

Original Research Article

Attitude, readiness and utilisation of artificial intelligence: a cross-sectional study among undergraduate medical students in a medical college, Kolkata

Shalini Pattanayak¹, Kalpana Gupta², Kuntala Ray^{2*}, Subhosri Saha², Mausumi Basu²

¹Department of Community Medicine, Calcutta National Medical College, Kolkata, West Bengal, India

²Department of Community Medicine, Institute of Post Graduate Medical Education and Research, Kolkata, West Bengal, India

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*Correspondence:

Dr. Kuntala Ray,

E-mail: drkuntala@gmail.com

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ABSTRACT

Background: Artificial intelligence (AI) is used to analyze various digital information and ease the diagnosis and adapted therapies. This study was conducted to assess the attitude and readiness towards AI among undergraduate medical students and to find out their utilization.

Methods: An online survey was performed among 443 medical students with a pre-tested pre-validated questionnaire, Sit's attitude scale and MAIRS-MS scale in 5 point Likert scale. The attitude was categorized as 'favourable' and 'unfavourable' based on the median of the overall attitude score. Scores for each of the four sub-domains under the readiness scale of MAIRS-MS were calculated, and an overall mean±SD score was obtained by summing up the mean scores. ANOVA tests were done to determine group differences, and Spearman's correlation coefficients was calculated to examine associations between individual variables.

Results: Almost all participants were aware of the use of AI in health care. Almost 56% had a 'favourable attitude' towards AI. 41.08% agreed to use AI applications for its purpose, and 32.27% agreed to use AI technologies effectively. The overall mean and SD score of readiness toward AI was 66.13±17.45. Spearman's correlation revealed a moderately positive correlation between the overall readiness score and attitude score (Spearman's rho- 0.483, p<0.001). 292 (66.0%) of the total participants use an AI-based application, out of which 85.0% of them commonly use Chat GPT.

Conclusions: Nearly half of the study participants showed a favorable attitude toward the role of AI in healthcare. They had a noticeable readiness to incorporate AI in medical education.

Keywords: Artificial intelligence, Attitude, Health care, Medical education

INTRODUCTION

Artificial intelligence (AI) is an emerging promising field which is taking over the entire healthcare like a storm globally. AI focuses on creating computer systems capable of human-like cognitive functions, encompassing tasks like image and speech understanding, decision-making, and language translation. In healthcare, AI mainly refers to algorithms and software, for analyzing

digital health data for diagnoses, management and follow-up of patients.¹ AI in medicine is an umbrella term that uses algorithms and software that analyze data and digital information to make diagnoses and suggest therapies.² Incorporating AI in the healthcare sector can potentially enhance precision, efficiency, and patient outcomes. The various AI applications in the field of medicine are scanning health data, laboratory reports, radiological imaging, developing protocols for treatment, surgical

interventions, drugs and vaccines development, genetic studies, and many more.^{3,4} AI applications are also influencing medical education, serving students, educators, and administrators to enhance learning and teaching. Medical students, as future healthcare professionals, are crucial in embracing and utilizing AI in patient care.⁵ Machine learning (ML) and deep learning (DL), subsets of AI, are increasingly relevant in undergraduate and postgraduate medical training.

Despite the potential advantages, the medical community has expressed concerns about AI adoption. A recent debate centered on the possibility of AI algorithms surpassing radiologists, potentially rendering their expertise redundant.⁶ This lack of comprehensive information regarding AI's impact may deter students from pursuing certain medical specialties. A UK-based study indicated that 49% of respondents were less inclined to choose radiology as a career due to AI. These anxieties may shape undergraduate medical students' perceptions of AI, despite their limited exposure to it within the undergraduate medical curriculum.⁷ Medical institutions already face challenges with continuously evolving curricula and the demands to incorporate new subjects, alongside a shortage of specialized faculty and appropriate teaching methodologies.

Notwithstanding existing survey data, the attitude of undergraduate medical students towards AI in medicine and their openness to its inclusion in the medical curriculum remains uncertain, particularly within our state and India. With this background in mind, the present study was conducted to assess the attitude towards AI among undergraduate medical students of a medical college in Kolkata and to identify the readiness towards AI among the study participants. This study aimed to assess the utilization of AI among the study participants.

