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RESEARCH ARTICLE

Exploring Jordanian medical students' perceptions and concerns about ChatGPT in medical education: a cross-sectional study

Adnan Abu Hammour[a], Khawla Abu Hammour[b], Hamza Alhamad [c], Razan Nassar[d], Faris El-Dahiyat [e,f], Majd Sawaqed[g], Aya Allan[g], Qusai Manaseer[h], Mohammad Abu Hammour[a], Abdulsalam Halboup [i,j] and Rana Abu Farha[d]

[a]Internal Medicine Department, Jordan University Hospital, Amman, Jordan; [b]Department of Clinical Pharmacy and Biopharmaceutics, University of Jordan, Amman, Jordan; [c]Department of Clinical Pharmacy, Zarqa University, Zarqa, Jordan; [d]Department of Clinical Pharmacy and Therapeutics, Applied Science Private University, Amman, Jordan; [e]Clinical Pharmacy Program, Al Ain University, Al Ain, United Arab Emirates; [f]AAU Health and Biomedical Research Center, Al Ain University, Abu Dhabi, United Arab Emirates; [g]Pharmacy Department, Jordan University Hospital, Amman, Jordan; [h]Orthopeadic Department, Jordan University Hospital, Amman, Jordan; [i]Department of Clinical Pharmacy and Pharmacy Practice, University of Science and Technology, Sana'a, Yemen; [j]Discipline of Clinical Pharmacy, School of Pharmaceutical Sciences, Universiti Sains Malaysia, Penang, Malaysia

ABSTRACT

Background: The integration of Artificial Intelligence (AI) tools like ChatGPT into medical education is expanding, offering benefits such as efficient information synthesis. However, concerns about the accuracy, reliability, and proper use of these tools persist. Understanding medical students' perceptions of ChatGPT is crucial for optimising its use in educational settings.

Objectives: To evaluate how medical students perceive ChatGPT for educational purposes and to assess its perceived advantages and disadvantages.

Methods: A cross-sectional study was carried out using a questionnaire with five main domains to explore Jordanian medical students' perceptions, practices, and concerns regarding the ChatGPT. This study was conducted from May to July, 2023, and the data were collected using the convenience sampling technique through Google Forms shared within medical students' Facebook groups. Descriptive statistics summarised participant demographics, while logistic regression identified factors influencing ChatGPT usage. Variables with a P-value ≤ 0.05 in multiple regression were considered statistically significant.

Results: Nearly two-thirds (N = 136, 61.5%) claimed to have knowledge of AI but not in clinical settings. Most participants (88.5%, N = 216) were aware of ChatGPT, with 86.9% (N = 212) agreeing that 'Medical students can benefit from using ChatGPT.' Additionally, 83.2% (N = 203) felt that 'ChatGPT helps

CONTACT Abdulsalam Halboup ✉ a.halboup@ust.edu.ye ▣ Department of Clinical Pharmacy and Pharmacy Practice, University of Science and Technology, P.O. Box 13064, Sana'a, Yemen

students quickly and easily summarize complex information.' Conversely, 78.3% (N = 191) expressed concerns about ChatGPT's potential inaccuracies, with accuracy and reliability cited as primary concerns. Multiple logistic regression showed that younger students (OR = 0.902, P = 0.025) and those with lower proficiency (OR = 0.487, P = 0.007) used ChatGPT more frequently than others. **Conclusion:** Although the use of the ChatGPT could be more beneficial for aiding students in developing medical knowledge, evidence-based academic regulations should guide its use. Future research should be conducted to examine the enablers and barriers to ChatGPT use in medical education.

