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## Original Research Article

# Knowledge, fear and application of artificial intelligence in healthcare and learning, analysis of undergraduate medical students' perspective

Kartikey Sharma<sup>1\*</sup>, Madhumita Dixit<sup>2</sup>, Dwividendra Kumar Nim<sup>1</sup>,  
Rakesh Chandra Chaurasia<sup>1</sup>

<sup>1</sup>Department of Pharmacology, Moti Lal Nehru Medical College, Prayagraj, Uttar Pradesh, India

<sup>2</sup>Department of Pharmacology, Autonomous State Medical College, Sultanpur, Uttar Pradesh, India

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### \*Correspondence:

Dr. Kartikey Sharma,

Email: [sharmakartikey230@gmail.com](mailto:sharmakartikey230@gmail.com)

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## ABSTRACT

**Background:** Artificial Intelligence (AI) is increasingly integrated into healthcare and medical education. Understanding how future healthcare professionals perceive this transformation is crucial for shaping curricula and policy.

**Methods:** A multicentric, cross-sectional analytical study was conducted using a structured, anonymous online questionnaire. The survey comprised 15 multiple-choice questions across three domains: AI knowledge, concerns about its adoption, and expectations of its role in clinical practice and education. A total of 403 MBBS students participated. Descriptive and inferential statistics were used to analyse the data.

**Results:** Most students (75.7%) recognized AI's potential in predicting patient outcomes, and 76.7% believed AI could support but not replace clinical judgment. Ethical and privacy issues (54.3%) were the most cited integration barriers. While 63.3% viewed AI-driven decision support systems positively, 61.8% feared AI might replace doctors—especially due to reduced human interaction (40.9%). Limited practical exposure was evident; 44.4% had never used AI tools, though 86.4% expressed interest in learning more. A majority (67.2%) prioritized human intuition over data-driven decision-making.

**Conclusions:** MBBS students show positive attitudes and curiosity toward AI but have limited practical exposure and formal training. The findings highlight the urgent need to integrate AI education into medical curricula to prepare students for its ethical and clinical implications.

**Keywords:** Artificial intelligence, Education, Medical, Undergraduate, Attitude of health personnel, Ethics, Clinical decision-making

## INTRODUCTION

Artificial Intelligence (AI) is rapidly transforming the landscape of modern healthcare and medical education.<sup>1</sup> From enhancing diagnostic accuracy to optimizing treatment plans and streamlining hospital operations, AI is becoming an indispensable tool for clinicians and healthcare systems worldwide. In medical education, AI-powered platforms are offering innovative ways to deliver personalized learning, simulate clinical scenarios, and

assess student performance.<sup>2,3</sup> As the technology continues to evolve and integrate deeper into the medical field, it is crucial for future healthcare professionals, especially undergraduate MBBS students to be aware of these changes, understand their implications, and be prepared to work alongside intelligent systems.<sup>2,3</sup>

Medical students represent the next generation of doctors who will not only witness but actively engage with the AI-driven transformation of healthcare. Their perceptions,

knowledge, and attitudes toward AI can significantly influence how seamlessly and ethically AI is integrated into clinical practice.<sup>6,7</sup> Despite the growing presence of AI in healthcare, there is still limited insight into how medical students are responding to this shift, whether they feel prepared, threatened, curious, or optimistic about AI's role in their education and future careers.<sup>2,3</sup> Understanding their mindset is essential for designing curricula, policies, and training programs that ensure competent, confident, and ethically responsible use of AI in medicine.<sup>4,5</sup>

This study seeks to address that gap by exploring the awareness, concerns, and expectations of MBBS students regarding AI in healthcare and medical education. The survey focuses on three main dimensions: knowledge of current AI applications, fears or apprehensions related to AI implementation, and perspectives on how AI might impact their future roles as doctors.<sup>6-8</sup> Specifically, the study aims to assess whether students understand how AI is being used in diagnostics, treatment, and education, whether they are concerned about job displacement, ethical dilemmas, or dehumanization of care, and how optimistic they are about AI augmenting rather than replacing medical professionals.<sup>9</sup>

## METHODS

### Study type

This study was designed as a cross-sectional, multicentric, analytical survey aimed at assessing the perspectives of undergraduate MBBS students regarding the role of AI in healthcare and medical education.

