Doi: 10.21608/JHPEI.2025.347543.1040

ORIGINAL ARTICLE **Open Access**

Exploring the Effect of Using Artificial Intelligence Tools on Preclinical Medical Students' Workload and Well-being: A Cross-Sectional Study

Eman Elrefaei [1], Omnia Safwat El-Deeb[1], Sarah Ragab Abd El-Khalik[1], Amira K. Eltokhy [1], Asmaa H. Okasha [1], Mohamed Elsheikh [4,5], Shereen Gamal Shamma [2], Rowida Raafat Ibrahim [1,2], Azza Aboraya [2,3]

[1] Department of Medical Biochemistry, Faculty of Medicine, Tanta University, Tanta, Egypt.
[2] Department of Medical Education, Faculty of Medicine, Tanta University, Tanta, Egypt.
[3] Department of Histology, Faculty of Medicine, Tanta University, Tanta, Egypt.
[4] Department of Health Informatics, Graduate School of Medicine and Public Health, Kyoto University, Kyoto, Japan
[5] Department of Emergency Medicine and Traumatology, Faculty of Medicine, Tanta University, Tanta, Egypt

Abstract

Background:

There is a recent rise in the application of AI in medical education, research and development. We aim to assess the effects of AI tools on the workload and well-being of preclinical medical students, concentrating on their views, acceptance, and satisfaction with these technologies. A cross-sectional survey was conducted between September and October 2024. A total of 926 preclinical medical students from Tanta University, Egypt, were involved. Data were gathered using a validated online questionnaire that included sections on demographic data, perception of AI tools, the impact of AI on medical education and willingness to use it, and the impact of AI on workload and well-being. Descriptive statistical analyses of questionnaire sections were done. A logistic regression model was used to assess the association of 13 predictor questions with the effect of AI on students' well-being and their willingness to use AI. A significant P-value ($P < 0.001$) suggests a strong association between computer literacy and willingness to use AI. Among all predictor questions, the strongest association for a 'strongly agree' response was observed for the statement 'I'm aware of AI applications in different aspects of life' (Adjusted Odds Ratios [AORs]: 3.19 [95% CI: 1.96–5.26]). Additionally, the statement 'I assume AI could replace traditional teaching methods' showed significant associations in improving well-being for both 'strongly agree' (AOR: 2.24 [95% CI: 1.38–3.68]) and 'agree' (AOR: 1.55 [95% CI: 1.04–2.37]). This study highlights the significance of integrating AI technologies into medical education to improve students' well-being and decrease workload.

Keywords:

Artificial Intelligence, Medical Education, Student Well-being, Workload, AI Perception, Cross-Sectional Study.

Received: 25-12-2024 Accepted: 20-04-2025

Published Online: May 2025

How to cite this article
Elrefaei E., El-Deeb O., Abd El-Khalik S., Eltokhy A., Okasha A., Elsheikh M., Shamma S., Raafat R.& Aboraya A. "Exploring the Effect of Using Artificial Intelligence Tools on Preclinical Medical Students' Workload and Well-being: A Cross-Sectional Study." J Health Prof Edu Innov, Vol. 2, No. 1, May 2025, pp 11-21.
Doi: 10.21608/jhpei.2025.347543.1040

Address for Correspondence
Dr. Eman Elrefaei
Department of Medical Biochemistry, Faculty of Medicine, Tanta University, Tanta 31511, Egypt.
Instructor of Medical Biochemistry Department, Faculty of Medicine, Tanta University, El-Geesh St, Tanta, Egypt.
E-mail: eman.elrefaei@med.tanta.edu.eg

Introduction:

One of the contemporary scientific and technological domains that has been aptly labeled "The Stethoscope of the 21st Century" is artificial intelligence (AI), suggesting that it is a vital instrument for the medical community [1]. AI is the emulation of human intellect in robots that are designed to think and behave like people [2]. AI's ability to reason and act to achieve a certain objective is what makes it so attractive. From virtual assistants like Apple's Siri to face recognition, healthcare systems, self-driven cars, and robotics, AI has unknowingly permeated almost every part of our everyday life [3].

Though it includes a number of fields, including linguistics, psychology, mathematics, medicine, and more, AI is most commonly associated with computer science. Since its debut, AI applications have grown quickly in a constantly changing digital ecosystem, where public expectations are rising due to pressure from healthcare experts and industry leaders [4]. AI in medical education was the subject of the first Web of Science search, which revealed a growing interest in this area. There has been a recent spike in the use of AI in medical education, research and development, as evidenced by the increase in publications and the frequency of citations of these papers during the past 20 years [5].

Using AI in medical education can help students learn and comprehend AI algorithms by offering targeted feedback [6]. Numerous AI applications for education have been fashioned in recent years, including progress tracking, feedback provision, and content distribution. These technologies have been crucial in identifying students' knowledge gaps and offering them individualized support. Additionally, they have reduced the workload for educators, freeing up more time for pupils and improving the individualized and flexible teaching process [7].

Learning gaps are being recognized, and what and how pupils learn are being altered by AI [8]. Because of this change, it is becoming more and more important to include AI into medical school in order to prepare ambitious doctors for the rapidly changing healthcare environment. Its expanding significance in medical education is further demonstrated by its applications, which include medical distance learning and administration, virtual inquiry systems, and medical school teaching video recording [4].

Given the growing complexity and demands of professional school certification, the idea of student workload expectations is complex, multifaceted, and lacks a straightforward, broadly applicable solution [9]. As prospective end users of AI systems, medical students' attitudes and behavior must be taken into consideration. The audience is essential to the integration of AI into medicine and medical education since they are researchers, educators, and medical professionals. Additionally, since students will continue to use technology and interact with patients, it is crucial to assess how they see AI in order to determine whether further training will be necessary in the future [10].

The ability of people to adjust to technological advances that change the socioeconomic landscape has a significant impact on their well-being [11]. In this day and age, the development of a well-rounded and productive learning environment depends heavily on the welfare of the students. Universities and other educational establishments understand how crucial student well-being is to raising academic performance, reducing stress and anxiety, and fostering a positive learning environment. One innovative strategy for achieving this objective is artificial intelligence [12].

