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والثلاثون

استخدام الذكاء الاصطناعي لدى طلبة الطب في العراق: المزايا والتحديات

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المستخلص:

ومع التطور السريع لأدوات الذكاء الاصطناعي وتزايد دمجها في الرعاية الصحية، تبرز الحاجة إلى تمكين طلبة الطب من فهم هذه التقنيات والتكيف معها واستخدامها بفاعلية. إلا أنّ هناك فجوة واضحة في التعليم الرسمي والتدريب العملي، خاصة في الدول النامية مثل العراق. هدفت هذه الدراسة إلى تقييم مستوى الوعي والاتجاهات والاستعداد لدى طلبة الطب الجامعيين في العراق تجاه استخدام الذكاء الاصطناعي في الطب.

أُجريت دراسة وصفية مقطعية شملت ٤٦١ طالبًا من كليات الطب في جامعات حكومية وأهلية مختلفة في العراق. جُمعت البيانات باستخدام استبيان إلكتروني منظم وُزِع عبر المنتديات الطلابية ومنصات التواصل الاجتماعي، وتضمن معلومات ديموغرافية، ومستوى المعرفة واستخدام الذكاء الاصطناعي، والفوائد والمخاوف المتصورة، إضافة إلى تفضيلات الطلبة بشأن تعليم الذكاء الاصطناعي. تم تحليل البيانات باستخدام الإحصاء الوصفي والاستدلالي عبر برنامج SPSS.

أظهرت النتائج أن غالبية المشاركين (٩٥.٢%) يستخدمون أدوات الذكاء الاصطناعي، وكان ChatGPT الأداة الأكثر استخدامًا. ومع ذلك، فإن نسبة قليلة فقط تلقّت تدريبًا رسميًا في هذا المجال، واعتمد معظم الطلبة على التعلم الذاتي. وأعرب عدد كبير منهم (٦٣.٣%) عن رغبة قوية في الحصول على تعليم إضافي في الذكاء الاصطناعي، لا سيما في مجالات الجراحة، وإدارة البيانات الصحية، وتشخيص الأمراض. كما اتفق الطلبة على أن الذكاء الاصطناعي يمكن أن يسهم في تحسين التعليم الطبي ودقة الممارسة السريرية، مع وجود مخاوف تتعلق بالجوانب الأخلاقية،



وخصوصية البيانات، وتأثير الذكاء الاصطناعي على فرص العمل مستقبلاً. وقد حظي إدماج الذكاء الاصطناعي ضمن المناهج الطبية بدعم واسع من قبل المشاركين. تخلص الدراسة إلى وجود اهتمام كبير لدى طلبة الطب في العراق بتطبيقات الذكاء الاصطناعي في الرعاية الصحية، رغم محدودية التعرض الرسمي له. وتشير هذه النتائج إلى الحاجة الملحة لإدخال تعليم منظم للذكاء الاصطناعي ضمن المناهج الطبية، بما يسهم في إعداد كوادر طبية قادرة على استخدام هذه التقنيات بصورة مسؤولة وفعالة، وتحسين جودة الرعاية الصحية وتعزيز الابتكار الطبي.

الكلمات المفتاحية: الذكاء الاصطناعي؛ التعليم الطبي؛ العراق؛ المزايا والتحديات.

Artificial Intelligence in Medical Education: A Survey of Awareness and Readiness Among Iraqi Medical Students

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Abstract:

Artificial Intelligence (AI) has become a transformative technology across numerous sectors, particularly in medicine. With the rapid advancement in AI tools and their integration into healthcare, there is a growing need for medical students to understand, adapt to, and utilize these technologies effectively. However, gaps in formal education and practical exposure remain significant, particularly in developing countries such as Iraq. This study aims to assess the level of awareness, attitudes, and readiness of undergraduate medical students in Iraq regarding the use of artificial intelligence in medicine. A descriptive cross-sectional study was conducted among 461 medical students from various public and private universities in Iraq. Data were collected through a structured online questionnaire distributed via student forums and social media platforms. The questionnaire covered demographic information, knowledge and usage of AI, perceived benefits and drawbacks, and preferences for AI education. Descriptive and inferential statistics were used to analyze the data using SPSS software.



