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# Knowledge and acceptance of artificial intelligence and its applications among the physicians working in military medical centers affiliated with Aja University: A cross-sectional study

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## Abstract:

**BACKGROUND:** The use of artificial intelligence (AI) in medical sciences promises many benefits. Applying the benefits of this science in developing countries is still in the development stage. This important point depends considerably on the knowledge and acceptance levels of physicians.

**MATERIALS AND METHODS:** This study was a cross-sectional descriptive–analytical study that was conducted on 169 medical doctors using a purposive sampling method. To collect data, questionnaires were used to obtain demographic characteristics, a questionnaire to investigate the knowledge of AI and its applications, and an acceptability questionnaire to investigate AI. For data analysis, SPSS (Statistical Package for the Social Sciences) version 22 and appropriate descriptive and inferential statistical tests were used, and a significance level of  $< 0.05$  was considered.

**RESULTS:** Most of the participants (102) were male (60.4%), married (144) (85.20%), had specialized doctorate education (97) (57.4%), and had average work experience of  $10.78 \pm 6.67$  years. The mean and standard deviation of knowledge about AI were  $9.54 \pm 3.04$ , and acceptability was  $81.64 \pm 13.83$ . Multiple linear regressions showed that work history ( $P = 0.017$ ) and history of participation in AI training courses ( $P = 0.007$ ) are effective in knowledge and acceptability of AI.

**CONCLUSION:** The knowledge and acceptability of the use of AI among the studied physicians were at an average level. However, due to the importance of using AI in medical sciences and the inevitable use of this technology in the near future, especially in medical sciences in crisis, war, and military conditions, it is necessary for the policymakers of the health system to improve the knowledge and methods of working with this technology in the medical staff in addition to providing the infrastructure.

## Keywords:

Artificial intelligence, health personnel, knowledge

## Introduction

The application of artificial intelligence (AI) in the healthcare system can improve healthcare quality, costs, individual care management and treatment outcomes. However, some studies indicate that hospital staff do not easily adopt new information technology.<sup>[1]</sup> The expansion of knowledge in the field of medicine and the

complexity of decisions related to diagnosis and treatment have drawn the attention of specialists to the use of decision support systems in medical affairs.<sup>[2]</sup> One of these support systems is the use of AI.<sup>[3]</sup> AI is one of the young and growing branches of computer sciences, which means building computers that can do intelligent tasks that require intelligence and thinking.<sup>[4]</sup> The beginning of the use of this science goes

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back to after the First World War in 1950 AD. When Norbert Wiener raised cybernetics issues and Alan Turing proposed to identify the intelligence of machines, they tried to bring AI to the level of human intelligence.<sup>[5]</sup> In fact, AI is the use of computers to perform actions that previously required human cognition, judgment, and recognition.<sup>[6]</sup> With its help, it is possible to process large sets of data and understand complex relationships between variables.<sup>[7]</sup> In this way, AI techniques are widely used to detect risks and predictive factors of diseases in medical centers, especially in war, crisis, and disaster conditions, to help the medical care team.<sup>[8]</sup> It helps health professionals in making early diagnosis, reducing complications, optimizing treatment or suggesting less invasive options, improving the quality of life of patients, improving public health, and reducing the length of hospitalization.<sup>[9]</sup> It enables them to make a correct, quick, and accurate initial diagnosis and to treat patients effectively and with proper quality.<sup>[10]</sup>