The theoretical Framework of the study explained the importance of investigating the effects of AI in medical education which are mainly within these two theories:

• Cognitive Load Theory AI can manage cognitive load by offering personalized learning resources, making it easier for students to focus on key concepts.

• Self-Determination Theory AI supports self-directed learning, enhancing students' autonomy and competence, which improves motivation and wellbeing

The purpose of this study is to investigate how AI tools affect preclinical medical students' workload and general well-being. It aims to comprehend how students view, accept, and feel about AI systems, highlighting both the apparent advantages and possible drawbacks.

Subjects and methods

1. Research Design:

This study employed a cross-sectional design, utilizing a web-based questionnaire distributed via Google Forms (Alphaet Inc. Mountain View, CA, USA) from 25 September 2024 to 28 October 2024. During this time frame, medical students who were regularly enrolled in 1st, 2nd, and 3rd years at the Faculty of Medicine, Tanta University were invited to contribute to the study through social media platforms.

2. Ethical Considerations:

The study was executed in coherence with the Declaration of Helsinki for research with human participants. The study protocol was accepted by the Medical Research Ethics Committee of the Faculty of Medicine, Tanta University, Egypt (approval no. 36264PR807/8/24). Participants were fully informed about the study's purpose, and the survey was conducted following the satisfaction of all necessary criteria.. Participation in the study was entirely voluntary and did not involve any incentives. IP addresses were not collected. Completion and submission of the survey provided implied consent to participate in the study.

3. Setting and Participants:

The candidates of the study were preclinical medicinal students (1st, 2nd, and 3rd years) of the Bachelor of Medicine and Surgery-Credit Points Program at the Faculty of Medicine, Tanta University, who are currently enrolled in the medical program (2025). The participants who had previous experience or not with AI tools in their coursework or extracurricular activities were included in the study.

4. Sample size calculation:

To conclude the accurate sample size for the current work, we used the Risk Calc sample size calculator with the following parameters: a 5% margin of error, a 95% confidence level, and a 50% response distribution. Separate sample sizes for each year group are the method adopted in this work, and each year group (first, second, and third-year students) was treated as a distinct subpopulation [13]. So, the samples needed from the 1st, 2nd, and 3rd years were 302, 291, and 291 students, respectively. The main advantages of this strategy are the more detailed insights; hence, this method allows a detailed analysis of each year's group, providing specific insights into perceptions of AI tools. Furthermore, calculating sample sizes separately minimizes bias and ensures that the unique characteristics of each year group are adequately represented.

5. Pilot Testing

The questionnaire was pretested by being administered to 30 medical students [14]. Through sending emails to randomly selected preclinical medical students in 1st, 2nd and 3rd grades (not included in the study). The Cronbach alpha value for reliability was 0.8.

6. Data collection:

Following a thorough review of the literature pertaining to AI in healthcare and medical education, the questionnaire was developed and then underwent iterative refinement by a panel of medical education experts to ensure its validity. Furthermore, minimal changes were included based on the feedback provided from the pretest. The final questionnaire was in English and comprised four sections, including the demographic data, perception of AI tools, impact of AI on medical education and willingness to use it in the future, and impact of AI on workload and well-being. A 5-point Likert scale was employed to assess respondent agreement with each statement. Domain scores were subsequently calculated by summing the scores of the corresponding items. Each survey question permitted only one response, which could be modified until survey completion and submission.

7. Statistical analysis

Categorical variables are presented as numbers (frequencies). Fisher's exact test assessed the association between demographic characteristics and students' willingness to use AI in the future. The primary outcome is the effect of AI on students' well-being, while the secondary outcome is their willingness to use AI in the future. We developed a score based on several related questions to assess the two outcomes. After calculating the total score for each respondent, we calculated the median split -each outcome separately- for all respondents. We used the median score as the cutoff value. Respondents scoring above the median score were assigned “Yes” and those scoring below were assigned “No” [15]. Cronbach's Alpha had been calculated to measure the reliability for the following: students' perception towards AI in medical education, the effect of AI on students' well-being, and students' willingness to use AI in the future.

The logistic regression model was used to assess the association of 13 predictor questions with the effect of AI on students' well-being and their willingness to use AI. Each predictor question had five response options: strongly agree, agree, neutral, disagree, and strongly disagree. For analysis, we combined 'disagree' and 'strongly disagree' into a single category ('disagree') and set it as the reference group. We also calculated P for trend to assess the directional trend among responses to the predictor questions. We accessed multicollinearity by analyzing the variance inflation factors (VIFs). Collinearity was considered negligible when the VIF values were less than 5. Accordingly, 26 final models were established, each with one predictor question adjusted with age and sex. Adjusted odds ratio (AOR) of more than one was considered significant. Statistical analyses were performed using R software version 4.4.0 (R Core Team, Vienna, Austria).

Results:

Reliability of the questionnaire

The Cronbach's Alpha of reliability for the ten questions of section two about students' perceptions of AI in medical education was 0.855; for the six questions of section three about the effect of AI on student's well-being, 0.891; and for the seven questions of section four about students' willingness to use AI in the future, 0.874.

Characteristics of the study participants

Of 3800 students (the total number of preclinical students in 1st, 2nd and 3rd grade), 926 (24.4%) participated in this study. Analysis of pooled data revealed that the participants' age ranged from 18 to over 20 years, with the largest group being 18-year-olds (32.7%). Among them, 465 (50.2%) were female. Most participants were first-year medical students 342 (37.0%), with the majority having the ability to do something successfully using AI 564 (61.0%). There was no significant association between age and willingness to use AI (P = 0.429), while a significant association was found with sex (P < 0.001). Female possibly shows high interest or concern compared to their male counterparts. Additionally, a significant association was found in both academic level (P < 0.001) and computer illiteracy (P < 0.001) (Table 1).

Table 1. Baseline characteristics of the participants.

