Awareness, Needs, and Curriculum Preferences Regarding Artificial Intelligence and Medical Big Data among Clinical Medical Undergraduates in China: A Cross-Sectional Study

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Abstract

Background: The rapid integration of artificial intelligence (AI) and medical big data into health care is transforming diagnostic accuracy, treatment planning, and research capabilities. Despite these developments, formal AI and medical big data education is limited in undergraduate medical curricula, particularly in China.

Objective: This study aimed to investigate clinical medical undergraduates' familiarity with AI and medical big data, their perceived need for relevant courses, and their preferred curriculum design and assessment methods.

Methods: A cross-sectional, web-based survey was administered to students in the five-year clinical medicine program at a medical university in China from January 10 to January 17, 2025.The self-administered questionnaire was developed through a comprehensive literature review, and its content validity was assessed by experts in medical education and artificial intelligence.Descriptive statistics summarized participant demographics and survey responses. Two-way-ANOVA was performed to evaluate differences in grade and gender.

Results: A total of 871 clinical medicine undergraduates participated in the study (62.6% female).While 36% of the students agreed or strongly agreed that they were familiar with the application of artificial intelligence and medical big data in the healthcare field, only 32.6% had prior learning experience in this area.A total of 94% of the students indicated that a course on artificial intelligence and medical big data is needed in their undergraduate curriculum.65% of the students indicated that if a course on artificial intelligence and medical big data is offered, they would prefer personalized teaching based on the textbook, and 73% expressed a preference for open-book examinations. Significant differences in perceptions and curriculum preferences were observed across gender and grade ($P < 0.05$).

Conclusions: This study reveals a strong demand among clinical medicine undergraduates for AI and medical big data education. Even with limited prior experience,students showed clear interest and preferences,emphasizing the need for curriculum adjustments to forster data-driven health care.

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ConclusionThis study reveals a strong demand among clinical medicine undergraduates for AI and medical big data education. Even with limited prior experience,students showed clear interest and preferences,emphasizing the need for curriculum adjustments to forster data-driven health care.

Keywords:artificial intelligence; medical big data; medical education; undergraduate curriculum; curriculum design

Introduction:

In recent years, artificial intelligence(AI) technologies such as machine learning, big data analysis,ChatGPT,and DeepSeek have experienced unprecedented advancement.This technological evolution is bringing fundamental changes to many fields,especially healthcare.For example,in clinical diagnostics,deep learning techniques demonstrated the ability to automatically and accurately detect cancers from histopathological slides and radiological images,potentially reducing the burden of repetitive tasks for pathologists and radiologis[1-4].AI algorithms also enable intelligent analysis of biosignals such as electrocardiograms (ECG) and electroencephalograms (EEGs)[5-7].Furthermore, AI enhances clinical decision support systems (CDSS) by analyzing electronic health records (EHRs) to identify diagnostic errors and highlight abnormal results[8-10].These applications underscore the growing importance of AI in clinical practice and the urgent need to incorporate AI competencies into medical education and training. Future clinicians must not only master clinical reasoning but also attain AI literacy to effectively apply these tools in patient care.The rapid development of AI in healthcare poses both significant challenges and opportunities for medical education globally.However,the integration of AI-related education into medical curricula,particularly in specific regions like China, appears to be lagging behind its adoption in clinical practice.Many students may be inadequately prepared to understand and apply these technologies in real-world settings[11-14].

In response to this educational gap, we conducted an exploratory online survey to assess undergraduate medical students’awareness of AI and medical big data, their perceived educational needs, and preferred instructional formats, with the aim of generating evidence to inform the design of future curricula tailored to the Chinese context.

Methods

Ethical Considerations

This study was approved by the institutional review board(KYLL-2025-057) in the Second Affiliated Hospital of Zunyi Medical University.

Study design and participants

This cross-sectional survey study was conducted online among undergraduate clinical medicine students in Guizhou Province, China, primarily targeting first- and second-year students, with a small number of third- and fourth-year students. After providing informed consent, participants received an anonymous questionnaire via the wjx platform (https://www.wjx.cn). Participation was voluntary, and all respondents were instructed to submit the questionnaire only once. Data collection took place from January 10, 2025, to January 17, 2025.

Survey instrument

A self-developed questionnaire was designed following an extensive review of the literature on artificial intelligence and big data education in clinical medicine, with the objective of identifying and measuring core domains such as AI literacy, perceived demand for relevant courses, and preferred instructional formats.Following standard questionnaire design principles, we defined key constructs and mapped them to specific items to ensure consistency.Content validity was established through expert evaluation by a panel of five specialists,comprising two medical education scholars, one clinical AI researcher.Two experts in survey methodology, independently assessed each item for relevance,clarity,and comprehensiveness.Expert review is recognized as an effective method to maximize content coverage and detect measurement errors before data collection[15]. The final instrument comprised three sections: (1) demographic and educational background; (2) awareness and attitudes toward AI and medical big-data applications; and (3) course demand and format preferences. A total of 18 items were included in the questionnaire, comprising 16 single-choice and 2 multiple-response questions **(Multimedia Appendix 1**.