Many studies have been conducted on the applications of medical AI in the military, for example, Svenmarck *et al.*<sup>[11]</sup> (2018) by conducting a study, listed, and announced the military applications of AI in three major areas of surveillance, underwater mine weapons, and virtual security. This technology is also associated with challenges, including the lack of transparency in the use of AI and the difficulty of training, and also, it can be challenging when used for educational purposes. Also, Yoon *et al.*<sup>[12]</sup> (2021) stated that AI models can provide useful solutions in the direction of disease diagnosis, classification of clinical symptoms, and guidance of clinical and treatment decisions and care in crisis and war conditions. Having knowledge about AI and its applications in the military health and treatment system is an issue that, despite its high importance, has received little attention, especially in developing countries.<sup>[13]</sup> Meanwhile, having sufficient and appropriate knowledge about the new technology of AI is the first step to its use in treatment and care centers.<sup>[14]</sup> In fact, being aware of the benefits and applications of AI in providing military health services can be considered basis for strategic planning and ultimately improving the achievements of the health system based on military technology.<sup>[13]</sup> However, in developing countries, less attention has been paid to this matter. For example, in the study of Ahmed *et al.*<sup>[15]</sup> (2021) in Pakistan, which aimed to determine the knowledge, attitude, and application of AI among physicians and medical students, only 27.3% of physicians and 19.4% of medical students had acceptable knowledge of AI and its applications in the medical sciences. Despite the importance of being up-to-date in all organizations, especially the use of AI technology in military organizations, no study was found that dealt with AI as a combination of medical and military sciences.

Considering the increasing use of AI in modern medicine and its subbranches such as military medicine and emergency medicine and its prominent role in improving services to patients and clients, having sufficient knowledge and information about it for all members of the medical care team is necessary. This study was conducted with the aim of determining the level of knowledge and acceptability of using AI among general practitioners and specialists working in selected medical centers affiliated with Aja University of Medical Sciences in Tehran, Iran, in the first half of 2022.

## Material and Methods

### Study design and setting

This descriptive–analytical research was conducted in Tehran—the capital of Iran—in the first half of 2022 in five military medical centers.

The working method was as follows: First, after obtaining the necessary permits, the researcher went to the research centers and, in coordination with the officials of these centers, prepared a list of physicians, who met the criteria for entering the study, and explained the objectives of the research to them, and if they agreed to participate in the project, an informed consent was obtained. Then, the questionnaires were distributed among the samples and the necessary explanations were given on how to fill them. The questionnaires were collected on the same day or the next day.

### Study participants and sampling

The number of samples required for this study was determined to be 169 people according to the total number of physicians working in these centers and with the help of the Cochran formula.

$$n = \frac{\frac{Z^2 pq}{d^2}}{1 + \frac{1}{N} \left( \frac{Z^2 pq}{d^2} - 1 \right)}$$

The sampling method was purposive. The inclusion criteria included willingness to participate in the study, having at least a doctorate in general medicine, working in one of the medical centers affiliated with Aja University of Medical Sciences, and not having completed training courses on AI in medical sciences, and the exclusion criteria were patients' withdrawal and incomplete answering of questionnaires for at least 10% of the questions.

### Data collection tool and technique

To collect data, a three-part questionnaire was used, which was completed by the samples. The first part was

the demographic profile of the participants, the second part contained eight questions to measure knowledge, and the third part contained 34 questions to measure the acceptability of AI. The demographic data form measures such as gender, marital status, education level, age, and work experience. The questionnaire for investigating the knowledge of AI and its applications is scored with a three-point Likert spectrum of "Yes, it's correct," "I don't know," and "No, it's not correct," points given from 2 to zero, respectively. A score between 0 and 6 was considered as low level of knowledge, 7 to 11 as average level of knowledge, and 12 to 16 as high level of knowledge. The second part of the questionnaire related to the acceptability of AI contains 34 questions with a 5-point Likert scale of completely agree (score 4), agree (score 3), have no opinion (score 2), disagree (score 1), and completely disagree (score zero). The total scores are between zero and 136. A score of 0 to 77 was considered as low level of acceptability, 78 to 107 as medium level of acceptability, and 108 to 140 as high level of acceptability.

To carry out validity, the method of determining formal and content validity was used. For this purpose, the questionnaire was provided to 10 academic faculty members, three AI experts, and 15 research community members, and their points on the face validity of the tool were taken into account. To check the content validity, two CVR (Coefficient of Variation Ratio) and CVI (Content validity index) coefficients were used and the content validity index was calculated as 0.79, which was acceptable. To confirm the reliability, the questionnaire was given to 15 eligible people, and after completion, it was calculated by calculating Cronbach's alpha coefficient ( $\alpha = 0.81$ ).