### Study place

The research was conducted across multiple medical colleges to ensure a diverse and representative sample of students from varying academic backgrounds and geographical locations. A total of 403 MBBS students voluntarily participated in the study, making it one of the more comprehensive surveys targeting this demographic on the subject of AI.

### Study period

The study was conducted over a period of 1 month (From September, 2024 to October, 2024)

### Selection criteria and data collection procedure

To collect data, a structured survey instrument comprising 15 multiple-choice questions was developed. The questionnaire was carefully designed to cover three key domains: knowledge of AI applications in medicine, concerns or fears about the increasing adoption of AI in clinical practice, and perspectives on how AI may influence future roles as healthcare professionals. Questions ranged from basic awareness of AI technologies to more nuanced topics such as ethical concerns, the

perceived risk of job displacement, and the anticipated benefits or drawbacks of AI integration in medical education and patient care.

Data collection was carried out anonymously to promote honest and unbiased responses. The anonymity of the survey allowed participants to freely express their thoughts, fears, and opinions without apprehension of judgment or academic consequences. The survey was distributed electronically through secure platforms, ensuring easy access and high participation rates across institutions.

### Statistical analysis

Once the data was collected, a thorough analytical process was undertaken. Responses were systematically coded and analysed to identify trends, patterns, and correlations among various subgroups such as year of study, previous exposure to AI, or differences based on the institution. Descriptive statistics were used to summarize the data, while inferential methods helped in identifying significant associations between different variables. All statistical analysis were done using IBM SPSS v.22. A p-value of <0.05 was considered to be statistically significant.

## RESULTS

A total of 403 undergraduate MBBS students participated in the study, representing diverse sociodemographic backgrounds. The majority of respondents (79.4%) were between the ages of 20–24 years, while 12.4% were younger than 20 years and 8.2% were 25 years or older. In terms of gender distribution, 55.6% of participants were male and 44.4% were female. (Table 1).

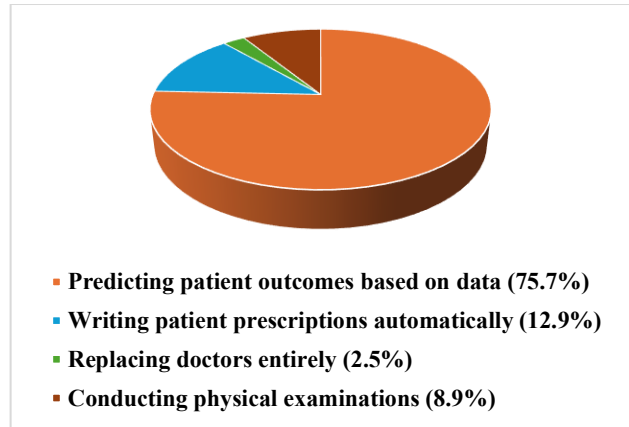
**Table 1: Sociodemographic characteristics of the participants (n=403).**

Parameters	Frequency	Percentage
<b>Age (years)</b>		
<20	50	12.4
20-24	320	79.4
25 and above	33	8.2
<b>Sex</b>		
Female	179	44.4
Male	224	55.6

Regarding knowledge and awareness of AI in healthcare, most students demonstrated a fair understanding of its potential applications. When asked about AI's clinical use, 75.7% recognized its role in predicting patient outcomes, and 12.9% associated it with writing prescriptions. Only a small fraction (8.9%) believed AI could conduct physical examinations, and 2.5% mistakenly thought AI could entirely replace doctors (Figure 1). Notably, 76.7% of students agreed that AI can support but not replace human judgment in diagnosis, while 17.9% believed it could enhance diagnostic speed and accuracy. Ethical and

privacy concerns were identified as the leading challenge to AI integration (54.3%), followed by limited computational power (19.1%) and patient resistance (17.4%) (Table 2).