List of abbreviations

USMLE	United States Medical Licenzing Exam
AI	Artificial intelligence
IRB	Institutional Review Board
SPSS	Statistical Package for the Social Sciences
MBBS	Bachelor of Medicine and Bachelor of Surgery

Background

Artificial intelligence is an integrative machine learning approach that can simulate a human intelligence process (Soori et al., 2023). AI applications, including ChatGPT, could significantly shift medical education and practice in the present and future (Abu Hammour et al., 2023; Jairoun et al., 2024; Javaid et al., 2023; Kitamura, 2023; Sallam, 2023; Saqib et al., 2023; Zawiah et al., 2023). A growing number of studies highlight the applications of the ChatGPT in medical education (Dave et al., 2023; Khorshidi et al., 2023; Seda-ghat, 2023; Tsang, 2023), with a few focusing on medical students' percep-tions, practices, and concerns (Adamopoulou & Moussiades, 2020; Deng & Lin, 2022; King & ChatGPT, 2023; Sallam, 2023; Tsang, 2023 Zhai, 2022). Its rapid growth rate signifies a significant shift in human–computer interaction, with substantial implications for medical education and practice (Dwivedi et al., 2023). ChatGPT has emerged as a focal point in medical education dis-cussions, with potential applications in academic learning, clinical decision-making, and health education (King & ChatGPT, 2023; Wang et al., 2023; Zhai, 2022).

Reports suggest that this approach can reshape pathways for medical stu-dents in two pivotal ways. First, as medical studies embrace digital forms and media, AI-powered chatbots could substantially enhance the online learning experience for students, providing access to diverse learning materials such as case studies, illustrations, and practical demonstrations (Alhamad et al., 2023; Alhamad et al., 2023; Dave et al., 2023; Hofmann, 2022). Second, by acting as a virtual tutor, ChatGPT can customise learning experiences,

adapt to individual learning styles and improve academic performance (Gandhi Periaysamy et al., 2023). Additionally, its utility extends to aiding research endeavours and promoting cross-cultural communication among healthcare professionals (Gao et al., 2023; King, 2023; Kung et al., 2023; Sallam et al., 2023; Temsah et al., 2023). Recent studies evaluating the performance of the ChatGPT in the United States Medical Licenzing Exam (USMLE) reveal its remarkable ability to approach passing thresholds without specific training (Gilson et al., 2023; Kung et al., 2023). These findings suggest the potential of large language models in supporting medical education and decision-making.

ChatGPT offers several potential benefits, such as enhanced accessibility to information, improved efficiency in communication, and support for various educational and professional tasks. Its ability to provide instant responses can facilitate learning and streamline workflows. However, there are also notable risks associated with its use, including the potential for misinformation, dependency on technology, and concerns about data privacy. Users may misinterpret AI-generated content as authoritative, leading to the dissemination of incorrect information. Additionally, reliance on AI tools can diminish critical thinking and problem-solving skills. Balancing these benefits and risks is crucial for responsible integration of AI technologies into daily life (Binns, 2022).

Additionally, the integration of the ChatGPT raises ethical and legal concerns, including questions about data ownership, biases, and content validity. The risk of students relying on 'cut and paste' methods without critical thinking poses a challenge, emphasising the need to strike a balance between leveraging ChatGPTs and preserving human intellect in medical education (Gao et al., 2023; Kung et al., 2023).

The medical education system in Jordan is well-structured and emphasises both theoretical knowledge and practical skills. It typically begins with a six-year undergraduate programme leading to a Bachelor of Medicine and Bachelor of Surgery (MBBS) degree. This education is offered by several accredited universities. The curriculum includes foundational sciences, clinical training, and hands-on experience in hospitals and clinics. Following graduation, students must complete a one-year internship, known as the 'housemanship,' which provides further practical exposure. Assessing medical students' perceptions, practices, and concerns toward ChatGPT is pivotal for ensuring the optimal utilisation of innovative technologies in education and training and for the subsequent enhancement of healthcare delivery quality. Notably, no study has been conducted to assess how medical students at the University of Jordan, the largest medical school in Jordan, perceive and engage with ChatGPT in their studies and practice. Therefore, this study aimed to evaluate medical students' previous knowledge, experience, and proficiency in using AI tools. It will also explore students' perceptions regarding the benefits and concerns of utilising ChatGPT in medical

education, as well as their willingness to incorporate ChatGPT in future studies. Sections addressing perceptions and concerns will be measured using a 5-point Likert scale to quantify responses.

Methods

Research design

A cross-sectional study was conducted at the University of Jordan to investigate the perspectives of medical students from one of the largest medical schools regarding the integration of ChatGPT into their medical education.