Characteristics	Total (n = 926)	P-value
Age, n (%)		0.429
18 Years	303 (32.7)	
19 Years	265 (28.6)	
20 Years	217 (23.5)	
More than 20 Years	141 (15.2)	
Sex		<0.001
Female	465 (50.2)	
Male	461 (49.8)	
Academic level, n (%)		<0.001
First-year medical school student	342 (37.0)	
Second-year medical school student	293 (31.6)	
Third-year medical school student	291 (31.4)	
Computer literacy, n (%)		<0.001
Having no idea about it	161 (17.3)	
Having the ability to do something successfully	564 (61.0)	
Highly skilled and experienced in something	201 (21.7)	

The associations between baseline characteristics and students' willingness to use Artificial Intelligence (AI) in the future were evaluated using Fisher's Exact Test.

Students' response analysis to different sections of the questionnaire.

The survey responses related to students' backgrounds and awareness of AI applications (Section 1). While 35% of students strongly agreed or agreed (n =102 and n =222, respectively) with the statement that "I have a background in statistics/computer science", only 29 % strongly disagreed and disagreed (n =83 and n =185, respectively); however, 36% were neutral (n = 334). The majority of students, 63%, agreed or strongly agreed (42.2% agreed [n = 391], 20.5% strongly agreed [n = 190]) with the statement that "I use computer technology in learning". Moreover, in the statement "I'm aware of AI applications in aspects of life," 56% agreed or strongly agreed (40.1% agreed [n = 371], 15.6% strongly agreed [n = 144]) (Fig. 1).

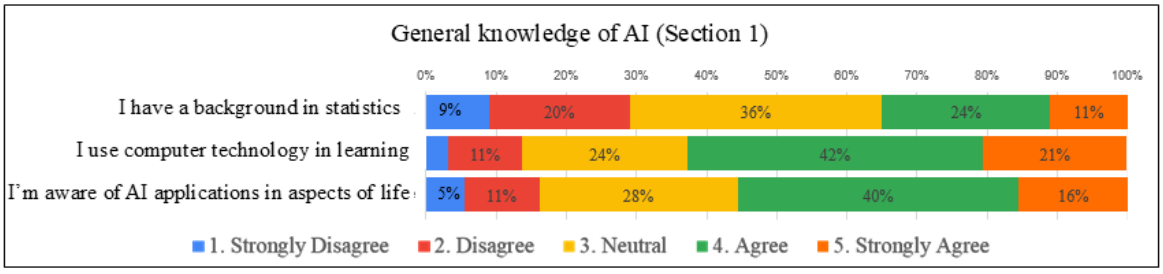


Fig. 1: Students' responses to questions related to general knowledge of AI (Section 1)

The survey responses from students regarding their views on the future impact of AI in medical education and learning (section 2) showed 49% (n = 454) disagreed with the statement that "I assume AI can substitute the human teachers". However, 45% agreed or strongly agreed with the statement that "I assume AI could replace traditional teaching methods". Moreover, more than half of the students (agreed and strongly agreed) with the recommendation to provide training courses on using AI tools and to integrate AI programs into the educational process, respectively. 70%, 74%, 61%, 74%, 54%, and 60% agreed and strongly agreed to the remaining statements (5-10) shown in (Fig. 2).

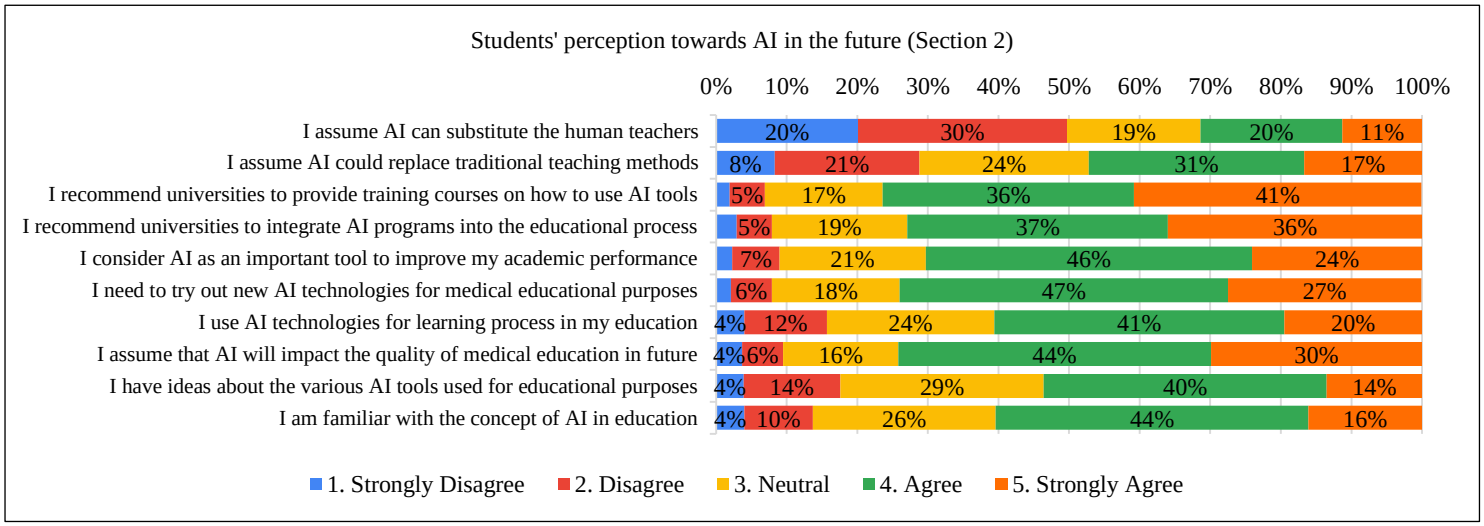


Fig. 2: Students' responses to questions related to students' perception towards AI (Section 2)

The survey responses regarding the impact of AI on various aspects of students' lives (section 3). 59% agreed or strongly agreed (41% agreed [n = 380], 18% strongly agreed [n = 167]) that AI provided valuable insights that influenced their educational choices. More than half of the students agreed or strongly agreed with the statement that "AI improved my academic performance". Moreover, nearly half of the students agreed and strongly agreed, as well as 33% were neutral (n = 287) to the statement that "AI positively influenced my mental health and well-being". Also, 41% agreed and strongly agreed (27% agreed [n = 269], 14% strongly agreed [n = 139]), and 29% were neutral (n = 269) to the statement that 'AI improved my social interactions.'