Data analysis

Quantitative survey data were analyzed descriptively and presented as frequencies and percentages. Two-way-ANOVA was used to compare response distributions across gender and grade levels. A two-sided *p*-value < 0.05 was considered statistically significant. All statistical analyses were performed using R (version 4.5.0).

Results

The study sample comprised 326 males (37.4%) and 545 females (62.6%). Stratification by academic year showed that second-year undergraduates represented the majority (n = 457, 52.5%), followed by first-year undergraduates (n = 381, 43.7%). (**Table 1**).

Table 1:Participant demographic data(n=871)

characteristic	
Gender,n(%)	
Male	326(37.4%)
Female	545(62.6%)
Grade,n(%)	
First-year undergraduate	381(43.7%)
Second-year undergraduate	457(52.5%)
Third-year undergraduate	22(2.5%)
Fourth-year undergraduate	11(1.3%)
Overall	**871**

Students' responses to the questionnaire revealed limited familiarity with AI and medical big data (**Table 2**). Only about one-third (35%) agreed or strongly agreed that they were familiar with the topic, while nearly half reported being neutral. Consistently, only 32.6% had any prior learning experience, and fewer than 5% reported frequent or in-depth study. Although most students had little prior experience with the subject, they expressed highly positive attitudes toward the proposed course.Nearly all respondents recognized its potential value: 94% rated it as necessary or somewhat necessary, and over half (57%) indicated a willingness to pursue self-directed learning through online resources.In terms of instructional preferences, personalized teaching based on textbooks was most favored (65%), followed by flexible teacher-led instruction (23%) and the use of fixed textbooks (12%). Regarding assessment methods, open-book examinations were the dominant preference (73%), whereas closed-book exams (17%) and written assignments (10%) were less popular.

Table 2:Awareness, Educational Needs, and Curriculum Preferences Regarding AI and Medical Big Data among Undergraduate Medical Students

characterstics	items	Overall,n (%)
	Familiarity with AI and Medical Big Data Information	
	A.Agree	167 (19%)
	B.Disagree	119 (14%)
	C.Neutral	418 (48%)
	D.Strong agree	136 (16%)
	E.Very disagree	31(3.6%)

Awareness	**Prior Learning Experience in AI & Medical Big Data**	
	A.Never studied	165(19%)
	B.Rarely studied	419(48%)
	C.Some learning experience	247(28%)
	D.Frequent learning	28(3.2%)
	E.In-depth study with practical experience	12(1.4%)
	Necessity of Offering AI & Big Data Course at University	
	A.completely unnecessary	14(1.6%)
	B.unnecessary	38(4.4%)
	C.somewhat necessary	406(47%)
	D.Necessary	283(32%)
	E.Very necessary	130(15%)
Education Needs	**Intention to Self-learn AI & Big Data via Online Resources**	
	A. Definitely self-learn	75(8.6%)
	B. Likely to self-learn	417(48%)
	C. Uncertain	301(35%)
	D. Unlikely to self-learn	70(8.0%)
	E. Definitely not self-learn	8(0.9%)
Curriculum preferences	**Preferred Type of Course Materials**	
	A. Use fixed textbooks	102 (12%)
	B. Personalized teaching based on textbooks	566 (65%)
	C. Teacher-led flexible teaching	203 (23%)
	Preferred Assessment Method for the Course	
	A. Closed-book exam	152 (17%)
	B. Open-book exam	633 (73%)
	C. Writing papers	86(9.9)

Differences in Questionnaire Responses by Gender and Academic Year

Two-way ANOVA examined the effects of gender and academic year on selected questionnaire items (**Figure 1; Multimedia Appendix 2**). Significant main effects were observed for several items. Familiarity with AI and medical big data (Q1) and understanding of AI and big data applications in healthcare (Q2) differed by both gender and academic year ($p < 0.05$). Prior learning experience (Q3) varied across academic years ($p=0.003$,). Intention to enroll in an AI and big data course (Q13) and preferences regarding course assessment methods (Q15) also showed significant group differences ($p =0.02$,$p=0.04$), while preferred assessment method (Q16) differed by gender ($p =0.04$). No significant interaction effects between gender and academic year were found. Analyses included only

first- and second-year undergraduates due to limited numbers of third- and fourth-year students.