The majority of participants (95.2%) reported using AI tools, with ChatGPT being the most widely used. However, only a small percentage had received formal AI training, and most relied on self-learning. A significant number (63.3%) expressed a strong desire for further education in AI, especially in fields like surgery, health data management, and disease diagnosis. Students generally agreed that AI could improve medical education and clinical accuracy, although many raised concerns about ethical issues, data privacy, and the impact of AI on future employment. There was also broad support for integrating AI into the medical curriculum. The study highlights a substantial interest among Iraqi medical students in the application of AI in healthcare, despite limited formal exposure. These findings indicate a critical need for structured AI education within the medical curriculum. Addressing this gap will better prepare future healthcare professionals to responsibly and effectively implement AI tools in clinical practice, contributing to improved patient outcomes and healthcare innovation.

Keywords: Artificial Intelligence; Medical education; Iraq; Advantages and Disadvantages.

Introduction

In several scientific domains, including engineering, technology, and medicine, artificial intelligence (AI) has recently gained prominence. It gives aspiring medical professionals the knowledge and resources they need to successfully navigate AI-driven developments. Its incorporation into medical education is extremely important; increasing medical students' knowledge of AI can help them better prepare for the changing patient care environment. Modern computers were developed in the 1950s, led by prominent scientists like Alan Turing, marking the beginning of their journey to peak advancement (Amisha *etal*, 2019). Artificial intelligence was incorporated into medicine during the early 1970s, particularly to help with precise disease diagnosis (Li and Qin,2023). Future autonomous diagnosis will be possible thanks to the training of machine learning and deep learning algorithms to understand and evaluate a variety of radiological pictures and disorders (Alghamdi and Alashban,2024). Between 1997 and 2015, by mid-



2021, this number had risen to more than 350 devices, reflecting substantial advancements in medical technology within healthcare. (Chen *et al.*,2022).

There are many obstacles to the use and applications of AI, especially those related to moral quandaries, invasions of patient privacy, and mistakes that could endanger patient lives. Even with remarkable advancements in diagnostic and treatment capabilities, AI falls short of matching the full complexity of human cognition. (Kwak *et al.*,2022). here have already been attempts to raise the general ethical awareness of those working on AI development. Today, prestigious universities and research facilities have included ethics into their technological courses with the express goal of improving developers', programmers', and engineers' critical thinking skills (Huisman *et al.*,2021). While some view AI as a transformative technology that can enhance patient outcomes, others express concerns regarding the reliability, security, and ethical implications of AI-based medical decision-making (Al-Qerem *et al.*,2023). Because technology and biomedical knowledge are developing at such a rapid rate, it will be crucial to include AI-based content in medical education. Educators must be prepared to teach different aspects of AI technologies (Hua *et al.*,2024). To improve patient care, radiologists must proactively educate themselves about artificial intelligence (AI) and its uses while working with researchers. Additionally, AI's effects go beyond radiology and will also have an impact on other medical specialties like pathology, cardiology, and others (Lambert *et al.*,2023; Jackson *et al.*,2024)

An evident knowledge gap is present in this field in Iraq, which must be addressed due to the inevitable future increase in AI use in the medical field. It is important to understand the attitudes and behaviors of medical students as end users of AI applications in the future to integrate AI into medicine and medical education. Additionally, evaluating students' perceptions of AI is essential to determining whether additional training may later be needed, given that they will constantly interact with patients and use technology. However, based on our knowledge, there are no recent studies investigating the perceptions of Iraqis medical students about the integration of AI in medical education.