Half of the students agreed or strongly agreed that "AI improved my daily routine and productivity." However, regarding the statement that 'AI relieved my educational stress and anxiety,' 46% agreed and strongly agreed (33% agreed [n = 204], 13% strongly agreed [n = 157]), and 32% were neutral (n = 296) and around a quarter (29%) of the students are disagreed (Fig.3a).

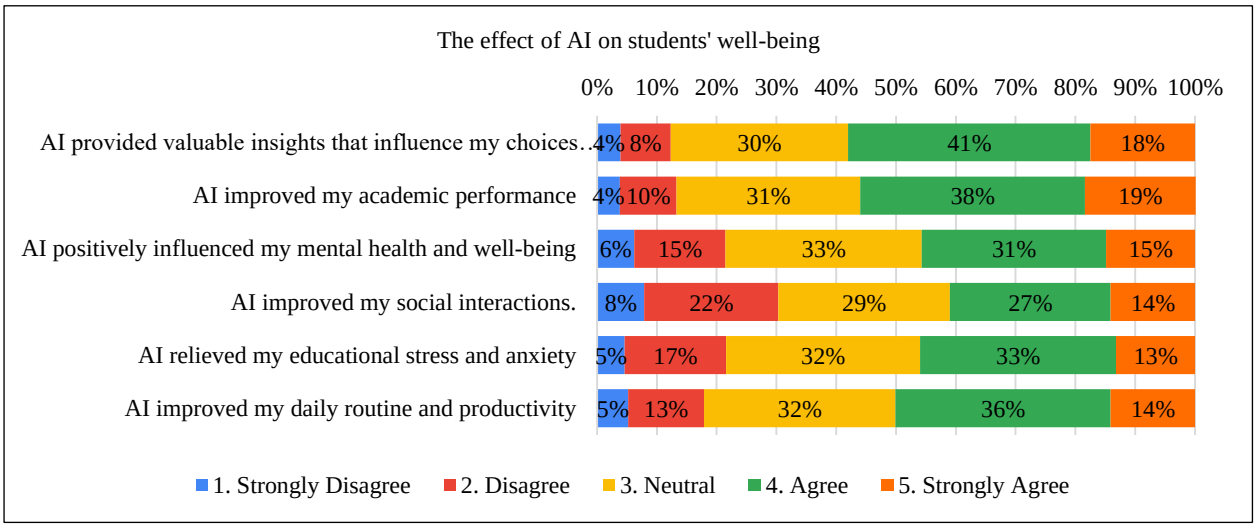
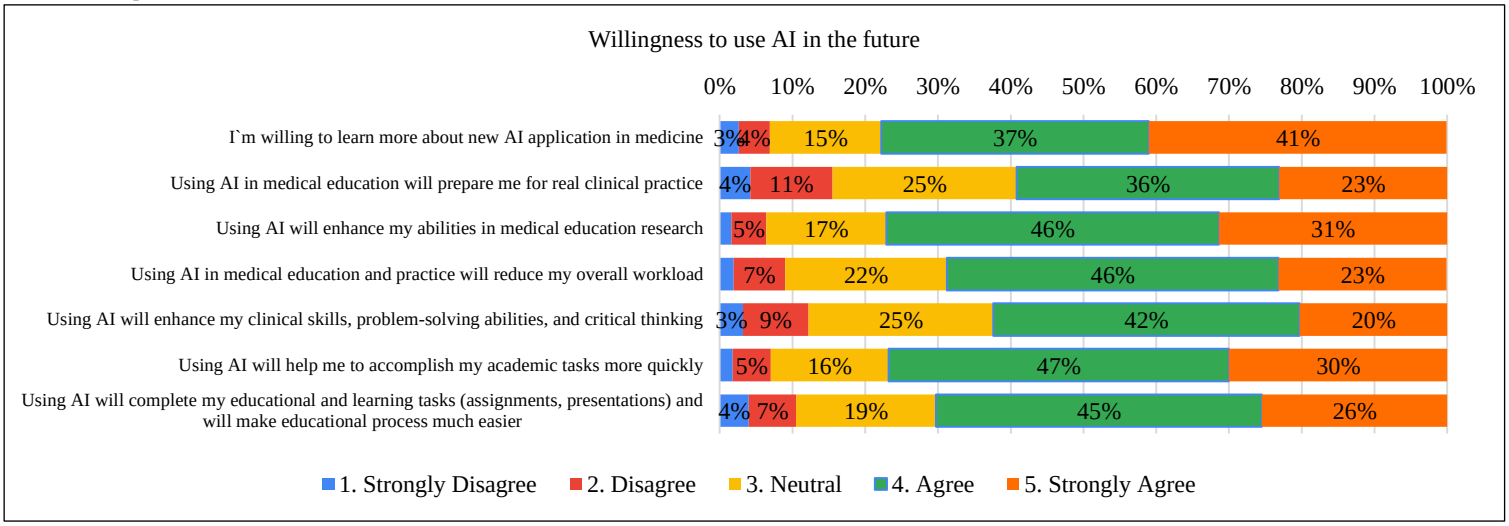


Fig. 3: Students' response toward the two primary outcomes of our study.
(A) Responses to questions related to the effect of AI on students' well-being (Section 3)

The survey responses regarding students' openness and readiness to utilize AI technologies in the future (section 4) explore that 78%, 59%, 77%, 69%, 62%, 77%, and 71% of responses agreed and strongly agreed with the questionnaire (1-7) statements of this section (Fig.3b).



(B) Responses to questions related to students' willingness to use AI in the future (Section 4).