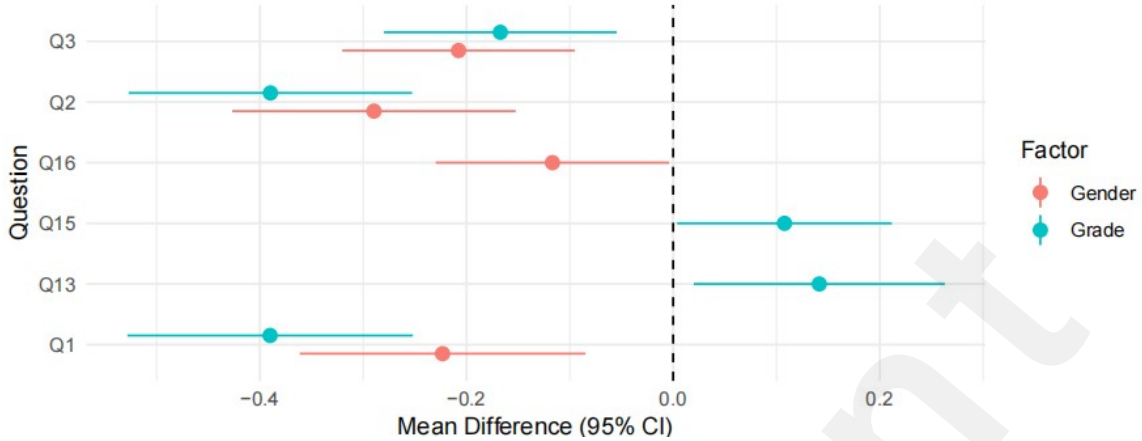

Figure 1. Two-way ANOVA results for selected questionnaire items by gender and academic year. Error bars represent 95% confidence intervals. Significant differences by gender and/or academic year are indicated in the figure. Only first- and second-year undergraduates were included due to small numbers of third- and fourth-year students. Note: Q1 = Familiarity with AI and medical big data; Q2 = Understanding of AI and big data applications in healthcare; Q3 = Prior learning experience; Q13 = Intention to enroll in an AI and big data course; Q15 = Preferences regarding course assessment methods; Q16 = Preferred assessment method.

Motivations and Topic Preferences Regarding an AI and Big Data Course

The most frequently reported purposes for taking the course were enhancing overall academic literacy (22.1%),better involvement in faculty projects (21.1%), and preparation for postgraduate study (19.0%). Regarding the proposed "AI and Big Data in Healthcare" course, the top three preferred topics were data collection and integration (15.7%), statistical analysis and data mining (13.1%), and Clinical Decision Support Systems (12.0%).

Correlation between Cognition and Course Demand

A statistically significant but weak positive correlation was observed between students' understanding of AI and big data (Q2) and their demand for the course (Q12) (Spearman rho = 0.095, $p < 0.01$).(**Figure 2)**

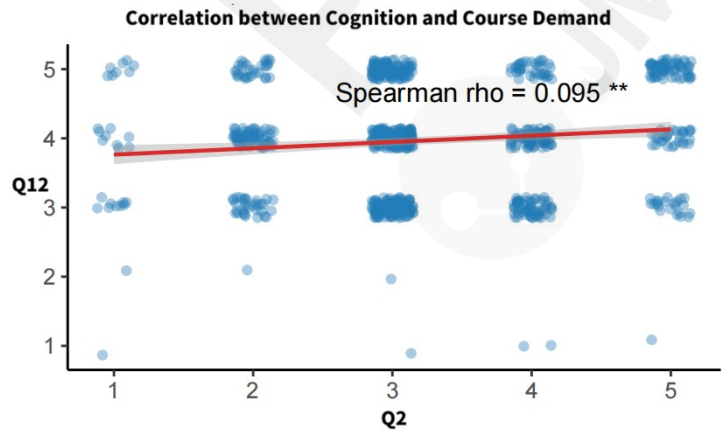

Figure 2. Scatterplot showing the correlation between students' understanding of AI and big data (Q2) and their demand for the course (Q12), with fitted regression line and 95% CI. Spearman's rho = 0.095, $p < 0.01$.

Discussion:

This study provides comprehensive insights into undergraduate medical students' cognition,

demand, and curriculum preferences regarding artificial intelligence (AI) and medical big data. Despite the rapid growth of AI applications in healthcare[16-18], only about one-third of students in our survey reported any familiarity with AI, and fewer than 5% had engaged in substantial learning. These findings mirror international reports from Palestine and Canada, where the majority of students demonstrated limited knowledge and lacked formal training in AI [12, 13]. A recent systematic review further confirmed that most medical students globally exhibit poor baseline literacy but recognize AI as increasingly relevant to clinical practice.