Therefore, this study aims to identify undergraduate medical students' attitudes toward AI in medicine, explore present AI-related training opportunities, investigate the need for AI inclusion in medical curricula, and determine preferred methods for teaching AI curricula. The findings will help in making decisions about medical AI implementation and the development of medical curricula in the future.

Methodology

A descriptive cross-sectional study was conducted among medical students from all public and private universities in Iraq. Data were collected using a voluntary sampling method through an online Google Forms questionnaire, which was distributed via medical student social media groups, forums, and student representatives across the country. A total of 461 valid responses were obtained. The questionnaire included items on demographic characteristics (year of study, university, and governorate), awareness and patterns of AI usage, perceived advantages of AI, such as improved learning efficiency and research support, perceived disadvantages, including concerns about reliability, reduced critical thinking, and ethical issues, as well as overall attitudes toward the use of artificial intelligence.

5.Data Analysis:

Descriptive Statistics: Frequencies, percentages, Inferential Statistics : Chi-square tests (for categorical variables, e.g., year vs. tool usage).

6.Ethical

Considerations

Participation in the study was voluntary, and informed consent was implied upon initiation of the online survey. The questionnaire was piloted before distribution to assess feasibility, clarify ambiguous wording, identify unclear items, and ensure accessibility of the online form. Ethical approval was obtained from the College of Medicine Ethical Committee, Wasit University, Iraq (Approval No. 2945; 4-11-2025). The study was conducted in accordance with the ethical principles of the Declaration of Helsinki.

This cross-sectional study aimed to evaluate the awareness, attitudes, and usage patterns of artificial intelligence among medical students in Iraq. The findings reveal a high level of engagement with AI tools, albeit with limited formal training, reflecting both opportunities and challenges in the



integration of AI into medical education and practice. After analyzing the data from the Usage of Artificial Intelligence Among Medical Students in Iraq survey, 461 samples, the findings are as follows:

Table 1: Socio-demographic characteristics of undergraduate medical students who participated in the Artificial Intelligence survey.

Variable		Frequency	Percentage
Gender	Male	153	33.2%
	Female	308	66.8%
Age(yrs)	Less than 20	46	10.0%
	20-25	390	84.6%
	26-30	16	3.5%
	More than 30	9	2.0%
Year of study	First year	32	6.9%
	Second year	64	13.9%
	Third year	97	21.0%
	Fourth year	64	13.9%
	Fifth year	139	30.2%
	Sixth year	65	14.1%

This table presents the demographic characteristics of the 461 participants included in the Usage of Artificial Intelligence Among Medical Students in Iraq study. Females constituted the majority of the sample (66.8%), while males represented 33.2%. Most participants were aged 20–25 years (84.6%), followed by those younger than 20 years (10%). Regarding the year of study, fifth-year students formed the largest group (30.2%), followed by third-year students (21%), sixth-year students (14.1%), and second-year students (13.9%). The observed pattern of high self-reported familiarity coupled with scarce formal training is consistent with the Jordanian multi-university survey of Al-Qerem et al. (2023) and the Syrian nationwide online study of Swed et al. (2022), both of which documented that medical students actively seek AI knowledge through social media and search engines rather than through curricular offerings. Amisha et al. (2019)



have argued that such informal acquisition, while commendable for motivation, risks leaving knowledge gaps in basic machine-learning concepts and clinical validation principles. The present data, therefore, reinforce the call by (Li & Qin,2023) for scaffolded AI literacy courses that begin with foundational terminology and progress to critical appraisal of algorithms.