METHODS

A descriptive, observational study with a cross-sectional study design was undertaken among undergraduate medical students in phases I, II, and III (part I and part II) at Institute of Post Graduate Medical Education and Research (IPGME and R), Kolkata from August to October 2024. The study participants who were unwilling to give informed consent for participating in the study were excluded. A Microsoft form questionnaire was prepared and distributed to the students through emails and social media platforms (WhatsApp). Informed consent was obtained from all the eligible study participants via electronic means (e-consent) where the purpose of the study was thoroughly explained. Ethical approval was obtained from the institutional ethics committee (IPGME/IEC/2024/0609 dated 17.08.24) of IPGME and R. The study contained no names and their emails were masked so that the participants could not be tracked, to maintain anonymity and confidentiality.

This study tool divided into 3 segments to assess AI readiness. The first section collected data across the domains of sociodemographic information, (participants'

age, gender, current medical year, etc.) and their awareness of various AI applications and their usage.

The second section contained items taken from the medical artificial intelligence readiness scale for medical students questionnaire (MAIRS-MS).⁸ The MAIRS-MS questionnaire is a validated study tool, which is designed to assess medical students' readiness and capability to embrace AI across four distinct domains, namely, cognition (8 questions), ability (8 questions), vision (3 questions), and ethics (3 questions), where each question was assigned with a maximum score of 5 ("strongly agree") and a minimum score of 1 ("strongly disagree"). Attitude towards AI was assessed by the attitude scale developed by Sit et al, which is a 5-point Likert scale, having a total of 11 items for the attitude domain, with options for each item having scores of 5 ('strongly agree') to 1 ('strongly disagree').

Data collection period lasted for 2 weeks, where Microsoft forms were circulated among the eligible study participants across all phases of MBBS through social media platform. Relevant information was also shared with each batch of students in their social network group. After obtaining written e-consent, the participants were asked to fill out the online questionnaire. Reminders were sent periodically to the students to encourage their participation in the study.

The collected data underwent a thorough verification process for completeness and accuracy followed by tabulation and statistical analyses using IBM SPSS Statistics, version 25.0 (IBM Corporation, Armonk, NY, USA). Descriptive statistics, like frequency and percentage, were calculated for the demographic variables and all items in the questionnaire. The attitude was categorized as 'favourable' and 'unfavourable' based on the median of the overall attitude score. Score $\geq$ median was classified as 'favourable' while score $<$ median was considered as 'unfavourable'. Item number 3 in the attitude domain of the scale was reversely scored. Mean ($\pm$ SD) scores for each of the four sub-domains under the readiness domain of MAIRS-MS were calculated, and an overall mean $\pm$ SD score was obtained by summing up the mean scores of the four sub-domains. Statistical associations between categorical variables were assessed using the Pearson's Chi-square test, and a p value <0.05 at 95% confidence interval (CI) was taken as statistically significant.

RESULTS

Sociodemographic characteristics

Nearly 57% of the study participants belonged to the age group of 18-21 years. 74.26% of the study participants were males and 32.27% of the study participants belonged to phase I of the current academic year. 67.49% of fathers and 53.95% of mothers of the participants had completed their graduation. 61.62% currently reside in the institutional hostel.

Table 1: Distribution of study participants according to their attitude towards AI (n=443).