Paradoxically, while familiarity was low, enthusiasm for AI education was strikingly high in our cohort: 94% of students considered the course necessary, and over half expressed willingness to self-study. Similar patterns have been documented in studies from Saudi Arabia, Germany, and Canada, where students strongly advocate for AI integration into curricula despite little formal exposure [19-21]. This mismatch between curricular offerings and learner needs highlights an urgent gap in current medical education.

Our findings also revealed significant gender and academic year differences. Male students reported higher familiarity and prior experience with AI, consistent with earlier studies suggesting gender disparities in digital literacy and STEM self-efficacy [22-24]. Encouragingly, however, both male and female students expressed equally strong support for AI training, suggesting equitable receptivity once opportunities are provided. Similarly, second-year students demonstrated higher familiarity than first-years, echoing research that postgraduate students often report greater AI readiness [25]. Together, these results suggest that progressive, scaffolded exposure beginning early in medical school could help reduce disparities and build competencies over time.

Students' preferences for course design also align with international evidence. Personalized, textbook-based teaching was most favored, followed by flexible instructor-led formats, while open-book examinations were overwhelmingly preferred. These preferences indicate a desire for structured but adaptable learning that emphasizes application over rote memorization, a finding consistent with frameworks advocating clinically relevant, low-stakes learning environments[26, 27]. The prioritized course topics—data collection, statistical analysis, and clinical decision support systems—closely mirror global calls for curricula to focus on technical literacy, applied data science, and ethical reasoning . Pilot initiatives using AI-based simulations, such as MedSimAI, have demonstrated that practical, hands-on modules can enhance competencies and engagement .

Interestingly, we found a statistically significant but weak correlation between students' understanding of AI and their demand for the course (rho = 0.095). This weak effect suggests that enthusiasm for AI training is driven less by prior knowledge and more by perceived relevance to future careers, institutional influences, and awareness of AI's growing role in healthcare . In line with the cognitive-affective theory of learning, demand may be shaped more by motivational and contextual factors than by technical familiarity alone.

The rapid emergence of large language models (LLMs) such as ChatGPT and DeepSeek further underscores the urgency of fostering critical AI literacy. While these tools offer opportunities for personalized learning, clinical simulations, and data interpretation support, they also pose serious risks—including factual inaccuracies, exaggerated claims, and fabricated references. For instance, a study found that only 7% of references automatically generated by ChatGPT were both authentic and accurate, while 47% were entirely fabricated and 46% were inaccurate[28]. Another investigation reported that LLMs used for systematic reviews produced misleading references in over 25% of cases[29]. Additionally, trainees often struggle to detect LLM-generated hallucinations, particularly in complex clinical scenarios—highlighting the need for enhanced critical appraisal training[30]. Currently, no clear guidelines or consensus exist on their responsible use in medical education, leaving students uncertain about how to engage with them appropriately. To address this gap, future curricula should blend technical and ethical AI foundations with targeted training in critical appraisal and evidence-based LLM use, empowering students to engage safely and effectively with these emerging technologies.

Several implications emerge from these findings. First, AI education should be implemented early in undergraduate training and expanded longitudinally across the learning continuum. Scoping reviews and Delphi consensus studies recommend curricula that integrate foundational knowledge, applied data skills, ethical reasoning, and clinical applications across preclinical, clinical, and postgraduate stages . Second, addressing gender confidence gaps and ensuring equitable access are essential for inclusive training . Finally, curricula should leverage innovative approaches such as simulations, online modules, and blended learning to sustain engagement and build progressive competencies .

This study has limitations. It was conducted at a single institution with a predominance of first- and second-year undergraduates, limiting generalizability. The cross-sectional design precludes causal inferences, and self-reported measures may be subject to bias. Future research should employ multi-center and longitudinal designs to evaluate the long-term impact of AI curricula, explore barriers to implementation, and examine outcomes such as clinical competence, confidence, and career trajectories.

In conclusion, this study reveals a paradoxical yet important finding: although Chinese medical undergraduates currently possess limited exposure to AI and big data, they strongly support the integration of related courses and demonstrate clear preferences regarding instructional design. Responding to this demand through structured, equitable, and evidence-based curricula is essential to prepare future physicians for data-driven healthcare.

Conclusion

Clinical medical undergraduates in China showed limited familiarity but strong demand for education in artificial intelligence and medical big data. This “low familiarity–high demand” gap highlights the urgency of incorporating structured AI and data science training into medical curricula. Our findings provide evidence to guide curriculum development and support the integration of future-oriented competencies in medical education.

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Supplementary Files

Multimedia Appendixes

Survey questionnaire.
URL: http://asset.jmir.pub/assets/6371fddc558c63289500a18b09ed5919.xlsx

Analysis of differences by grade and gender.
URL: http://asset.jmir.pub/assets/849e81a6ed8d9cd73c9cc705293a6f6e.xlsx