Effect of AI on students' well-being

Our results show a significant directional trend in the impact of agreement levels on well-being outcome. Students who responded with 'strongly agree' or agree were significantly more likely to report improved well-being than those who disagreed or strongly disagree. Among all predictor questions, the strongest association for a 'strongly agree' response was observed for the statement 'I'm aware of AI applications in different aspects of life' (Adjusted Odds Ratios [AORs]: 3.19 [95% CI: 1.96–5.26]). Additionally, the statement 'I assume AI could replace traditional teaching methods' showed significant associations in improving well-being for both 'strongly agree' (AOR: 2.24 [95% CI: 1.38–3.68]) and 'agree' (AOR: 1.55 [95% CI: 1.04–2.37]). Neutral responses were consistently associated with a lower likelihood of reporting improved well-being than the reference group, with significant AORs observed for eight predictors (Table 2).

Table 2. The Association of Predictor Questions with the Effect of Artificial Intelligence on Students' Well-Being.

Predictor Questions	Disagree	Strongly Agree AOR (95% CI)	Agree AOR (95% CI)	Neutral AOR (95% CI)	P for trend
I have a background in statistics / computer science	1 (Ref)	2.23 (1.39–3.59)	0.93 (0.61–1.44)	0.67 (0.47–0.95)	<0.001
I Use computer technology in learning	1 (Ref)	2.66 (1.70–4.24)	0.75 (0.54–1.04)	0.68 (0.46–1.01)	<0.001
I'm aware of AI applications in different aspects of life	1 (Ref)	3.19 (1.96–5.26)	1.21 (0.79–1.87)	0.64 (0.45–0.88)	<0.001
I am familiar with the concept of AI in education	1 (Ref)	2.66 (1.67–4.23)	0.79 (0.51–1.22)	0.90 (0.65–1.24)	<0.001
I have ideas about the AI tools used for educational purposes	1 (Ref)	1.74 (1.14–2.70)	0.90 (0.55–1.49)	0.77 (0.54–1.09)	<0.001
I assume that AI will impact the quality of medical education	1 (Ref)	1.94 (1.31–2.87)	1.03 (0.65–1.60)	0.69 (0.48–0.99)	<0.001
I use AI technologies for learning process in my education	1 (Ref)	2.56 (1.52–4.36)	0.97 (0.60–1.54)	0.51 (0.35–0.73)	<0.001
I need to try out new AI technologies for medical educational	1 (Ref)	1.91 (1.30–2.84)	0.98 (0.57–1.61)	0.65 (0.45–0.94)	<0.001
I consider AI a tool to improve my academic performance	1 (Ref)	1.68 (1.11–2.55)	0.75 (0.52–1.09)	0.98 (0.64–1.61)	<0.001
I recommend universities to integrate AI into the educational	1 (Ref)	1.71 (1.14–2.59)	0.63 (0.24–1.25)	0.63 (0.39–1.06)	<0.001
I recommend universities to provide courses on how to use AI	1 (Ref)	2.80 (1.76–4.52)	1.09 (0.63–1.80)	0.56 (0.37–0.85)	<0.001
I assume AI could replace traditional teaching methods	1 (Ref)	2.24 (1.38–3.68)	1.55 (1.04–2.37)	0.55 (0.38–0.78)	<0.001
I assume AI can substitute the human teachers	1 (Ref)	1.88 (1.24–2.86)	1.25 (0.76–2.14)	0.38 (0.24–0.60)	<0.001

All logistic regression models were adjusted for gender and age in each model.
Abbreviations: AI, Artificial intelligence; AOR, Adjusted odds ratio; CI, Confidence interval.

Effect of AI on students' willingness to use AI in the future

Similar to the findings for well-being, students who strongly agreed or agreed with all predictor statements were significantly more likely to express willingness to use AI in the future. Agreement responses showed significant associations within three statements: "I recommend universities to provide courses on how to use AI" (AOR: 2.01 [95% CI: 1.11–3.47]), "I assume AI could replace traditional teaching methods" (AOR: 1.73 [95% CI: 1.09–2.78]), and "I assume AI can substitute human teachers" (AOR: 1.58 [95% CI: 1.07–2.38]). In contrast, students who responded with neutral responses were less willing to use AI across several predictor variables (Table 3).

Table 3. The Association of Predictor Questions with Students' Willingness to Use Artificial Intelligence in the Future.

Predictor Questions	Disagree	Strongly Agree AOR (95% CI)	Agree AOR (95% CI)	Neutral AOR (95% CI)	P for trend
I have a background in statistics / computer science	1 (Ref)	1.72 (1.09–2.71)	1.04 (0.71–1.56)	0.64 (0.46–0.89)	<0.001
I Use computer technology in learning	1 (Ref)	2.02 (1.29–3.18)	1.07 (0.73–1.57)	0.80 (0.58–1.09)	<0.001
I'm aware of AI applications in different aspects of life	1 (Ref)	1.65 (1.10–2.47)	1.48 (0.98–2.27)	0.68 (0.49–0.94)	<0.001
I am familiar with the concept of AI in education	1 (Ref)	2.03 (1.29–3.24)	1.21 (0.80–1.83)	0.67 (0.49–0.92)	<0.001
I have ideas about the AI tools used for educational purposes	1 (Ref)	1.68 (1.06–2.69)	1.33 (0.89–2.00)	0.57 (0.41–0.78)	<0.001
I assume that AI will impact the quality of medical education	1 (Ref)	2.10 (1.32–3.37)	1.23 (0.75–1.97)	0.65 (0.44–0.95)	<0.001
I use AI technologies for learning process in my education	1 (Ref)	1.83 (1.14–2.97)	1.28 (0.86–1.90)	0.43 (0.31–0.61)	<0.001
I need to try out new AI technologies for medical educational	1 (Ref)	1.59 (1.05–2.41)	0.76 (0.29–1.52)	0.81 (0.51–1.35)	<0.001
I consider AI a tool to improve my academic performance	1 (Ref)	1.86 (1.15–3.03)	1.28 (0.72–2.14)	0.76 (0.52–1.12)	<0.001
I recommend universities to integrate AI into the educational	1 (Ref)	2.09 (1.26–3.53)	1.15 (0.44–2.33)	0.72 (0.44–1.22)	<0.001
I recommend universities to provide courses on how to use AI	1 (Ref)	2.24 (1.37–3.72)	2.01 (1.11–3.47)	0.51 (0.32–0.82)	<0.001
I assume AI could replace traditional teaching methods	1 (Ref)	2.55 (1.73–3.82)	1.73 (1.09–2.78)	0.49 (0.35–0.70)	<0.001
I assume AI can substitute the human teachers	1 (Ref)	2.93 (1.89–4.07)	1.58 (1.07–2.38)	0.55 (0.37–0.81)	<0.001

All logistic regression models were adjusted for gender and age in each model.
Abbreviations: AI, Artificial intelligence; AOR, Adjusted odds ratio; CI, Confidence interval.