Participants

The study enrolled a convenience sample of medical students between May 18, 2023, and July 10, 2023. Students in their fourth academic year or older were eligible to participate in the study.

Sample size calculation

The sample size was calculated using the standard formula the Raosoft ® sample size calculator for online survey: $n = P \times (1 - P) \times z^2 / d^2$. Based on a conservative proportion (P= 50%), a desired precision of 10%, and a confidence level of 95%, a minimum sample size of 96 students was considered representative of this study. A sample of 244 medical students was recruited.

Ethical consideration

The study adhered to the ethical guidelines outlined in the World Medical Association Declaration of Helsinki. Approval for the study was obtained from the Institutional Review Board (IRB) committee of Jordan University Hospital (Approval No. 10/2023/16283). Additionally, all participants provided electronic informed consent before participating in the study.

Study tool development

Following an extensive review of the relevant literature on medical students' perceptions of ChatGPT in medical education (King, 2023; Zhai, 2022), a questionnaire was designed in English to align with the study's objectives. The initial draft of the questionnaire underwent content validation by three independent academic experts with experience in the medical field and questionnaire development. Feedback from the experts was provided by the primary

investigator (KA) to prepare the final version, ensuring clarity and compre-
hensibility. Subsequently, the questionnaire was pilot tested on 10 students
to provide feedback on the comprehensibility and clarity of the questions.
Pilot test data were excluded from the final analysis. Cronbach alpha for
section 3 is 0.825 and for section 4 is 0.783.

The questionnaire comprises five main domains: 1) Demographic character-
istics of students (age, gender, academic year). 2) Students' previous knowledge,
experience, and proficiency in using AI tools. 3) Students' perceptions of the
benefits of using the ChatGPT in medical education. 4) Students' concerns
about using the ChatGPT during medical education. 5) Students' willingness
to use the ChatGPT in future studies. Sections 3 and 4 were assessed using a
5-point Likert scale (strongly agree, agree, neutral, disagree, strongly disagree).

Data collection

Data collection was conducted through electronic platforms, specifically utilis-
ing Google Forms shared within medical students' Facebook groups. The ques-
tionnaire's introduction provided information about the study's objective,
voluntary participation, data anonymity, and the estimated time required to
complete the survey. Participants were given an electronic consent form and
the option to decline participation. To ensure participant privacy, identities
were kept anonymous, as the questionnaire did not request any personal iden-
tifying information. The collected data were securely stored on the principal
investigator's personal computer using password-protected files.

Statistical analysis

Survey responses collected through Google Forms were exported as an Excel
file for analysis using IBM® SPSS® version 24.0 (IBM Corp., Armonk, NY, USA).
Descriptive statistics were used to summarise the demographic information
of the research participants. Simple logistic regression was conducted to
screen the potential variables for multiple regression. Variables with a p
value less than 0.25 were considered eligible for inclusion in the multiple
logistic regression, which investigated the factors that independently affect
ChatGPT use. Variables with a p value of 0.05 or lower according to multiple
regression were considered to be significantly different. The analysis ensured
the absence of multicollinearity among the independent variables.

Results

Sociodemographic characteristics

The study involved 244 participants, with a mean age of 23.62 years (SD =
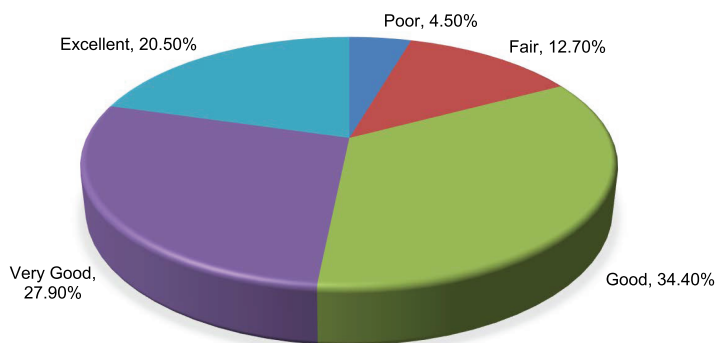3.216). The majority of the participants were males (n = 148, 60.7%).

Figure 1. Students' assessment of their proficiency with digital technology and computers (n = 244).