An overwhelming majority (98.1%) identified broader systemic or technological barriers as the key challenge in integrating AI into healthcare. Very few respondents (0.5%) considered patient resistance a significant obstacle. A significant proportion of participants (63.3%) viewed AI-driven clinical decision support systems (DSS) positively, believing these systems can improve patient care by assisting doctors. However, 10.7% perceived such systems as potentially confusing, and 5% believed they could eliminate the need for specialists (Figure 2). Encouragingly, a large majority (86.4%) expressed interest in learning more about AI and its healthcare applications.



**Figure 1: Which of the following is a potential application of AI in clinical settings?**

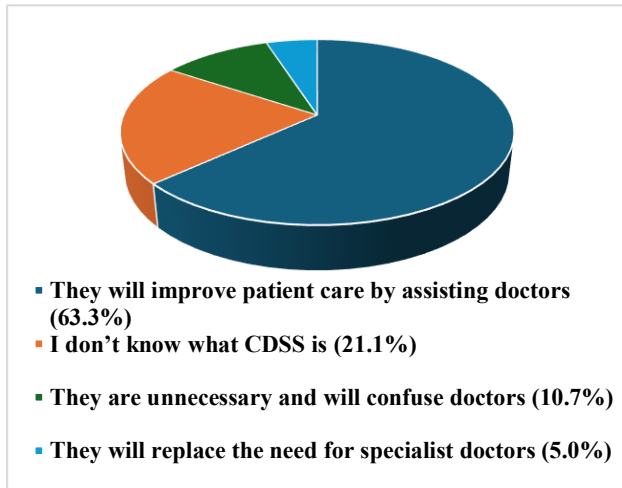
**Table 2: Knowledge of AI in healthcare in the participants (n=403).**

Parameters	Frequency	Percentages
<b>Potential application of ai in clinical settings</b>		
Conducting physical examination	36	8.9
Predicting patient outcomes based on data	305	75.7
Replacing doctors entirely	10	2.5
Writing patient prescriptions automatically	52	12.9
<b>AI's role in assisting with diagnosis</b>		
AI can only support but not replace human judgement	309	76.7
AI has no role in diagnosis	4	1
AI may lead to more errors in diagnosis	18	4.5
AI will make diagnosis faster and more accurate	72	17.9
<b>Main clinical challenge in integrating AI into healthcare</b>		
High patient resistance	70	17.4
Lack of computational power	77	19.1
Ethical and privacy concerns	219	54.3
Shortage of healthcare data	37	9.2
<b>Opinion on AI-driven clinical decision support systems (DSS)</b>		
Don't know	85	21.1
Unnecessary and will confuse doctors	43	10.7
Will improve patient care by assisting doctors	255	63.3
Replace the need for specialist doctors	20	5
<b>Interested in learning more about AI and its application in healthcare</b>		
Yes	348	86.4
No	55	13.6