Discussion

Like most developing countries, the healthcare education in Egypt also faces several difficulties like overload of instructor workforce, insufficient resources, "rephrase", and restricted access. In the current cross-sectional questionnaire-based study 926 preclinical medical students (1st and 2nd years and 1st semester 3rd year) at Faculty of Medicine, Tanta University in the Bachelor of Medicine and Surgery, Credit Point Programs (2023 – 2024) shared in the study, most of participants had a minimal experience with AI in medical school. Students with prior experience with AI technology were significantly more likely to have positive views of the technology.

AI Technology in Medical Education

Over the last decade, the use of AI in healthcare education has grown considerably, making significant strides in many fields. AI's influence in healthcare, from robotic operations to imaging analysis, is profound. The World Medical Association, recognizing this potential, advocates for the integration of AI education into medical courses. AI algorithms, with their ability to enhance clinical decision-making, provide a sense of reassurance and confidence. They can assist students in preclinical training, enabling them to analyze medical problems, identify high-risk conditions, and recognize potential drug interactions [16].

Former inquiries uncovered the integration of generative AI, like ChatGPT [17], into university education could generate optimized scientific outcomes [18]. By supplying personalized aid, actual-time reflexes, and a richness of information, these AI structures enable students to decode sophisticated issues, clarify problem-solving discernment, and upgrade their learning adventures [19]. It is crucial to apprise medical students of AI notions and ideas so that they can use this knowledge in attention to their patients and not get bogged down by glossary and idioms [20].

Despite the vast research on using AI in clinical practice, the concept of medical pro and their impasse about its inclusion into their daily practice is still unconfirmed. Our research focused on medical students' perceptions of using AI in their medical studies, reflecting their confusion and fears about the situation.

General knowledge of AI

The mean age of medical students enrolled in the study was about 19 years, most of them are females. A third of the participants are 1st-year medical students (37%). Of the study participants, only a little above the half understood the term AI. About 35% of participants in our study have a background in statistics, and more than half of the participants (63%) use computers in their learning courses. About (55%) of study participants are aware of AI applications in all aspects of life. This finding indicates that medical students may have difficulties in understanding the jargons and technical background behind AI.

The current findings agree with previous reports of Jackson, P. et al who stated that the lack of coverage of AI and medical education in Nepalese has resulted in students being unaware of AI's impact on individual patients and the healthcare system [21].

Moreover, Doumat et al reported that AI education should be enrolled in the medical learning curriculum among Lebanese students to enhance their acquaintances and situation. Optimizing AI awareness in medical students will, in turn, increase approval of AI as a device in medical education, thus opening the possibility of revolutionizing medical education [22].

Perception towards AI in the future

The scenarios of medical students on the potential impacts of AI in medicine were investigated via a survey. The highest level of agreement was found on the question of whether they were willing to experiment with new AI technology in education. In contrast, the lowest level of agreement was on the question of whether AI could replace the role of a medical teacher. Less than half (48%) of participants believed that AI could replace traditional teaching methods. This finding is in line with a 2021 report by Bisdas S. et al which suggested that AI could serve as a valuable helper, instead of a substitution for, old teaching methods in medical practice [23].

About a third of our participants (31 %) felt that the use of AI would substitute medical teachers. This is in accordance with Pinto Dos Santos D et al where most participants (83%) denied that human radiologists would be replaced by robots or computers [24].

Many studies said that rather than becoming surplus because of AI, physicians would change their practice and become "managers" rather than "custodians of information." [25].

Two-thirds of the respondents in current research (74%) assume that AI will impact the quality of medical education in the future. This agrees with a recent search made by Western Australian (2023) among medical students, which revealed that about 75% of the participants agreed that AI would improve their practice [26].

Participants in other studies believe that today's AI systems can enhance physicians' decision-making by integrating extensive medical literature to create the most current medical protocols [27].

The past research of Paranjape et al. suggests that physicians will be able to focus on supplying patients with comprehensive care, considering the biopsychosocial style of disease, as AI-supported models can manage the technical sides more efficiently [28].

More than three-quarters of students (77%) recommend universities provide a training course on how to use AI. At the American Medical Association meeting in 2018, called for the training of doctors so that they could get algorithms and work efficiently with AI systems to make better clinical care decisions [29].

Although, Paranjape et al. informed that medical education had not addressed training on the spine of electronic medical record systems, such as the impact of computer use in front of patients. This is a critical issue as it affects the patient-physician relationships, a cornerstone of effective healthcare. If used with adequate training and mou, AI will free up physicians' time and optimize their work hours so that they can care for and connect with patients in their free time [28].

The research results posted by Jha et al. in 2022 support the observation of insufficient coverage of AI and machine education in medical curricula [30].

A moderate fraction of studies is familiar with the concept of AI technology in education; there was considerable ambiguity about the technology's impact on improving the learning process. A recent Saudi study also demonstrated that healthcare workers highly cared with using AI tools for medical research (69.5%) but less so for decision-making (39.5%) or patient care (44.7%) [31].

Effect of AI on student well beings

It is encouraging to find that medical students in the study herein showed high agreement when asked if AI would improve their academic performance and social interaction, improve their daily routine and productivity, reduce educational stress and anxiety, and agree that the use of AI would positively influence their mental health.

These results are consistent with the findings of past reports by Sit C. et al., where 89% of students think that instruct in AI would be helpful for their occupations, and 78% agreed that students should receive training in AI as part of their medical grade [32].