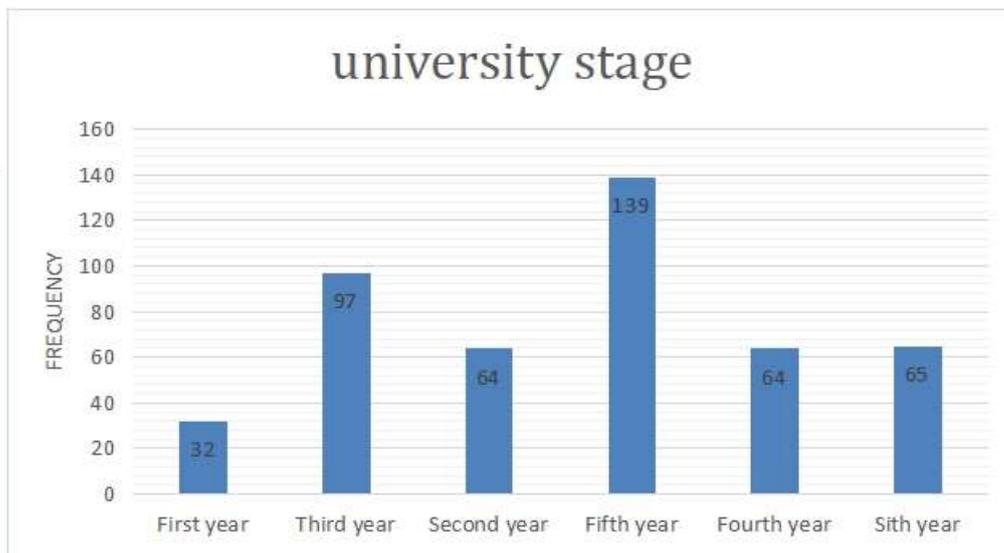


Figure 1: Distribution of participants by current academic year

Unlike the German radiology trainee cohort analysed by Huisman et al. (2021) or the Palestinian undergraduate sample reported by Jebreen et al. (2024), where male participants scored higher on AI self-efficacy scales, the current Iraqi dataset shows no significant gender divergence. This echoes the Saudi national study of Alghamdi & Alashban,2024, in which female health-science students actually outperformed males on AI attitude indices, suggesting that cultural context modulates technology acceptance more than biological sex. Similarly, the absence of a clear year-of-study gradient in our sample contrasts with the Syrian experience (Swed et al.,2022), where clinical-year students exhibited greater positivity, presumably because of imminent workplace exposure. One explanatory hypothesis, advanced by



Park et al. (2021), is that early clinical immersion in Iraqi colleges may homogenise AI perceptions across cohorts.

Table 2: Association between prior AI knowledge and selected demographic/educational variables

Variable		Do you have prior knowledge of artificial intelligence before receiving any formal or informal training?		p-value
		Yes	No	
Gender	Male	125	28	0.106
	Female	269	39	
Stage	First stage	25	7	0.721
	Second stage	57	7	
	Third stage	82	15	
	Fourth stage	57	7	
	Fifth stage	118	21	
	Sixth stage	55	10	
Have you received any formal education or training in the field of artificial intelligence?	Yes	66	3	0.009
	No	328	64	
Type of training	Non	٢٥٠	٥٠	0.371
	Self-learning via the Internet	١٢٠	١٥	
	Online course	١١	٠	
	University course	٦	١	
	Workshop/Seminar	٧	١	
Your understanding of artificial intelligence	Non	4	7	0.001
	Basic	116	21	
	Medium	181	32	
	Advanced	93	7	



This table examines the participants' prior knowledge of AI in relation to gender, study stage, formal education, type of training, and level of understanding. Most of both males and females reported having prior knowledge of AI, although the difference was not statistically significant ($p = 0.106$). No significant relationship was observed between study stage and AI knowledge ($p = 0.721$). Formal education or training in AI showed a statistically significant relationship with prior knowledge ($p = 0.009$), indicating that structured learning influences AI awareness. Although most participants reported no training, self-learning via the internet was common. Understanding level showed a significant relationship ($p = 0.001$); those with medium or advanced understanding were more likely to have prior knowledge.

Table 3: Patterns of Artificial Intelligence tool utilization and frequency of use among medical students.