Socio-demographic characteristics	n=443	Domain mean	t value* (independent sample t test)/F value# (ANOVA)
Cognitive domain			
Gender			
Male	329	20.34±6.71	2.509, 0.012
Female	114	18.48±7.05	
Permanent residence			
Urban	272	20.66±6.80	3.141, 0.002
Rural	171	18.58±6.72	
Mother's education			
Illiterate	7	18.43±8.01	3.889, 0.021
Primary/middle/secondary	92	18.16±7.00	
Higher secondary and above	344	20.34±6.72	
Ability domain			
Phase of MBBS			
Phase I	143	25.41±7.74	4.317, 0.005
Phase II	132	26.62±8.11	
Phase III part-I	80	27.63±6.11	
Phase III part-II	88	23.53±9.60	
Permanent residence			
Urban	272	26.76±7.70	3.208, 0.001
Rural	171	24.26±8.46	
Father's education			
Illiterate	8	23.75±12.57	5.625, 0.004
Primary/Middle/Secondary	45	22.13±9.28	
Higher Secondary and above	390	26.26±7.74	
Mother's education			
Illiterate	7	27.14±11.97	9.500, 0.000
Primary/middle/secondary	92	22.59±8.93	
Higher secondary and above	344	26.63±7.56	
Awareness on AI			
Present	423	26.04±7.81	2.907, 0.004
Absent	20	20.70±11.79	
Vision domain			
Phase of MBBS			
Phase I	143	9.91±2.90	2.643, 0.049
Phase II	132	10.55±2.79	
Phase III part-I	80	10.15±2.75	
Phase III part-II	88	9.42±3.62	
Permanent residence			
Urban	272	10.68±2.75	5.779, 0.000
Rural	171	9.04±3.17	
Father's education			
Illiterate	8	9.88±4.91	5.534, 0.004
Primary/middle/secondary	45	8.64±3.45	
Higher secondary and above	390	10.21±2.89	
Mother's education			
Illiterate	7	9.43±3.64	14.988, 0.000
Primary/middle/secondary	92	8.58±3.19	
Higher secondary and above	344	10.45±2.85	
Awareness on AI			
Present	423	10.18±2.89	4.472, 0.000
Absent	20	7.15±4.23	
Ethics domain			
Phase of MBBS			
Phase I	143	10.59±2.85	7.463, 0.000
Phase II	132	11.03±2.63	

Continued.

Socio-demographic characteristics	n=443	Domain mean	t value* (independent sample t test)/F value# (ANOVA)
Phase III part-I	80	10.58±2.52	
Phase III part-II	88	9.17±3.72	
Permanent residence			
Urban	272	10.96±2.64	4.791, 0.000
Rural	171	9.60±3.31	
Father's education			
Illiterate	8	8.75±5.03	8.749, 0.000
Primary/middle/secondary	45	8.87±3.45	
Higher secondary and above	390	10.65±2.82	
Mother's education			
Illiterate	7	10.00±3.46	5.844, 0.003
Primary/middle/secondary	92	9.51±3.49	
Higher secondary and above	344	10.69±2.79	
Awareness on AI			
Present	423	10.59±2.85	4.998, 0.000
Absent	20	7.25±4.02	

Attitude towards AI

Most common source of information on AI for the study participants were social media (378), followed by friends (238). 44.24% of the study participants have agreed that AI will play an important role in healthcare, while 37.69% of them agreed that AI may replace some medical specialties in near future. 37.69% agreed that all undergraduate medical students should be taught regarding basics of AI and its various emerging applications in healthcare (Table 1). Almost 56% had a 'favourable attitude' towards AI (Figure 1).

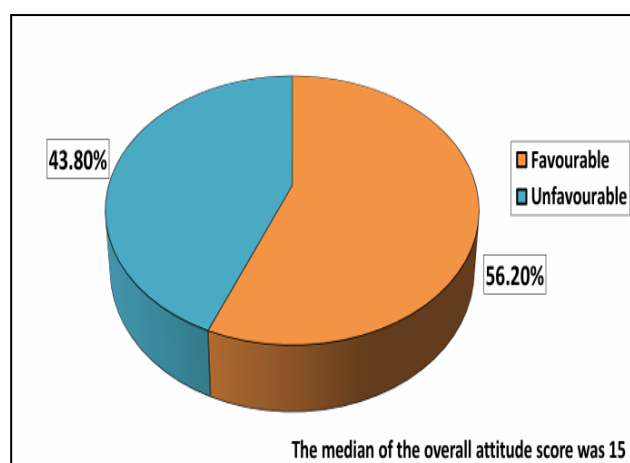


Figure 1: Pie-chart showing the distribution of the study participants based on their attitude towards AI (n=443).

