.26±0.66	3.47±0.67	4.03±0.65	t=1.505[k]	0.134
	Female (n=100)	3.14±0.55	3.44±0.46	4.10±0.53		
Formal AI Teaching	Yes (n=57)	3.30±0.76	3.64±0.68	4.09±0.69	t=2.691[a]	0.008*
	No (n=170)	3.18±0.56	3.40±0.54	4.05±0.57		
AI Tool Use	Yes (n=214)	3.21±0.63	3.47±0.59	4.07±0.60	t=0.412[k]	0.681
	No (n=13)	3.28±0.40	3.30±0.52	3.95±0.55		
One-Way ANOVA: Domain Score Variation by Year of Study						
First Year (n=69)		3.16±0.64	3.39±0.59	4.08±0.65	F=0.422[k]	0.793
Second Year (n=56)		3.23±0.47	3.41±0.60	4.03±0.52		
Third Year (n=60)		3.21±0.68	3.50±0.59	4.07±0.68		
Final Year (n=29)		3.32±0.72	3.58±0.54	4.13±0.48		
Intern (n=13)		3.13±0.55	3.56±0.63	3.91±0.43		

*p<0.05 (statistically significant). SD=Standard Deviation. Test statistics: t=independent t-test; F=ANOVA F-statistic

Test Statistic for Knowledge domain[(k)] / Test Statistic for Attitude domain[(a)]

Table IV: Inferential Statistics: Comparison of Domain Scores by Demographic and Educational Variables (N=227)

DISCUSSION

This study presents one of the first assessments of AI knowledge, attitudes, practice patterns, and ethical awareness among medical students in Nepal, contributing to a critically underrepresented literature from South Asia. Framed through a radiological lens, our findings reveal moderate AI knowledge, positive attitudes, high ethical awareness, and near-universal informal AI tool usage, a pattern with important implications for radiology-led medical education reform in the region.

A particularly notable finding from a radiology perspective was that 57.2% of students agreed that AI can assist in radiological image interpretation, surpassing agreement rates for all other clinical AI applications in the knowledge domain. This aligns with the global awareness that radiology has been the discipline most visibly disrupted by AI.[1] However, the considerable proportion of neutral or uncertain responses (30.8%) highlights a significant opportunity for radiology departments to assume a proactive educational role. This substantial neutral response rate may reflect limited exposure to radiology postings in early clinical years rather than active disagreement. Faculty in radiodiagnosis are ideally positioned to demonstrate AI applications in chest radiograph triage, CT lesion detection, and MRI segmentation to medical students during clinical postings, translating abstract AI concepts into tangible diagnostic practice.

The mean knowledge score of 3.21±0.62 and the finding that 56.8% of students demonstrated adequate knowledge are comparable to results reported from LMICs, where similar proportions showed limited formal AI literacy despite high interest.[10,11] In contrast, studies from high-income countries such as the United Kingdom and Australia have reported higher knowledge scores, likely reflecting greater integration of AI content in curricula, including radiology-specific modules.[7] This underscores the persistent educational gap in South Asian medical training institutions. The high ethical awareness score (4.06±0.60) is an encouraging finding and has been less consistently documented in comparable surveys. Students expressed strong agreement regarding patient privacy, informed consent, AI accountability, and the need for regulatory frameworks. This ethical sensitivity, even in the absence of formal AI training, may reflect broader social awareness of data privacy concerns and medical liability. This pattern suggests that ethical reasoning about AI may be cultivated through broader digital citizenship and social media discourse around data privacy, rather than requiring formal academic instruction. Studies from China similarly found high ethical concern scores, suggesting this dimension may be less dependent on formal curricula than knowledge or clinical application domains.[12]

The significant association between formal AI teaching and higher attitude scores (p=0.008) is a pivotal finding. Students who received structured AI education were more positive about AI's role in healthcare, even though their knowledge scores did not differ significantly. This suggests that educational exposure shapes professional orientation and receptiveness to AI even before it substantially improves technical knowledge, a distinction relevant to radiology curriculum designers. Conversely, the absence of year-of-study differences in knowledge and attitude is noteworthy, implying that clinical exposure alone, without deliberate AI instruction, does not improve AI-related competencies, as corroborated by various studies. [8,13]

The near-universal informal AI tool usage (94.3%) contrasted sharply with the low rate of clinical decision support use (13.2%), a pattern deserving separate consideration. Students predominantly engaged with AI for studying and exam preparation rather than clinical application, which reflects both the early stage of their clinical training and a cautious, appropriate boundary between academic and clinical AI use. However, as these students progress into clinical years and eventually into practice, structured guidance on when and how to transition from informal to clinical AI use will be essential. Furthermore, the near-ubiquitous use of large language models for academic

tasks raises important questions regarding academic integrity in medical education that institutions must proactively address. This study is among the very few from South Asia specifically assessing ethical dimensions alongside knowledge and attitudes, and the first from Nepal. Given the planned expansion of AI-assisted diagnostic imaging tools in Nepali public hospitals and the SAARC region's growing digital health infrastructure, baseline data of this nature are urgently needed to inform national AI health policy and undergraduate medical training reform.[14]

LIMITATIONS

This study has several limitations. Being a single-institution, cross-sectional study, generalizability to other medical schools in Nepal and South Asia is limited. Selection bias cannot be excluded given the voluntary nature of participation. The cross-sectional design precludes causal inference. The questionnaire, while expert-validated, was not externally validated using a standardized instrument. Additionally, Likert-scale self-report instruments are subject to social desirability bias and central tendency bias, which may have inflated scores, particularly in the ethical perspectives' domain. Also, the relatively small proportion of final-year students and interns (18.5% combined) may limit assessment of senior-year perspectives. Future multi-center, longitudinal studies are recommended to track changes in AI literacy as formal curricula, particularly radiology-led AI modules, are introduced.

CONCLUSION

Medical students in Nepal demonstrate moderate AI knowledge, positive attitudes, widespread informal AI tool usage, and high ethical awareness. Radiological image interpretation was the clinical AI application with the highest recognition among students, underscoring radiology's position as the gateway through which future physicians conceptualize AI in medicine. Formal AI education significantly improves student attitudes, yet three-quarters of students have received no such instruction a critical educational gap. Radiology departments, as primary stakeholders in AI-driven diagnostics, are uniquely positioned to champion the integration of AI literacy programs into undergraduate medical curricula. National medical councils and university governing bodies across South Asia must urgently establish AI competency frameworks in MBBS programs to prepare future physicians for an AI-augmented healthcare environment.

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