Regarding the students' current educational levels, 23.0% were in their fourth year, 18.0% were in their fifth year, 33.2% were in their sixth year, and approximately one-quarter were in their intern year (n = 63, 25.8%).

In terms of previous knowledge of artificial intelligence (AI) or natural language processing, one-fifth of the students stated that they had prior knowledge in clinical settings (n = 49), while 61.5% reported having knowledge of AI but not in clinical settings (n = 150). On the other hand, 18.4% of the students reported that they did not have any previous knowledge (n = 45).

The students' self-rated proficiency with digital technology and computers is illustrated in Figure 1. Approximately 34.0% of the students rated their proficiency as good (n = 84), 27.9% as very good (n = 68), and 20.5% as excellent (n = 50).

The majority of the students were aware of the ChatGPT (n = 216, 88.5%). Conversely, 4.5% did not know about it (n = 11), and 7.0% were unsure (n = 17). With regard to using ChatGPT previously, three-quarters of the students reported that they had utilised it before, and 25.0% of them stated that they had not used it previously (n = 61).

Perception toward the use of ChatGPT

Assessing students' perceptions of claims about ChatGPT (Figure 2) showed that the majority of the students agreed or strongly agreed that 'Medical students can benefit from using ChatGPT' (n = 212, 86.9%). This was followed by the claim that 'ChatGPT can help students quickly and easily summarise complex information' (n = 203, 83.2%) and that 'ChatGPT helps students with assignments across all forms of education' (n = 193, 79.1%).
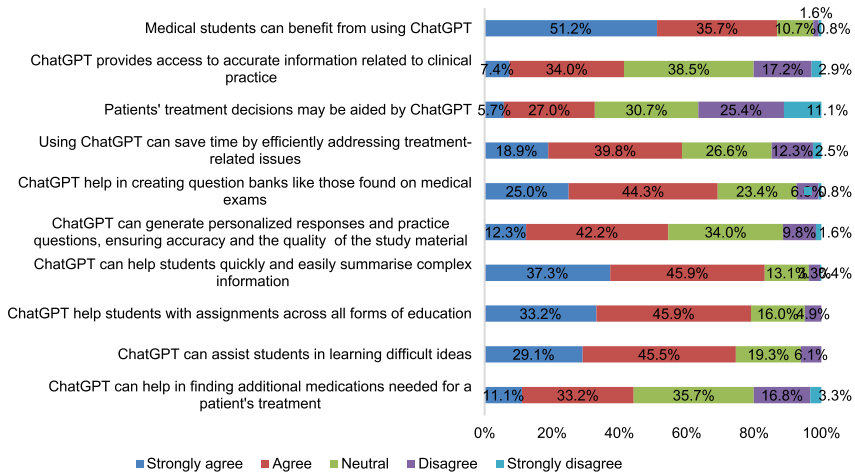
Figure 2. Students' agreement levels with various claims about their perceptions of the benefits of the ChatGPT in medical education (n = 244).

On the other hand, the lowest agreement score was observed for the statement 'Patients' treatment decisions may be aided by ChatGPT' (n = 79,32.7%).

Concerns about the use of ChatGPT

Students' perceptions of the worries associated with using the ChatGPT during medical education showed that the primary concern among the study participants was accuracy and reliability, as a total of 191 of the students (78.3%) agreed or strongly agreed that 'Although the ChatGPT has sophisticated natural language conversion abilities, there is still a chance that its responses will contain mistakes and inaccuracies'. The subsequent concerns expressed by the students revolved around a dependence on technology and overreliance on ChatGPT (N = 188, 77.1%, for each). A total of 188 students agreed or strongly agreed with 'Students who rely too heavily on ChatGPT risk not learning the analytical and problem-solving abilities necessary for a career in medicine' and 'There is a risk that students may rely too heavily on ChatGPT and may neglect other important sources of learning and training' (Table 1).

Practices of medical students in using ChatGPT

The frequency of using ChatGPT, specifically in clinical training, varied among students; 21.7% of the students used it frequently (once a week or more). On the other hand, 27.5% of the participants had never used it (Figure 3).