Readiness on cognitive factors towards AI

24.61% of study participants disagreed with explaining the basic concepts of data science, while 36.12% agreed to have a basic conception of statistics. Around 28.00% of the participants disagreed with explaining how AI systems are trained, 26.18% of them disagreed with

giving definitions on AI basics and its terminology, while and 22.57% disagreed with facing problems while analyzing the data obtained by AI in healthcare. Around one-fourth (25.0%) disagreed with differentiating the functions and features of AI-related tools and applications, while 29.35% agreed with expressing the importance of data collection, analysis, evaluation, and safety for the development of AI.

Readiness on ability factor towards AI

Regarding ability of the students concerning AI, approximately 30% agreed to use AI applications for healthcare problems, 31.37% were willing to explain AI applications in healthcare to patients, and 37.69% found value in using AI for education, service, and research. Additionally, 37.92% agreed they could access, evaluate, use, share, and create knowledge using information and communication technologies, 41.08% agreed to use AI applications based on their purpose.

Readiness on vision factor towards AI

41.76% of participants agreed they could foresee both the opportunities and threats AI technology might present, 42.21% agreed they could explain the strengths and limitations of AI, and 34.76% specifically agreed they could explain the limitations.

Readiness on ethics factor towards AI

Almost 40% participants agreed to adhere to the legal regulations in AI use within healthcare, 41.08% agreed to act ethically when using AI, and 39.27% agreed to handle health data according to legal and ethical standards while using AI.

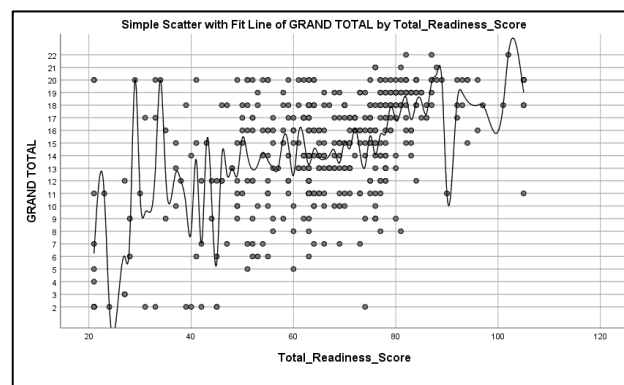
The overall mean and SD score of readiness toward AI was 66.13±17.45. The ability factor domain was found to have the highest mean±SD score (25.70±8.09) (Table 2).

Table 2: Distribution of mean domain scores under the ‘readiness’ factor of the study participants (n=443).

Domains	Mean score	Max. score	Min. score
Cognitive	19.86±6.84	40	8
Ability	25.79±8.09	40	8
Vision	10.04±3.02	15	3
Ethics	10.13±2.99	15	3
Total mean	66.13±17.45	110	22

The differences in mean scores of the domains under ‘readiness’ (cognitive, ability, visual and ethics) across the socio-demographic characteristics of study participants were calculated respectively using ANOVA. It was revealed that the gender of participants, permanent residence and mothers’ education had statistically significant differences with the cognitive domain; phase of MBBS, permanent residence, fathers’ and mothers’ education and awareness on AI had statistically significant differences with the both the ability and vision domain, while phase of MBBS, fathers’ and mothers’ education and awareness on AI had statistically

significant differences in mean scores with the ethics domain (Table 3).

**Figure 2: Scatter plot showing correlation between attitude score and overall readiness score (n=443).**

Spearman’s correlation revealed a moderately positive correlation between the overall readiness score and attitude score, which was statistically significant (Spearman’s rho- 0.483, p<0.001) (Figure 2).

Table 3: Differences in cognitive, ability, vision and ethics domain score of readiness across socio-demographic characteristics of the study participants (n=443).