Variable		Frequency	Percentage	
Are you using it?	Yes	439	95.2%	
	No	22	4.8%	
Tools used	ChatGPT	290	62.9%	
	Deep seek	98	21.3%	
	Other	Quillbot	73	15.8%
		Grammly		
		Paperpal		
		Jenny.ai		
Blainy				
Frequency of use	Daily	275	59.7%	
	Weekly	147	31.9%	
	Rare	32	6.9%	
	Never used	7	1.5%	



This table explores the use of AI tools among participants: An overwhelming majority (95.2%) reported using AI tools. The most commonly used tool was ChatGPT (62.9%), followed by Deep Seek (21.3%), and other tools (Quillbot, Grammarly, Paperpal, Jenny.ai, and Blainy) (15.8%). Regarding frequency of use, daily users formed the largest group (59.7%), followed by weekly users (31.9%). Only a small number reported rare use (6.9%) or never using AI tools (1.5%).

Table 4: Students' perceptions regarding educational impact, employment threat, data privacy, and curricular integration of Artificial Intelligence.

Variable		Frequency	Percentage
Can AI help improve the accuracy of education?	Yes	421	91.3%
	No	40	8.7%
Does AI negatively affect job opportunities for doctors?	Yes	161	34.9%
	No	300	65.1%
AI poses a threat to job security in the medical field.	Agree	102	22.1%
	strongly agree	48	10.4%
	Don't agree	178	38.6%
	Strongly don't agree	32	6.9%
	Indifferent	101	21.9%
How concerned are you about data privacy issues related to AI in healthcare?	Not worried	135	29.3%
	somewhat worried	136	29.5%
	A little worried	163	35.4%
	very worried	27	5.9%
AI should be integrated into medical curricula.	Agree	172	37.3%
	strongly agree	109	23.6%
	Don't agree	87	18.9%
	Strongly don't agree	18	3.9%
	Indifferent	75	16.3%



Variable	Frequency	Percentage
Do you think AI can make accurate medical decisions without human intervention?	Yes	68 14.8%
	No	222 48.2%
	Not sure	171 37.1%

This table presents participants' perspectives on AI's impact in the medical field: Most respondents (91.3%) agreed that AI can improve the accuracy of education. A smaller portion (34.9%) believed that AI negatively impacts job opportunities for doctors.

When asked whether AI poses a threat to job security, 32.5% either agreed or strongly agreed, while 45.5% disagreed or strongly disagreed. Participants expressed mixed levels of concern regarding data privacy, with 35.4% being a little worried, and 5.9% very worried. A majority supported integrating AI into medical curricula (60.9%). However, only 14.8% believed AI can make accurate medical decisions without human intervention, while 48.2% said no, and 37.1% were unsure.

Table 5: Future training interests and preferred clinical application domains of Artificial Intelligence.

Variable	Frequency	Percentage
Would you like to receive additional training in the field of AI?	Yes	292 63.3%
	No	77 16.7%
	Not sure	92 20.0%
What areas would you like to apply AI to in the future?	Treatment, diagnosis, and prognosis of diseases	75 16.27%
	Developing treatments	50 10.85%
	Surgery	100 21.69%
	Health data management	90 19.52%
	Other	146 31.67%
Drug discovery and development		
	Radiology	



This table examines participants' future interests in AI, with a majority (63.3%) expressing a desire for further training. When asked about preferred areas for AI application, the most frequently cited were surgery (21.7%), health data management (19.5%), diagnosis and prognosis (16.3%), and treatment development (10.9%), while 31.7% mentioned other applications. ChatGPT dominated the tool landscape, a finding that parallels the Baghdad-focused investigation of Al-Hassnawi & Abbas, 2023, and the southern Vietnamese survey of Truong *et al.*, 2023. The centrality of conversational agents indicates that students primarily exploit AI for instantaneous clarification rather than for structured problem-solving, a behaviour documented among Pakistani undergraduates by Imran & Jawaid (2020). From a pedagogical standpoint, Lamb *et al.* (2023) caution that over-reliance on generative text models may impede the development of first-principle reasoning unless balanced by faculty-moderated activities such as algorithmic trace-through sessions or uncertainty quantification exercises.