Table 1. Students' perceptions of worries associated with using ChatGPTs during medical education (n = 244).

	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)	Median (IQR)
Lack of personal interaction ChatGPT might not be able to offer students the same level of individualised contact and feedback that they would need for their training	63(25.8)	102 (41.8)	60(24.6)	16(6.6)	3(1.2)	1 (1)
Dependence on technology Students who rely too heavily on ChatGPT risk not learning the analytical and problem-solving abilities necessary for a career in medicine	88(36.1)	100(41.0)	36(14.8)	18(7.4)	2(0.8)	1 (0)
Accuracy and reliability Although ChatGPT has sophisticated natural language conversion abilities, there is still a chance that its responses will contain mistakes and inaccuracies	82(33.6)	109(44.7)	46(18.9)	6(2.5)	1(0.4)	1 (0)
Ethical concerns Such as those affecting patient confidentiality and privacy, could arise from the use of ChatGPT in medical education	52(21.3)	90(36.9)	76(31.1)	19(7.8)	7(2.9)	1 (1)
Accessibility Some students might not have access to the tools or materials they need to use ChatGPT in their training efficiently, which could lead to unequal learning opportunities.	36(14.8)	106(43.4)	61(25.0)	30(12.3)	11(4.5)	1 (1)
Inability to understand context ChatGPT could not be able to comprehend the context of a certain event or query, which could lead to inaccurate or insufficient responses	55(22.5)	104(42.6)	58(23.8)	22(9.0)	5(2.0)	1 (1)
Limited scope ChatGPT might not be able to give students thorough training or cover all the essential subjects and information needed for medical practice	64(26.2)	105(43.0)	51(20.9)	20(8.2)	4(1.6)	1 (1)
Over-reliance on ChatGPT There is a risk that	98(40.2)	90(36.9)	39(16.0)	12(4.9)	5(2.0)	1 (0)

(*Continued*)

Table 1. Continued.

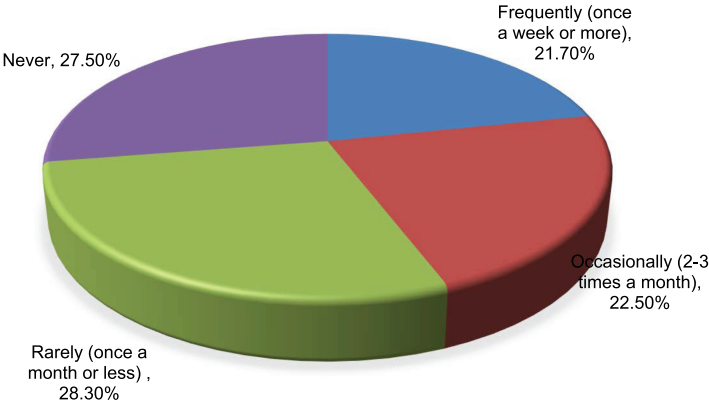|	Strongly agree n (%)	Agree n (%)	Neutral n (%)	Disagree n (%)	Strongly disagree n (%)	Median (IQR)
students may rely too heavily on ChatGPT, and may neglect other important sources of learning and training						
Data bias It is possible that ChatGPT uses biased training data, which could lead to biased recommendations or responses	64(26.2)	106(43.4)	56(23.0)	14(5.7)	4(1.6)	1 (1)

IQR: interquartile range

Figure 3. The frequency of using ChatGPT, specifically in clinical training, among the study participants (n = 244).

Half of the students expressed their intention to use the ChatGPT in their future clinical practice. Specifically, 13.9% of the participants (N = 34) stated that they would 'very likely' use it, while 36.5% (N = 89) stated that they were 'somewhat likely' to do so (Figure 4).

In terms of recommending ChatGPT to other medical students so that they could use it for future clinical practice, 18.0% of the students (N = 44) responded 'yes, definitely', 41.0% (N = 100) responded 'yes, probably', 20.5% (N = 50) responded 'undecided', 17.2% (N = 42) responded 'no, probably not', and 3.3% responded 'no, definitely not'.