Socio-demographic characteristics	Mean of cognitive domain score	Mean of ability domain score	Mean of vision domain score	Mean of ethics domain score
Phase of students				
Phase 1	19.50±6.69	25.41±7.74	9.91±2.90	10.59±2.85
Phase 2	20.20±6.44	26.62±8.11	10.55±2.79	11.03±2.63
Phase 3 part-I	20.96±6.05	27.63±6.11	10.15±2.75	10.58±2.52
Phase 3 part-II	18.92±8.16	23.53±9.60	9.42±3.62	9.17±3.72
t value/F value, p value	1.491, 0.216	4.317, 0.005	2.643, 0.049	7.463, 0.000
Gender				
Male	20.34±6.71	26.23±7.91	10.11±2.95	10.53±2.93
Female	18.48±7.05	24.54±8.49	9.87±3.23	10.16±3.16
t value/F value, p value	2.509, 0.012	1.938, 0.053	0.732, 0.465	1.149, 0.251
Permanent residence				
Urban	20.66±6.80	26.76±7.70	10.68±2.75	10.96±2.64
Rural	18.58±6.72	24.26±8.46	9.04±3.17	9.60±3.31
t value/F value, p value	3.141, 0.002	3.208, 0.001	5.779, 0.000	4.791, 0.000
Father’s education				
Illiterate	18.63±10.16	23.75±12.57	9.88±4.91	8.75±5.03
Primary/Middle/Secondary	17.98±7.50	22.13±9.28	8.64±3.45	8.87±3.45
Higher Secondary and above	20.10±6.66	26.26±7.74	10.21±2.89	10.65±2.82
t value/F value, p value	2.088, 0.125	5.625, 0.004	5.534, 0.004	8.749, 0.000
Mother’s education				
Illiterate	18.43±8.01	27.14±11.97	9.43±3.64	10.00±3.46
Primary/middle/secondary	18.16±7.00	22.59±8.93	8.58±3.19	9.51±3.49
Higher secondary and above	20.34±6.72	26.63±7.56	10.45±2.85	10.69±2.79
t value/F value, p value	3.889, 0.021	9.500, 0.000	14.988, 0.000	5.844, 0.003
Awareness of AI				
Present	19.97±6.65	26.04±7.81	10.18±2.89	10.59±2.85
Absent	17.60±9.99	20.70±11.79	7.15±4.23	7.25±4.02
t value/F value, p value	1.514, 0.131	2.907, 0.004	4.472, 0.000	4.998, 0.000

Utilization of AI

Among the study participants, 292 (66.0%) use an AI-based application, out of which, 85.0% of the study participants use Chat GPT. Among 96.9% of the study participants, studying is the most common purpose for using an AI-based application. Almost half of them (50.0%) use them weekly, while among the daily users (20.0%), 17.1% use them for more than 3 days a week. Almost 35 (12%) faced difficulties while using them, the most common being difficulty in understanding and interpreting the data [11 (31.4%)] (Table 4).

Table 4: Distribution of study participants according to the utilization of various AI applications (n1=292).

Utilization	Frequency	Percentage
Commonly used AI applications*		
Chat GPT	248	84.9
Google assistant	215	73.6
Siri	115	39.3
Alexa	117	40.0
Others (Meta AI, August AI, Research Rabbit, etc.)	55	18.8
Duration of use		
Daily	87	29.8
Weekly	146	50.0
Occasionally	59	20.2
Purpose of using AI applications*		
Education	283	96.9
Entertainment	187	64.0
Clinical practice	43	14.7
Others	6	2.0
Different AI applications used first by the participants*		
Google Assistant	127	43.4
Chat GPT	108	36.9
Alexa	28	9.6
Siri	19	6.5
Others	10	3.4

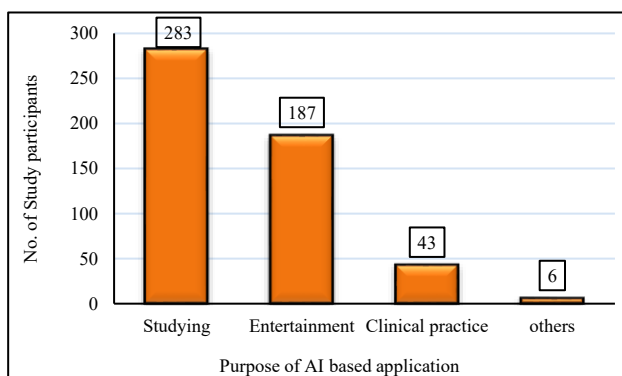


Figure 3: Bar diagram showing the distribution of study participants according to their purpose of AI application usage (n1=292).*

*Multiple response.