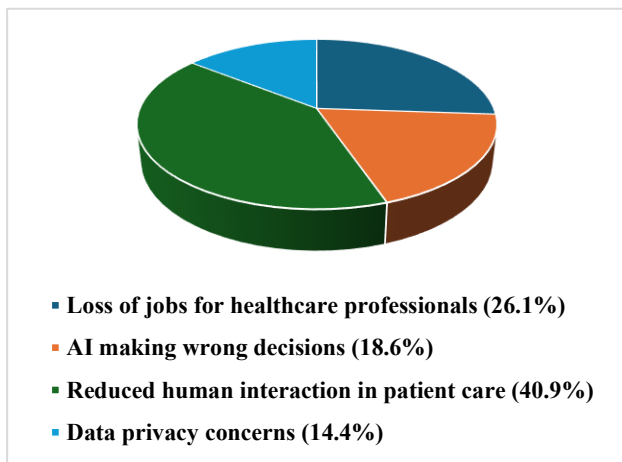
In terms of apprehensions, 61.8% of students were concerned about AI potentially replacing human doctors in the future. The most cited fear was the reduction of human interaction in patient care (40.9%), followed by job loss (26.1%), incorrect AI decisions (18.6%), and data privacy risks (14.4%) (Figure 3). When evaluating AI's ability to manage complex and rare medical cases, nearly half of the students (45.7%) were unsure, while 43.9% believed AI would perform worse than humans. Furthermore, 67.2% believed that human intuition is more important than data-driven approaches in clinical decision-making (Figure 4). Regarding AI-assisted surgeries, opinions were divided—44.2% supported their use, 28% disagreed, and 27.5% remained neutral.

In terms of practical experience, 44.4% of students reported never using any AI-based tools in healthcare, while 23.1% used them occasionally, 21.6% rarely, and only 10.9% frequently. The most commonly used tools were AI-assisted diagnostics (14.9%), AI-powered symptom checkers (13.6%), and predictive analytics tools (11.9%) while majority haven't used any AI tool (59.6%). Despite limited usage, 64.5% of students rated AI tools as effective though only 38% felt these tools had improved their clinical skills or decision-making. Interestingly, 45.4% were unsure about the tools' impact (Figure 5). As for motivations, 31.3% were driven to use AI tools to enhance learning, 26.6% to improve diagnostic accuracy,

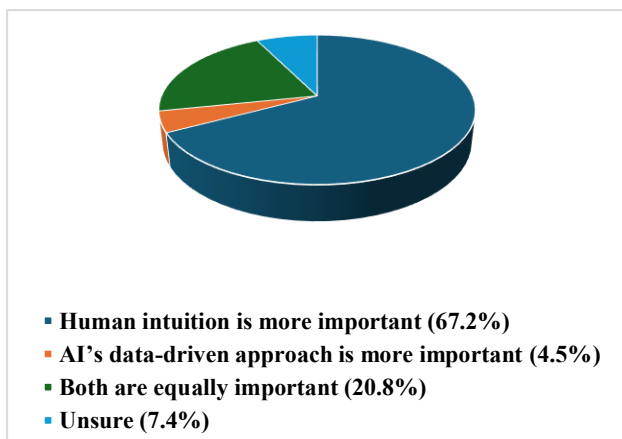
and 23.1% to save time, while 19.1% lacked motivation altogether (Figure 6).



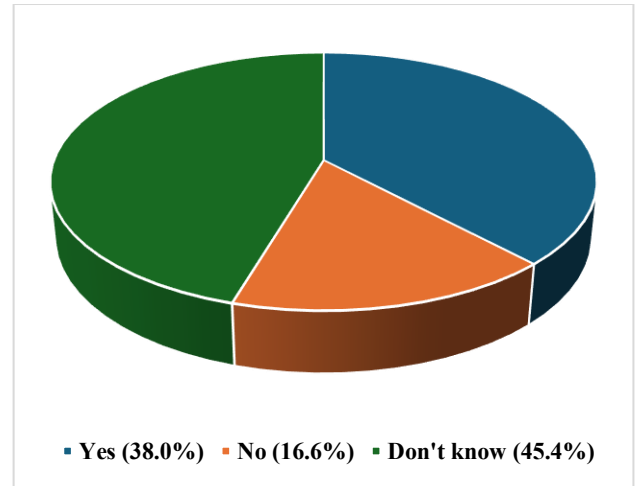
**Figure 2: What is your opinion on AI-driven clinical decision support systems (CDSS)?**