Willingness to use AI in the future

AI's prowess and vast prospects let it serve as an instrument in teaching and evaluation of medical students. AI could also act as an objective evaluator with the benefit of fast and real-time feedback. Although 71% of medical students in our study assume that AI could complete their educational tasks (assignments and presentations), only 62% believe that AI can enhance their clinical essentials, problem-solving, and critical thoughts.

Colleges universally have performed strategies to study AI to medical students. It is recommended that medical education authorities incorporate AI into medical students' platforms as soon as possible. The present study's findings are in consensus with Spanish and German studies, wherein most students featured involving AI in the medical school platforms [33, 34].

Another significant spotlight of the present research is that nearly two-thirds of participants assume that using AI will prepare them for clinical practice. The incorporation of AI into healthcare will doubtless be sophisticated. Prospects clinicians will need to understand AI and its role in healthcare by having basic knowledge and evaluating new AI technologies. It is our conviction that the physicians of tomorrow must have the methods to hire digital tools, including AI, in a manner that is closer to sensible evidence-based medication use.

This along with the reviews made by Javaid et al., who observed that ChatGPT can help healthcare professionals with writing tasks, like decide establishment and medical record copy, which can streamline the clinical functioning and save physicians time to concentrate on patient care [35].

Limitations

The present study had some restrictions. It embeds only one medical faculty; hence, the findings may not represent the entire country's students.

Recommendations

The authors advise that medical faculties insert AI into platforms based on the research outcome. Since it can be hard for medical schools to practice students on AI, universities and medical board should twist a task force with experts who can additionally practice the coaches. While incorporating AI into the curriculum, ethical issues must be given due importance.

Conclusion

This study highlights the significance of integrating AI technologies into medical education to reduce student workload and enhance the educational experience. It also recommends providing training courses in universities on how to use AI tools effectively.

Acknowledgment

We would like to acknowledge Dr. Mai Atef, Dr. Marwa Awad and Dr. Mona Abo-Elnoor for revising and validating the questionnaire. We would like to thank Rowaida Reda for the plagiarism check with Turnitin software.

Author contribution

E.E., O.S.E, S.R.A, A.K.E., and A.H.O. conceived the project idea and contributed equally to questionnaire preparation and manuscript first draft writing. M.E. and E.E. performed the statistical analysis and prepared figures and tables. All authors critically reviewed and edited the manuscript.

Conflict of interest

The authors declare no competing interests.

Funding

No Funding

Data Availability

Data could be provided by the corresponding author upon a reasonable request

References

1. Jindal A and Bansal M. Knowledge and Education about Artificial Intelligence among Medical Students from Teaching Institutions of India: A Brief Survey [version 1]. MedEdPublish 2020, 9:200. https://doi.org/10.15694/mep.2020.000200.1
2. Mohsen Soori, Behrooz Arezoo, Roza Dastres, Artificial intelligence, machine learning and deep learning in advanced robotics, a review, Cognitive Robotics, Volume 3, 2023, Pages 54-70, ISSN 2667-2413, https://doi.org/10.1016/j.cogr.2023.04.001.
3. Park S. H., Do K. H., Kim S., Park J.H., et al. What should medical students know about artificial intelligence in medicine?J Educ Eval Health. 2019 Jul 3;16:18. doi: 10.3352/jeehp.2019.16.18
4. Bulchand-Gidumal, J., William Secin, E., O'Connor, P., & Buhalis, D. Artificial intelligence's impact on hospitality and tourism marketing: exploring key themes and addressing challenges. Current Issues in Tourism. 2023, 27(14), 2345–2362. https://doi.org/10.1080/13683500.2023.2229480
5. Mir MM, Mir GM, Raina NT, Mir SM, Mir SM, Miskeen E, Alharthi MH, Alamri MMS. Application of Artificial Intelligence in Medical Education: Current Scenario and Future Perspectives. J Adv Med Educ Prof. 2023 Jul;11(3):133-140. doi: 10.30476/JAMP.2023.98655.1803