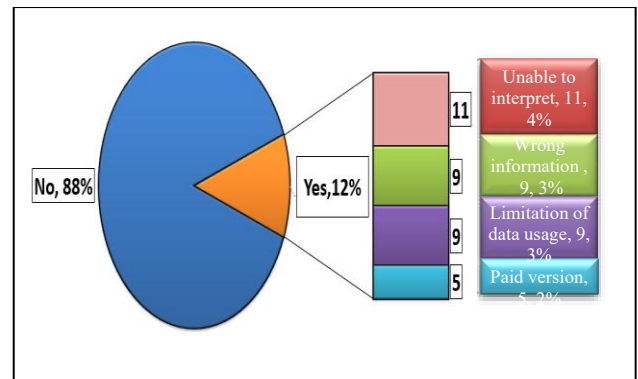


Figure 4: Bar of pie diagram showing the distribution of study participants based on various difficulties faced by them while using AI applications (n1=292).

Most of the study participants used AI-based applications for the study (283) followed by entertainment (187) (Figure 3).

The majority of participants using AI-based applications did so for studying (283), followed by entertainment (187). Among the 34 participants who reported difficulties, the inability to interpret results (11) and encountering wrong information (9) were the most common problems.

DISCUSSION

This study investigated the attitudes and readiness towards artificial intelligence (AI) among 443 medical students at a government medical college, utilizing a validated online questionnaire. Prior research by Li et al indicated that postgraduate medical students demonstrated greater awareness of medical AI compared to undergraduates.¹⁰ Their study also found a positive correlation between the intention to use medical AI and factors like performance expectancy, habit, enjoyment, and trust. In the present study, a significant portion of participants showed some hesitancy regarding fundamental AI concepts, with 24.61% disagreeing about explaining basic data science concepts and 26.18% disagreeing about defining core AI terminology. Additionally, 22.57% disagreed with the proper analysis of AI-derived healthcare data. However, approximately 56% of the students held a 'favorable attitude' towards AI. This underscores the importance of future medical education focusing on enhancing students' practical skills and designing engaging, easily understandable courses to prepare them for their medical careers in an AI-integrated landscape.

A study by Jebreen et al revealed that a majority of their participants (76.79%) had not received formal AI education before or during their medical studies.¹¹ Nevertheless, about two-thirds believed AI would become commonplace (67.9%) and revolutionize medical fields (68.7%). These participants also reported a lack of prior AI training in their formal medical education (74.5%),

highlighting a crucial need to incorporate AI education into medical curricula. Contrasting this, the most frequent sources of AI information for students in the current study were social media (378) and friends (238). A substantial 44.24% of our participants agreed that AI would play a significant role in healthcare, and 37.69% believed AI teaching should be mandatory for all undergraduate medical students. Consistent with Jebreen et al findings, roughly 56% in our study also expressed a 'favorable attitude' towards AI in healthcare. These studies collectively suggest that current learning opportunities for AI in medicine are insufficient, emphasizing the necessity for further exploration into the integration of AI in medical practice.

Findings from Pucchio et al indicated that their respondents generally agreed that AI applications would become common and improve medicine.¹² Furthermore, 73% believed they would need to use and understand AI in their careers, and 67% advocated for formal AI instruction in medical education. Similar to our study, Pucchio et al participants reported social media (378 in our study) and friends (238 in our study) as their primary sources of AI information. In our study, 44.24% agreed on AI's important role in healthcare, and 37.69% thought AI would replace some specialties within their lifetime. A matching 37.69% supported AI teaching for all undergraduate medical students. These findings reiterate the urgent need to integrate AI and its applications into the medical curriculum to encourage its responsible application in healthcare delivery.

