



The Attitudes of Medical Students at Babol University of Medical Sciences towards Artificial Intelligence

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Article Type	ABSTRACT
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Research Paper	Background and Objective: Artificial intelligence (AI) and associated technologies are having a significant impact on various medical fields. Familiarity with the applications of AI in medical education will create great potential for advancements in the healthcare system and empowerment of future generations of medical professionals. Therefore, the present study was conducted to evaluate the application of AI in medicine and its benefits and concerns based on the attitudes of medical students at Babol University of Medical Sciences. Methods: This cross-sectional study was conducted on 117 medical students at Babol University of Medical Sciences. Data were collected using a questionnaire both online and in person. The first part of the questionnaire included demographic information and the second part included 12, 15, and 6 items to examine the uses, benefits, and concerns related to AI, respectively. Findings: According to the results, 69 subjects (41%) were male and 48 subjects (59%) were female. The mean age of the study participants was 24.12±3.86 years. The results of this study showed that "education and training of medical students" (3.98±1.02) is the most important application of AI in medical sciences according to medical students. The most important advantages and concerns according to medical students were the following items: "AI can eliminate a variety of shortcomings in current medicine" (71%) and "There is a possibility of confidential patient information being published by some people or hackers" (80%). Conclusion: The results of the present study showed that based on the attitudes of medical students, the greatest advantage of using AI is to address the weaknesses of current medicine and the greatest concern is the possibility of some people publishing confidential patient information. Keywords: Attitude, Artificial Intelligence, Medical Student, Medical Education.
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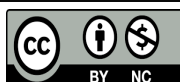
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Introduction

Artificial intelligence (AI) and associated technologies are showing a significant impact on various medical fields. The integration of various aspects of medical science, including education, research, prevention, diagnosis, and treatment with AI is transforming various parts of the healthcare system (1). AI is used in various fields, including early diagnosis of disease, prediction and diagnosis of treatment course, selection of surgical procedures, precision medicine, and increasing patient safety. However, realizing the benefits of AI requires education and acceptance of this technology by those involved in the healthcare system (2). AI has emerged as a powerful tool in medical education and can offer unique opportunities for advanced learning and bridging the gap between knowledge and improving patient care in clinical settings (3). Familiarity with the applications of AI in medical education will create great potential for advancement in the healthcare system and empowering future generations of medical professionals. However, it is important to note that proper familiarity with the applications of AI, along with careful consideration of the risks, opportunities, and limitations associated with it, can facilitate the optimal use of this technology among medical students and professors (3). In addition, considering its emerging nature, it has created various challenges in different health systems which requires a comprehensive review and familiarization of students and professionals with this technology (4-6). Therefore, given the emerging nature of AI in Iran and the lack of information in this field, the present study was conducted to evaluate the application of AI in medicine and its benefits and concerns based on the attitudes of medical students at Babol University of Medical Sciences.

Methods

After approval by the Ethics Committee of Babol University of Medical Sciences with the code IR.MUBABOL.REC.1402.164, this cross-sectional study was conducted at Babol University of Medical Sciences to investigate the application of AI and the benefits and challenges of using it in healthcare based on the attitudes of medical students. The study population included all medical students at Babol University of Medical Sciences who entered the study using convenience sampling method. The inclusion criterion included studying in the field of medicine at Babol University of Medical Sciences, and the exclusion criteria included dissatisfaction and incomplete completion of the questionnaire. The sample size for this study was determined using the statistical formula $n = Z^2 S^2 / d^2$ and similar studies (3) with 95% confidence interval, an estimated standard deviation of 2.5 and an estimated error of 0.5, and considering a 20% dropout rate, and at least 116 samples were finally considered. Self-report questionnaires were used to collect data in this study. In the first stage, the questions were entered into Pressline Online. Then, the online link to the questionnaire was shared on the social networks of these students. The response rate to the shared link was 21.3%. The research team then delivered the study questionnaires to the hospital training units and explained the study objectives to them for completion. The sampling process continued until the minimum number of samples required was reached.

The questionnaire used in this study consisted of two main parts. The first part of the questionnaire was designed to assess the demographic characteristics of the participants, including gender, age, use of AI, and participation in AI courses. For the second part, the questionnaire on the applications of AI and the benefits and challenges of using AI was used. This researcher-made questionnaire was designed by Hamedani et al. in Iran and included 12 questions related to the applications of medical AI. The Cronbach's alpha coefficient for this questionnaire in the study by Hamedani et al. was 0.81. Furthermore, to examine the most important advantages and concerns, students could choose the ones they thought were the most important advantages

from among the 15 advantages presented. To examine the most important concerns, students could choose their preferred options from among the 6 options presented. Finally, two questions based on the questionnaire used in the study by Hamedani et al. were presented: "If the judgment of the doctor and the AI are different, which one do you think is preferable?" (Answer: A. Physician's opinion, B. AI's opinion, C. Patient's choice) and "Who do you think will be responsible for legal problems caused by AI?" (Answer: A. The physician in charge, B. The company that created the AI, C. Patients who have consented to AI being used in their treatment process) (7).