When students were asked about the potential reasons for using the ChatGPT, more than half of them (N = 132, 54.0%) reported that they had used it previously as a drug or disease information source; for example, they had asked about particular conditions, treatments, medications, or
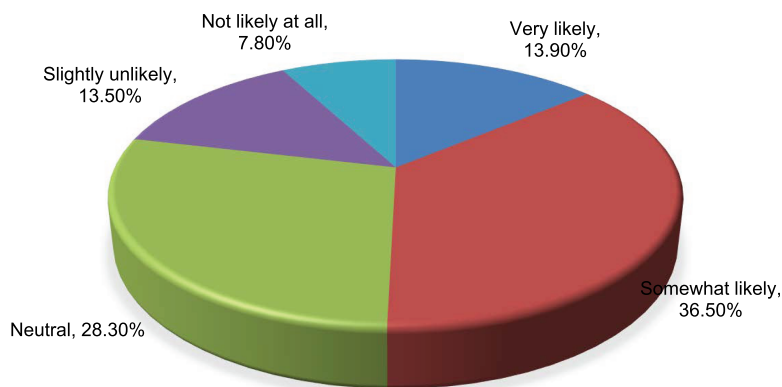
Figure 4. The probability of students incorporating ChatGPT into their future clinical practice (n = 244).

lifestyle changes, whereas 16.8% (N = 41) of the students used it for medication reconciliation. Furthermore, 15.2% (N = 37) of the students used ChatGPT to develop a pharmacological pharmaceutical care plan, while 33.6% (N = 81) used it to develop a nonpharmacological pharmaceutical care plan, such as dietary and lifestyle modifications (Figure 5).
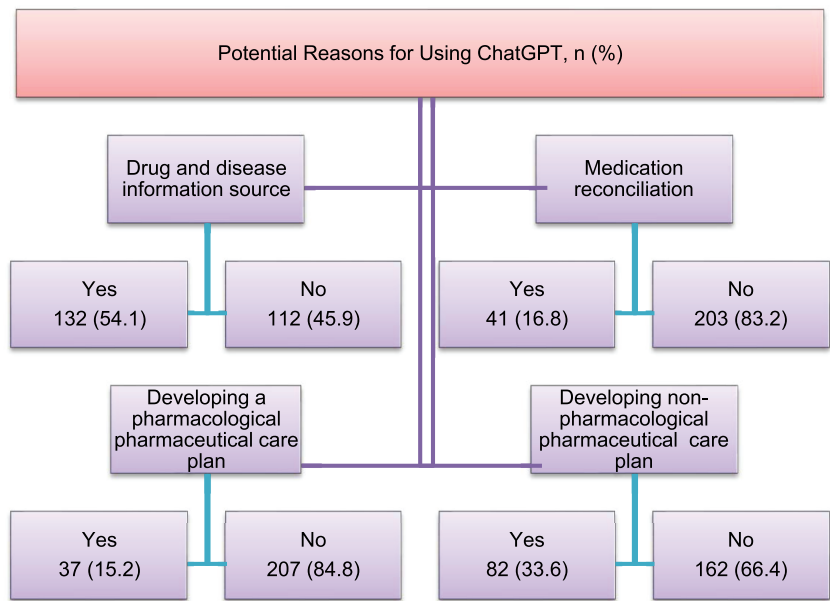

Figure 5. Potential reasons for using the ChatGPT among the study participants (n = 244).

Table 2. Usefulness of ChatGPT compared to other sources according to the students.

Usefulness level	Drug and disease information source n = 132	Medication Reconciliation n = 41	Developing a pharmacological pharmaceutical care plan n = 37 n (%)	Developing a non-pharmacological pharmaceutical care plan n = 82
More helpful	42 (31.8)	11 (26.3)	10 (27.3)	32 (39.0)
Equally helpful	59 (45.0)	25 (60.5)	23 (60.6)	41 (50.0)
Less helpful	31 (23.2)	5 (13.2)	4 (12.1)	9 (11.0)

Among the 132 students who used ChatGPT as a drug and disease information source, 31.8% reported that ChatGPT was more helpful than other standard sources, such as UpToDate, Medscape, Lexicomp, and therapy textbooks. In contrast, 23.2% of the participants (N = 56) reported that this approach was less helpful than other methods, and 45.0% (N = 110) reported that it was the same as that used for other sources. Furthermore, the response patterns of the students remained consistent across the different use scenarios (medication reconciliation, developing pharmacological or nonpharmacological pharmaceutical care plans). The majority of the students reported that ChatGPT was equally helpful, followed by more helpful and less helpful in terms of accuracy compared to human-made decisions (Table 2).