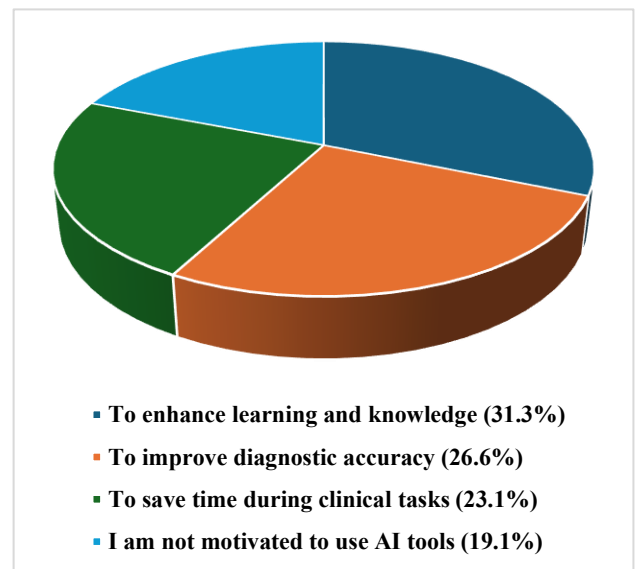
**Figure 3: What is your biggest fear regarding AI in healthcare?**



**Figure 4: How important do you think human intuition is in medical decision-making, compared to AI's data-driven approach?**



**Figure 5: Do you feel that the AI tools you have used improved your clinical skills or decision-making?**



**Figure 6: What motivates you to use AI-based tools in healthcare?**

## DISCUSSION

The objective of this study was to explore MBBS students' awareness, concerns, and expectations regarding AI in healthcare and medical education. A cross-sectional analytical survey was conducted among 403 students using a structured questionnaire covering knowledge, attitudes, fears, and practical experiences with AI. The findings revealed that a majority of students (75.7%) were aware of AI's role in predicting patient outcomes, and 76.7% believed AI could support but not replace human judgment in diagnosis. Similar patterns of moderate knowledge and cautious optimism were reported by Swed et al, who found that while 70% of Syrian respondents had heard of AI, only 23.7% understood its medical applications.<sup>2</sup> Likewise, Amin et al and Buabbas et al observed that students held favourable attitudes toward AI's diagnostic potential

despite limited familiarity with its technical aspects.<sup>2,3</sup> These parallels suggest a consistent global trend: awareness of AI's promise coexists with uncertainty about its operational scope.

Ethical and privacy concerns emerged as the predominant perceived barrier to AI integration (54.3%). This concern echoed the results of Al-qerem et al, and Chan et al who reported that medical students highlighted insufficient knowledge and ethical dilemmas as major obstacles.<sup>2,3</sup> Similarly, Khater et al found that over 80% of Egyptian students demanded curriculum inclusion to mitigate such concerns, underscoring the urgent need for structured education to address apprehensions and misconceptions.<sup>2</sup>

Regarding attitudes toward clinical decision support systems (CDSS), 63.3% of participants in this study viewed them positively, anticipating improved patient care. These findings align with Alwadani et al, who reported that 87% of Saudi students recognized AI's significant role in healthcare, with 71.3% advocating its curricular integration.<sup>8</sup> Similar results were also found by Li et al<sup>3</sup> However, the skepticism expressed by 10.7% of participants here about CDSS creating confusion mirrors the caution reported by Sit et al, where UK students feared that AI might dissuade them from pursuing certain specialties such as radiology.<sup>3</sup> These comparisons suggest that although enthusiasm for AI is prevalent, its acceptance

hinges on clarifying its collaborative, rather than competitive, role in clinical decision-making.

Apprehension about AI replacing doctors was notable, with 61.8% of students expressing concern. The leading fear was reduced human interaction (40.9%), followed by job loss (26.1%). These concerns reflect global anxieties, as reported in Baigi et al's systematic review, where 24% of studies noted students perceived AI as a threat to professional roles.<sup>4</sup> Similarly, Sit et al identified that nearly half of UK students were less inclined to choose radiology, fearing automation might dominate the specialty.<sup>5</sup> These findings highlight a recurring theme: while AI is viewed as an asset, fears of depersonalization and role redundancy persist across regions.