Full completion of the questionnaire by the students was considered as informed consent to participate in the study. Finally, the collected data were analyzed using descriptive statistics and independent t-test using SPSS 27, and $p < 0.05$ was considered significant.

Results

117 medical students from Babol University of Medical Sciences participated in this study. The results of this study showed that the mean age of the study participants was 24.12 ± 3.86 years. The mean years of education for the students was 4.64 ± 1.88 (Table 1). Table 2 shows the opinions of the students about the various applications of AI in medical sciences. Table 3 shows the results of the most important benefits and concerns about AI among medical students.

Table 1. Relationship between AI application and demographic characteristics

Variable	Number(%)	Mean $\pm$ SD	Mean difference (95% CI)	p-value*
Age				
≤ 23	62(53)	43.82 $\pm$ 8.24	0.48	0.778
> 23	55(47)	43.35 $\pm$ 10.04	(-2.87 – 3.83)	
Gender				
Male	69(59)	44.80 $\pm$ 7.54	-2.48	0.141
Female	48(41)	42.33 $\pm$ 10.46	(-5.78 – 0.83)	
Academic year				
≤ 3	61(52.1)	42.97 $\pm$ 8.86	-1.31	0.436
> 3	56(47.9)	44.29 $\pm$ 9.37	(-4.66 – 2.02)	
Using artificial intelligence				
Yes	61(52.1)	44.44 $\pm$ 8.32	-2.28	0.173
No	56(47.9)	42.16 $\pm$ 9.48	(-0.57 – 1.01)	
Participating in artificial intelligence courses				
Yes	15(12.8)	46.36 $\pm$ 8.07	-3.37	0.195
No	102(87.2)	42.99 $\pm$ 9.15	(-8.49 – 1.75)	
Total(Mean$\pm$SD)			43.60 $\pm$ 9.09	

*Independent t-test

Table 2. The extent of AI application based on the attitudes of medical students

Applications of medical artificial intelligence	Mean±SD	Very much (5) Number(%)	Much (4) Number(%)	Little (3) Number(%)	Very little (2) Number(%)	Artificial intelligence should not be used in this case (1) Number (%)
Education and training of medical students	3.98±1.02	41(35.0)	47(40.2)	21(17.9)	2(1.7)	6(5.1)
Rapid diagnosis of diseases	3.61±1.20	26(22.2)	48(41.0)	28(23.9)	1(0.9)	14(12.0)
Making treatment decisions	3.28±1.25	19(16.2)	37(31.6)	36(30.8)	8(6.8)	17(14.5)
Evaluation of the effectiveness of the treatment performed	3.62±1.04	21(17.9)	48(41.0)	37(31.6)	3(2.6)	8(6.8)
Predicting the effect of therapeutic interventions	3.74±0.91	19(16.2)	63(53.8)	23(19.7)	9(7.7)	3(2.6)
Performing autonomous surgeries (without the need for a surgeon)	2.76±1.33	13(11.1)	21(17.9)	39(33.4)	13(11.1)	31(26.5)
Performing semi-autonomous surgeries (instruments used by the surgeon)	3.60±1.04	20(17.1)	51(43.6)	33(28.2)	5(4.3)	8(6.8)
Post-surgery follow-ups	3.67±0.94	21(17.9)	50(42.7)	35(30.0)	8(6.8)	3(2.6)
Analysis of medical tests and imaging (biochemical tests, ultrasound, endoscopy, CT, MRI, ECG, etc.)	3.93±1.03	35(29.9)	54(46.2)	18(15.4)	4(3.4)	6(5.1)
Increasing the accuracy of diagnostic tests	3.89±0.96	30(25.6)	59(50.4)	16(13.7)	9(7.7)	3(2.6)
Identifying drug interactions	3.86±0.99	34(29.1)	46(39.3)	27(23.1)	7(6.0)	3(2.6)
Disease prognosis assessment	3.81±0.94	28(23.9)	50(42.7)	31(26.5)	5(4.3)	3(2.6)

Table 3. The most important benefits and concerns regarding the use of AI based on the attitudes of medical students