Factors affecting the use of the ChatGPT

Multiple logistic regression analysis of factors affecting the use of the ChatGPT highlighted that participants' age, sex, education level, and proficiency in digital technology were significantly affected by the ChatGPT (Table 3). Accordingly, younger students (OR = 0.857, P value = 0.008); fourth – or fifth-year students (OR = 0.429, P value = 0.027); students with poor, fair, or good digital technology proficiency (OR = 0.310, P value = 0.001); and females (OR = 2.563, P value = 0.005) previously used ChatGPT more than their peers did.

Multiple logistic regression analysis of factors affecting the use of ChatGPT, specifically, as a drug and disease information source, revealed that younger students (OR = 0.902, P value = 0.025) and those with lower proficiency (OR = 0.487, P value = 0.007) used it more frequently than other students did.

Discussion

In this study, more than half of the medical students reported having knowledge of AI but not in clinical settings, with one-third of the medical students reporting their proficiency with digital technology and computers as good.

Table 3. Assessment of factors affecting the use of the ChatGPT among the study participants (n = 244).

Parameter	Have you used ChatGPT before? [0: No, 1: Yes]			
	OR	P value[#]	OR	P value[$]
Age less	0.941	0.157[^]	0.857	0.008*
Gender				
• Male	Reference			
• Female	3.240	<0.001[^]	2.563	0.005*
Education				
• Fourth or fifth year	Reference			
• Sixth-year or intern	0.640	0.134[^]	0.429	0.027*
Proficiency in digital technology				
• Poor, fair, or good	Reference			
• Very good, or excellent	0.253	<0.001[^]	0.310	0.001*

Notes**:** # Using simple logistic regression
$ Using multiple logistic regression,
^ Eligible for entry in multiple logistic regression (significant at the 0.25 significance level)
*Significant at the 0.05 level; **Abbreviations:** OR, odds ratio

Additionally, the majority of medical students were aware of and utilised the ChatGPT before. Regarding students' perceptions of the benefits of ChatGPT in medical education, the majority agreed that they could benefit from using ChatGPT and that ChatGPT can help students quickly and easily summarise complex information and assignments across all forms of education. However, only one-third of medical students agreed that the ChatGPT might aid in patient treatment decisions. The positive perception of the ChatGPT benefit reported in our study was consistent with the findings of other studies reporting the beneficial use of the ChatGPT in healthcare education, research, and practice (Kitamura, 2023; Moons & Van Bulck, 2023; Sallam, 2023; Sallam et al., 2023).

Concerning medical students' worries associated with using the ChatGPT during medical education, the primary concern was the accuracy and reliability of the ChatGPT. The majority agreed that there is a chance that ChatGPT responses will contain mistakes and inaccuracies despite its sophisticated natural language conversion abilities. Additionally, the majority agreed that there is a risk that students may rely too heavily on the ChatGPT, may neglect other important sources of learning and training and may risk the learning, analytical, and problem-solving abilities necessary for a career in medicine. Similar results regarding the inaccuracy and risk of bias with possible medical consequences related to the application of the ChatGPT in medical education and clinical practice have been reported in other studies (D'Amico et al., 2023; Lubowitz, 2023; Moons & Van Bulck, 2023; Shen et al., 2023; Temsah et al., 2023; 'Tools such as ChatGPT threaten transparent science; here are our ground rules for their use', 2023). However, some studies have reported conflicting results, ensuring the accuracy and relevance of ChatGPT responses (Fijačko et al., 2023; Sallam, 2023).