Uncertainty about AI's capability to handle rare and complex cases was evident, with 45.7% unsure and 43.9% predicting inferior performance compared to humans. This scepticism aligns with Amin et al, who reported that Sudanese students doubted AI's ability to replicate nuanced human judgment, reinforcing the notion that clinical intuition remains highly valued.<sup>6</sup> In this study, 67.2% prioritized human intuition over data-driven approaches, echoing Khater et al, who found that Egyptian students strongly supported integrating AI without compromising human decision-making (Table 3).<sup>7</sup>

**Table 3: Fear about AI in healthcare in the participants (n=403).**

Parameters	Frequency	Percentages
<b>How concerned are you about AI replacing human doctors in future</b>		
Not concerned	154	38.2
Concerned	249	61.8
<b>Biggest fear regarding AI in healthcare</b>		
AI making wrong decisions	75	18.6
Data privacy concerns	58	14.4
Loss of jobs	105	26.1
Reduced human interaction in patient care	165	40.9
<b>How well do you think AI will handle complex rare cases that require human touch</b>		
Better than humans	28	6.9
Equal to humans	14	3.5
Unsure	184	45.7
Worse than humans	177	43.9
<b>How important do you think human intuition is in medical decision making</b>		
AI's data driven approach is more important	18	4.5
Both equally important	84	20.8
Human intuition more important	271	67.2
Unsure	30	7.4
<b>Opinion on AI systems being used to assist in surgical procedures</b>		
Agree	179	44.4
Disagree	113	28
Neutral	111	27.5

**Table 4: Practice regarding AI in healthcare in the participants (n=403).**

Parameters	Frequency	Percentages
<b>Ever used ai-based tools for any healthcare related task</b>		
Never	179	44.4
Occasionally	93	23.1
Rarely	87	21.6
Frequently	44	10.9
<b>Type of AI-tools used</b>		
Ai-assisted diagnostics	60	14.9
Ai-based predictive analytics	48	11.9
Ai-powered symptom checkers	55	13.6
Haven't used any ai	240	59.6
<b>Effectiveness of AI tools in performing healthcare tasks</b>		
Effective	260	64.5
Not effective	143	35.5
<b>AI tools have improved clinical skills and/or decision making</b>		
Yes	153	38
No	67	16.6
Don't know	183	45.4
<b>Motivation to use AI based tools in healthcare</b>		
I am not motivated	77	19.1
Enhance knowledge and learning	126	31.3
Improve diagnostic accuracy	107	26.6
Save time during clinical tasks	93	23.1

Practical exposure to AI tools was limited, with 44.4% never having used any, while only 10.9% reported frequent use. This lack of hands-on experience parallels findings from Baigi et al (2023), who noted that 67% of students in reviewed studies admitted to having no practical interaction with AI technologies. Amin et al (2024) similarly highlighted the absence of formal training as a critical barrier to effective adoption.<sup>17</sup> Despite these limitations, 64.5% of respondents rated AI tools as effective, indicating an openness to future engagement if appropriate resources are provided (Table 4).

## CONCLUSION

This study demonstrated that while MBBS students exhibited strong interest and generally positive attitudes toward AI in healthcare and education, their practical exposure and formal training remained limited. Most students recognized AI's supportive role in diagnostics and prognostics, yet many expressed concerns regarding ethical implications, loss of human interaction, and potential job displacement. These concerns aligned with findings from similar studies globally, highlighting the universal need for ethical literacy and practical AI education among future healthcare professionals. The high demand for AI integration into medical curricula, combined with clear gaps in usage and understanding, emphasized an urgent need for structured, hands-on training.

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