Advantages	Number(%)
AI reduces healthcare costs	56(47.9)
AI shortens patient hospital stays	47(40.2)
AI increases the speed of providing services to clients	65(55.6)
AI can address many weaknesses in current medicine	71(60.7)
The use of AI reduces the heavy workload of members of the care-treatment team	59(50.4)
AI creates new jobs in healthcare	40(34.2)
AI has no physical limitations or fatigue	58(49.6)
AI is not limited by time and space	57(38.7)
AI can help reduce medical errors	63(53.8)
AI can reduce differences in judgments and diagnoses between doctors	32(27.4)
You can rely on AI opinions to make difficult decisions	27(23.1)
With the use of AI, doctors will have more time for their patients and focus on more complex tasks	32(27.4)
AI devices provide reliable reports after analyzing patient data	27(23.1)
AI gives researchers access to a massive database of (anonymized) patients across the country	54(46.2)
The use of AI increases profitability for medical centers	39(33.3)
Concerns	Number(%)
There is a possibility that confidential patient information may be published by some individuals or hackers	80(68.4)
AI increases the workload of care-treatment team members	25(21.4)
AI lacks the ability to empathize and consider the patient's emotional well-being	68(58.1)
AI could damage the doctor-patient relationship	73(62.4)
AI reduces the number of healthcare team members needed in society	50(42.7)
AI will diminish the role of healthcare team members in treating patients in the future	61(52.1)

The results also showed that when the judgment of the doctor and the AI differed in a field, 83% of the students believed that the doctor's opinion prevailed, 8% believed that the AI's opinion prevailed, and 9% believed that the patient's opinion prevailed. The study also examined the legal liability arising from problems with AI. The results showed that 29.4% of the students believed that the responsibility lay with the doctor, 45% believed that the responsibility lay with the AI company, and 25.7% believed that the responsibility lay with the patient who consented to the use of AI.

Discussion

The results of this study showed that the most common use of AI is in the education and training of medical students. In addition, the most significant benefits and concerns were related to addressing medical weaknesses and the possibility of information disclosure, respectively. The highest and lowest scores for the use of AI were obtained for "education and training of medical students" and "performing autonomous surgeries," respectively. In the study conducted by Jha et al., 54.6% of respondents were against the use of AI for performing surgeries, which is consistent with the findings of our study (8). Despite the importance of AI in medical education, students' opinions indicate that it is neglected in healthcare. The application of AI as a new phenomenon and concept needs to be reviewed and standardized in the curriculum. In addition, conducting high-quality research with strong methodology is essential for the advancement of education and training of medical students (9). Inadequate use of AI in medical education may be due to a lack of coordination and coherence between AI inventors and target users. Healthcare system professionals have the task of establishing a balance and coherence between AI and traditional teaching methods, while medical students should actively develop independent and analytical thinking skills. Moreover, the formation of research teams including members from different fields is essential to ensure the effective implementation of AI in medical education (10). In contrast to our study, a study by Al Hadithy et al. showed that 62% of participants believed that AI would replace doctors in performing surgery (11). The results of a study by Hamedani et al. showed that 57.9% of doctors responded that using AI in "performing autonomous surgery" had high and very high applicability. Furthermore, "education and training of medical students" was one of the applications that had the highest mean score based on the opinion of study participants (7). The lack of attention to AI in robotic surgery can be considered reasonable. This technology is still in its early stages and is expected to develop slowly in the future. Delays in progress in these areas are due to the immaturity of the technology, inadequate training in medical schools, and risks to patients' lives and high costs associated with it (12).

The results of the present study showed that from the perspective of medical students, the greatest advantage of using AI is to overcome the weaknesses of current medicine. In fact, in this section, students stated that AI is very helpful in improving the quality of medicine. In addition, 83% of students believed that the doctor's opinion is preferable in diagnosing a disease. Other studies have also stated that the use of AI can reduce medical errors and as a result, they had an optimistic view of AI and its use in the health system, which was in line with the results of our study (13-15). In the study of Ahmed et al., the results showed that 69.6% of medical students and 81.8% of doctors also stated that AI could soon act as an aid to doctors and most of them believed that AI could not replace doctors, which was in line with the results of our study (13). Another finding of this study was that medical students expressed their concern about the possibility of some people publishing confidential patient information. In a systematic review by Ali et al., one of the important challenges that has been examined in various studies was security issues, privacy implications, cybersecurity, and ethical issues (16). In another study by Al-Medfa et al., 114 physicians with different specialties were surveyed regarding their attitudes and knowledge about AI and its benefits and

harms. In this study, physicians gave the lowest mean score to the lower error rate of AI compared to physicians, and on the other hand, the highest mean score was related to the impact of AI on recruitment as the highest mean score among study participants (17), which was somewhat different from the results of our study. This difference may be attributed to the study population. Our study included medical students, who had a different age variable compared to the study population of Al-Medfa et al. In addition, the questionnaire was different in the two studies.

The present study has a couple of limitations which include evaluating the use of AI among a limited number of medical students in one university. It is suggested that similar studies be conducted in other parts of the country and on students and health personnel from different fields with larger sample sizes. The results of this study can be used for future planning in the area of integrating AI with medical courses and curricula and to familiarize medical students with it. It is also suggested that due to the lack of standard tools to assess concepts such as application, benefits, and concerns, standard, valid, and reliable tools be developed and psychometrically tested. This study was one of the first studies in this field in Iran on medical students, which is one of the strengths of this study. It is suggested that policymakers and health, treatment, and medical education officials take effective steps to apply AI in different fields based on the results of this study.

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