The strong endorsement of AI as an educational enhancer aligns with the systematic review of Chen *et al.* (2022), covering 58,000 physicians and students globally, where perceived learning utility was the strongest predictor of acceptance. Conversely, worries about future employment replicate the apprehension identified in India by Howard (2019) and in China by Dai *et al.* (2020), both of whom reported that trainees fear commoditization of diagnostic skills. Kwak *et al.* (2022) demonstrated that ethics education moderates such anxiety by reframing AI as a decision-support rather than decision-replacement tool; incorporating similar modules could mitigate workforce concerns in Iraqi curricula.

Privacy apprehension voiced in open-ended responses corroborates the quantitative findings of Buabbas *et al.* (2023) in Kuwait and Hassan & Al-Mousawi (2024) in Basrah, where security of patient datasets was rated the top barrier to AI adoption. Hua *et al.* (2024) emphasize that trust is contingent upon transparent governance frameworks that clarify data ownership, de-



identification protocols, and audit trails. Embedding these topics within existing medical ethics courses, as piloted by the World Medical Association (WMA,2013), would provide a low-resource strategy to address student misgivings without demanding new stand-alone modules.

The call for formal inclusion supports the multinational Arab survey of Allam *et al.* (2024 in which 87 % of respondents requested AI-revised syllabi. Jackson *et al.* (2024 provide a blueprint: a spiral curriculum starting with pre-clinical algorithmic literacy, followed by clerkship-based clinical decision-support laboratories and electives in data science. Such an incremental model obviates the faculty shortage problem highlighted by Lugito *et al.* (2024) in Indonesia, where inter-university resource sharing and massive open online courses (MOOCs) were leveraged to train teaching staff first.

The prioritisation of surgery, diagnostics, and health-data management mirrors preferences expressed by Palestinian (Jebreen and Radwan,2024), Jordanian (Hamad *et al.*, 2024), and Indonesian (Lugito *etal*,2024) cohorts. Neri *et al.* (2019 argue that radiology serves as a “gateway specialty” because of readily available imaging datasets and clear outcome metrics; thus, pilot AI electives could strategically start within radiology departments and subsequently diffuse to pathology and cardiology, as envisioned by Hricak (2018. Moreover, Hamet & Tremblay (2017 advocate for capstone projects that allow students to co-develop predictive models using local epidemiological data, thereby fostering contextual relevance and ownership.

While student motivation is evident, the scarcity of trained faculty is a recurrent bottleneck in low-resource settings (Truong *etal*,2023), (Lugito *etal*,2024). The experience of the University of Jordan, described by Hamad *et al.* (2024 , shows that a “train-the-trainer” model—where a seed group of clinicians undergoes intensive AI workshops and subsequently mentors peers—can triple teaching capacity within two academic years. Adopting a similar cascade approach in Iraq could accelerate curricular deployment without awaiting large-scale government funding.

European and North American medical schools have begun embedding AI competencies into accreditation standards (Jackson *et al.*, 2024; Park *et*



al., 2021). The Association of American Medical Colleges now recommends that graduating physicians should be able to “critically evaluate AI-based clinical evidence” (Wartman and Combs, 2018). Aligning Iraqi learning objectives with these emerging international benchmarks would facilitate student exchange, attract research collaboration and prepare graduates for licensing examinations that increasingly include AI vignettes.

Conclusion

This study reveals a high adoption rate of AI tools among Iraqi medical students, primarily through self-learning platforms like ChatGPT. Despite strong interest in AI applications, particularly in surgery, health data management, and diagnostics, formal AI education remains scarce. Students recognize AI’s potential to enhance medical education and clinical accuracy but express significant concerns regarding ethical issues, data privacy, and job security. There is a clear demand for integrating structured AI training into medical curricula to prepare future healthcare professionals for technologically advanced clinical environments.

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Conflicts of Interest

The authors declare no competing interests.

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