Regarding the use of ChatGPT among medical students, specifically in clinical training, less than a quarter (21.7%) used it frequently (once a week or more) or occasionally (22.5%) (2-3 times a month), while more than a quarter reported never (27.5%) or rarely (28.3%) using (once a month or less) ChatGPT. However, these percentages increased to more than half of the participants' intention to use ChatGPT in their future clinical practice. The use of the ChatGPT in undergraduate medical education and clinical training is evident and reported in the literature (Dave et al., 2023; Hosseini et al., 2023; Khan et al., 2023; Tsang, 2023).

Regarding the reasons medical students utilise ChatGPT, over half of the participants (n = 132) reported having used it previously as a source for drug or disease information. For instance, they inquired about specific conditions, treatments, medications, or lifestyle changes. Among those (i.e. n = 132), approximately one-third reported that this approach was more helpful than other standard sources, such as UpToDate, Medscape, Lexicomp, and therapy textbooks. In addition, one-third of medical students used it to develop a nonpharmacological care plan, such as dietary and lifestyle modifications. However, less than one-fifth of the medical students used it for medication reconciliation or to develop pharmacological care plans. The potential reasons for using the ChatGPT by undergraduate medical students and healthcare professionals were similarly reported in the literature (Dave et al., 2023; Khan et al., 2023; Mohammad et al., 2023). These findings indicate that, despite the various reasons for using ChatGPT, medical students who have utilised it generally perceive it to be a valuable tool, often equivalent in usefulness to traditional resources, despite occasional inaccuracies in ChatGPT responses. However, it is important to clarify that the ChatGPT does not replace the clinical judgment of healthcare professionals but rather serves as a valuable aid in promoting timely clinical practice.

Regarding the factors (i.e. age, gender, educational level, and proficiency in digital technology) significantly affecting the use of ChatGPT, a regression analysis showed that younger students; fourth – or fifth-year students; students with poor, fair, or good digital technology proficiency; and females previously used ChatGPT more than their peers did. This would be expected considering ChatGPT's rapidly evolving and spreading 'viral' nature and increasing integration by various healthcare professionals.

To the authors' knowledge, this is the first Jordanian study to explore medical students' perceptions, concerns, and practices toward using the ChatGPT in medical education.

The findings from this study showed that the majority of medical students positively endorsed the benefits and bright future of using ChatGPT in medical education. However, their worries about the accuracy and reliability of the ChatGPT and the risk that medical students would rely too heavily on the ChatGPT and neglect other important sources of learning and training

would affect their use of the ChatGPT. Our findings could help medical academics and policymakers in Jordan and comparable global countries gain more insight into the use of the ChatGPT in medical education in the near future, thus allowing them to react by defining the barriers and facilitators and regulating ChatGPT use in medical education in the future, if any.

Limitations

The study's findings should be considered within the scope of certain limitations. First, the survey was administered online, and data were exclusively gathered from 244 medical students at a single Jordanian university through social media platforms using a convenient sampling method, which may not represent all Jordanian medical students. Additionally, the data collection relied on self-reports, potentially introducing social desirability bias and recall bias.

Conclusion

The use of ChatGPT in medical education could have augmented potential benefits. It may help students develop their medical knowledge in promising ways. However, evidence-based academic regulations considering ChatGPT concerns (i.e. accuracy and reliability compared to other available resources such as UpToDate, Medscape, Lexicomp, and therapy textbooks) should guide its use in medical education. The findings of this study revealed that medical students have a positive endorsement of the use of the ChatGPT in medical education, although they express concerns about data accuracy, learning from data, and the potential for bias. Future studies should be conducted to explore facilitators of and barriers to the use of the ChatGPT in medical education.

Author contributions

Conceptualisation: Abu K, A AFR. Methodology: Abu Hammour, A, K, M, AA, MS, and MQ. Validation: Formal analysis: A and RN. Writing the original draft: ABU A, K, AFR, AH, HA and RN. Writing Review & Editing: All the authors conducted a comprehensive review of the final draft, sharing collective responsibility for the manuscript's content and similarity index.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

Disclosure statement

No potential conflict of interest was reported by the author(s).

ORCID

Hamza Alhamad http://orcid.org/0000-0002-9309-4565
Faris El-Dahiyat http://orcid.org/0000-0002-5264-8699
Abdulsalam Halboup http://orcid.org/0000-0002-9026-5656

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