6. Swed S, Alibrahim H, Elkalagi NKH, et al. Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Syria: A cross-sectional online survey. Front Artif Intell. 2022;5:1011524. Published 2022 Sep 29. http://doi:10.3389/frai.2022.1011524.
7. Aya S. Khater1; Ayman A. Zaaqoq1; Maha M. Wahdan2; Soha Ashry1Knowledge and Attitude of Ain Shams University Medical Students towards Artificial Intelligence and its Application in Medical Education and Practice Educational Research and Innovation Journal ERIJ 2023; Vol. 10 (10). Doi:10.21608/erji.2023.306718
8. Chaudhry MA, Kazim E. Artificial Intelligence in Education (AIEd): a high-level academic and industry note 2021. *AI Ethics*. 2022;2(1):157-165. http://doi:10.1007/s43681-021-00074-z.
9. Thornby KA, Brazeau GA, Chen AMH. Reducing Student Workload Through Curricular Efficiency. Am J Pharm Educ. 2023;87(8):100015. http://doi:10.1016/j.ajpe.2022.12.002
10. Jebreen, K., Radwan, E., Kammoun-Rebai, W. *et al*. Perceptions of undergraduate medical students on artificial intelligence in medicine: mixed-methods survey study from Palestine. 2024, BMC Med Educ **24**, 507 . https://doi.org/10.1186/s12909-024-05465-4
11. Lee, MH., Chai, C.S. & Hong, HY. STEM Education in Asia Pacific: Challenges and Development. 2019, Asia-Pacific Edu Res **28**, 1–4 . https://doi.org/10.1007/s40299-018-0424-z
12. Hafizh Zain Abdillah, Partino and Abd. Madjid Enhancing Student Well-being through AI Chat GPT in the Smart Education University Learning Environment: A Preliminary Review of Research Literature E3S Web Conf., 440 2023, 05005. https://doi.org/10.1051/e3sconf/202344005005
13. Wang X, Ji X. Sample Size Estimation in Clinical Research: From Randomized Controlled Trials to Observational Studies. Chest. 2020;158(1S):S12-S20. http://doi:10.1016/j.chest.2020.03.010
14. Hill, R. (1998). What sample size is “enough” in internet survey research? Interpersonal Computing and Technology: An Electronic Journal for the 21st Century, 6(3-4). ISSN: 1064-4326.
15. Iacobucci, D., Posavac, S. S., Kardes, F. R., Schneider, M. J., & Popovich, D. L. (2015). The median split: Robust, refined, and revived. Journal of Consumer Psychology, 25(4), 690–704. https://doi.org/10.1016/j.jcps.2015.06.014
16. Dorr DA, Adams L, Embí P. Harnessing the Promise of Artificial Intelligence Responsibly. JAMA. 2023 Apr 25;329(16):1347-1348. https://doi.org/10.1001/jama.2023.2771
17. P.P. Ray; ChatGPT: a comprehensive review on background, applications, key challenges, bias, ethics, limitations and future scope Internet Things Cyber-Physical Syst, 3 (March) (2023). https://doi.org/10.1016/j.iotcps.2023.04.003
18. A. Tlili, et al. What if the devil is my guardian angel: ChatGPT as a case study of using chatbots in education Smart Learn. Environ, 10 (1) (2023). https://doi.org/10.1186/s40561-023-00237-x
19. Shahzad MF, Xu S, Lim WM, Yang X, Khan QR. Artificial intelligence and social media on academic performance and mental well-being: Student perceptions of positive impact in the age of smart learning. Heliyon. 2024;10(8):e29523. Published 2024 Apr 15. http://doi:10.1016/j.heliyon.2024.e29523
20. Jha N, Shankar PR, Al-Betar MA, Mukhia R, Hada K, Palaian S. Undergraduate Medical Students' and Interns' Knowledge and Perception of Artificial Intelligence in Medicine. Adv Med Educ Pract. 2022;13:927-937. Published 2022 Aug 23. http://doi:10.2147/AMEP.S368519
21. Jackson, P., Ponath Sukumaran, G., Babu, C. et al. Artificial intelligence in medical education - perception among medical students. BMC Med Educ 24, 804 (2024). https://doi.org/10.1186/s12909-024-05760-0
22. Doumat G, Daher D, Ghanem NN, Khater B. Knowledge and attitudes of medical students in Lebanon toward artificial intelligence: A national survey study. Front Artif Intell. 2022;5:1015418. Published 2022 Nov 2. http://doi:10.3389/frai.2022.1015418.
23. Bisdas S, Topriceanu CC, Zakrzewska Z, et al. Artificial Intelligence in Medicine: A Multinational Multi-Center Survey on the Medical and Dental Students' Perception. *Front Public Health*. 2021;9:795284. Published 2021 Dec 24. http://doi:10.3389/fpubh.2021.795284
24. Pinto Dos Santos D, Giese D, Brodehl S, et al. Medical students' attitude towards artificial intelligence: a multicentre survey. Eur Radiol. 2019;29(4):1640-1646. http://doi:10.1007/s00330-018-5601-1
25. Wartman SA. Medicine, Machines, and Medical Education. *Acad Med*. 2021;96(7):947-950. http://doi:10.1097/ACM.0000000000004113
26. Stewart J, Lu J, Gahungu N, et al. Western Australian medical students' attitudes towards artificial intelligence in healthcare. PLoS One. 2023;18(8):e0290642. Published 2023 Aug 31. http://doi:10.1371/journal.pone.029064
27. Lareyre F, Adam C, Carrier M, Chakfé N, Raffort J. Artificial Intelligence for Education of Vascular Surgeons. Eur J Vasc Endovasc Surg. 2020;59(6):870-871. http://doi:10.1016/j.ejvs.2020.02.030
28. Paranjape K, Schinkel M, Nannan Panday R, Car J, Nanayakkara P. Introducing Artificial Intelligence Training in Medical Education. *JMIR Med Educ*. 2019;5(2):e16048. Published 2019 Dec 3. http://doi:10.2196/16048
29. Crigger E, Khoury C. Making Policy on Augmented Intelligence in Health Care. *AMA J* Ethics. 2019;21(2):E188-E191. Published 2019 Feb 1. http://doi:10.1001/amajethics.2019.188
30. Jha N, Shankar PR, Al-Betar MA, Mukhia R, Hada K, Palaian S. Undergraduate Medical Students' and Interns' Knowledge and Perception of Artificial Intelligence in Medicine. Adv Med Educ Pract. 2022;13:927-937. Published 2022 Aug 23. http://doi:10.2147/AMEP.S368519
31. Temsah MH, Aljamaan F, Malki KH, et al. ChatGPT and the Future of Digital Health: A Study on Healthcare Workers' Perceptions and Expectations. *Healthcare (Basel)*. 2023;11(13):1812. Published 2023 Jun 21. http://doi:10.3390/healthcare11131812

32. Sit C, Srinivasan R, Amlani A, et al. Attitudes and perceptions of UK medical students towards artificial intelligence and radiology: a multicentre survey. *Insights Imaging*. 2020;11(1):14. Published 2020 Feb 5. http://doi:10.1186/s13244-019-0830-7

33. Caparrós Galán G, Sendra Portero F. Medical students' perceptions of the impact of artificial intelligence in radiology. Percepciones de estudiantes de Medicina sobre el impacto de la inteligencia artificial en radiología. Radiologia (Engl Ed). Published online April 29, 2021. http://doi:10.1016/j.rx.2021.03.006

34. McLennan S, Meyer A, Schreyer K, Buyx A. German medical students´ views regarding artificial intelligence in medicine: A cross-sectional survey. PLOS Digit Health. 2022;1(10):e0000114. Published 2022 Oct 4. http://doi:10.1371/journal.pdig.0000114

35. Javaid M, Haleem A, Singh RP. ChatGPT for healthcare services: An emerging stage for an innovative perspective. Bench Council Transactions on Benchmarks, Standards and Evaluations. 2023 Feb;3(1):100105. https://doi.org/10.1016/j.tbench.2023.100105