Jackson et al study on undergraduate medical students found that only 4.2% believed AI could enhance medical decision accuracy, while 49% saw its potential to improve healthcare accessibility.¹³ Students expressed concerns about the impact on patient-physician relationships (54.5%) and breaches of confidentiality (53.5%). A strong demand for structured AI training, particularly on reducing medical errors (76.9%) and ethical issues (79.4%), was evident. Mirroring our study, Jackson et al participants also cited social media (378 in our study) and friends (238 in our study) as their main AI information sources. In our study, 44.24% agreed on AI's significant role in healthcare, 37.69% anticipated AI replacing some specialties, and 37.69% supported mandatory AI teaching for undergraduates. Additionally, 41.76% of our participants agreed they could foresee AI's opportunities and threats. These results again point towards the need for more AI-focused workshops and seminars for undergraduate medical students to improve their understanding and utilization of AI in healthcare.

A study by Allam et al found that most participants had an inadequate understanding (76.4%) of AI's importance and use in medicine, with a majority (87.4%) holding a negative attitude.¹⁴ Their study also reported that around 40% of participants agreed to follow legal regulations and ethical principles in AI use and data handling. In contrast, our current study showed that approximately 28.00% of

undergraduate medical students disagreed with understanding the efficient use of AI systems, 26.18% disagreed with defining basic AI concepts, and 22.57% disagreed with properly analyzing AI-derived healthcare data. Despite these reservations, about 56% of our students reported a 'favorable attitude' towards AI.

Lugito NPH et al study reported mean scores in cognitive, ability, vision, and ethics domains as 24.52 ± 5.26 (out of 40), 27.78 ± 4.65 (out of 40), 10.57 ± 2.07 (out of 15), and 10.47 ± 2.00 (out of 15), respectively.¹⁵ In contrast, our study found an overall mean readiness score towards AI of 66.13 ± 17.45 , with the ability factor showing the highest mean score (25.70 ± 8.09).

Similarly, Tung et al study found that 71% of students believed AI teaching would benefit their careers, and 69.44% supported mandatory AI education.¹⁶ On the MAIRS-MS scale, their students had mean scores of 21/40 (cognitive), 25/40 (ability), 10/15 (vision), and 11/15 (ethics), with an overall mean of 67 ± 14.8 out of 110. Our study, however, showed a comparable overall mean readiness score of 66.13 ± 17.45 on the MAIRS-MS scale, with the ability factor again exhibiting the highest mean score (25.70 ± 8.09).

Hamad et al research also using the MAIRS-MS scale reported the highest mean in the ability domain (23.38 ± 7.16), followed by cognitive, ethics, and vision.⁹ Their overall mean AI readiness score was 64.26 out of 110. Consistent with these findings, our present study also found the highest mean score in the ability factor (25.70 ± 8.09), with an overall mean readiness score of 66.13 ± 17.45 .

There is paucity of sufficient relevant literature on attitude, readiness, and utilization among undergraduate medical students of West Bengal regarding AI tools and its various applications in healthcare. A large sample size was considered and done on all four phases of undergraduate medical students. It also addressed quite unexplored issues which helps to resolve the problem in the near future. A possible limitation is the sampling technique using social media limits generalizability.

CONCLUSION

In this study, approximately half of the participants held a positive view regarding AI's potential in healthcare. A significant majority, around 60%, reported understanding fundamental concepts of both data science and AI and expressed a readiness to utilize AI applications in healthcare settings. This willingness to adopt AI was observed even though these students acknowledged a perceived lack of cognitive skills in this domain. Furthermore, the study identified a moderately positive correlation between the participants' overall readiness to adopt AI and their general attitude towards it. The primary use of AI-based applications among the students was for academic purposes, with Chat GPT being the

most popular tool. However, a small fraction of the participants reported encountering challenges while using these. This study sheds key insight into the willingness and outlook towards AI literacy among medical students, emphasizing the necessity for AI-related curriculum in undergraduate medical education.

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Ethical approval: The study was approved by the Institutional Ethics Committee (IPGMER/IEC/2024/0609 dt. 17.08.24)

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