**Ethical considerations**

An introduction letter was obtained from the Deputy of Research of AJA University of Medical Sciences, and permission was obtained from the ethics committee of AJA University of Medical Sciences with the code IR.AJAUMS.REC.1401.141 to comply with ethical considerations. Confidentiality of all documents related to the participants and respect for trust in the user information sources were implemented. The researcher reminded that participation in the study is completely voluntary and does not affect the personnel evaluation, the information of the participants will remain confidential, and informed consent was obtained from all patients.

**Statistical analysis**

SPSS version 22 software and independent-samples t-tests, one-way analysis of variance, Kruskal-Wallis, linear ANCOVA (Analysis of covariance), and Spearman's correlation coefficient were used for data

analysis. A significance level of less than 0.05 was considered.

**Results**

In the current study, 169 doctors ranging from general physicians to subspecialists in five Aja medical centers in Tehran participated, and the questionnaires related to all of them could be analyzed. Most of the participants were male (60.4%), married (85.20%), had specialized doctorate education (57.4%), and had an average work experience of  $10.78 \pm 6.67$  years [Table 1].

In this study, the mean and standard deviation of knowledge about AI were  $9.54 \pm 3.04$  and acceptance was  $81.64 \pm 13.83$ . 101 people (59.8%) and 98 people (58%) had average knowledge and acceptance toward AI, respectively [Table 2 and Figure 1].

The knowledge of the studied physicians about AI had a significant relationship with education ( $P = 0.006$ )

**Table 1: Demographic characteristics of physicians participating in the study**

Demographic characteristics	Prevalence	Percentage
Gender		
Male	102	60.4
Female	67	39.6
Marital status		
Single	25	14.8
Married	144	85.20
Education		
General physician	34	20.1
Specialist	97	57.4
Subspecialist	38	22.5
Age (years)		
18-24	6	3.6
25-34	31	18.3
35-44	39	21.1
45-54	65	38.5
55-64	23	13.1
65 and more	5	3
Work experience (years)		
1-5	12	7.1
6-10	39	23.1
11-20	93	55
20 and more	25	14.8

**Table 2: Frequency distribution of research units according to the level of knowledge of artificial intelligence and its acceptability**

Variable	Rating	Prevalence	Percentage	M±SD
Knowledge	Low	21	12.4	9.54±3.04
	Average	101	59.8	
	High	47	27.8	
Acceptance	Low	63	37.3	81.64±13.83
	Average	98	58	
	High	8	4.7	

and age ( $P = 0.006$ ) so the knowledge about AI in participants with general doctorate education and lower age was more. The level of acceptability of AI was also significantly related to education ( $P = 0.01$ ) and age ( $P = 0.017$ ) so the acceptability of AI was higher in participants with subspecialized education and older age [Table 3].

Multiple linear regressions showed that work experience ( $P = 0.017$ ) is effective in knowledge and acceptability of AI among physicians [Table 4].

### Discussion

The present study was conducted with the aim of determining the level of knowledge and acceptance of the use of AI among doctors working in medical centers affiliated with Aja University of Medical Sciences located in Tehran. Based on the obtained results, most of the participants had moderate knowledge and acceptance toward AI and its applications in the medical sciences.

To remain in the field of competition and also to improve the provided care for patients, it is necessary and inevitable to apply new sciences and technologies, but this will not be realized without having knowledge about it.<sup>[16]</sup> In this regard, Castagno and Khalifa<sup>[17]</sup> (2020) conducted a qualitative study in England titled "Perceptions of artificial intelligence among healthcare staff" and concluded that 50% of the participants had adequate knowledge of AI and the level of acceptability of AI was 79%. The samples believed that AI could be highly effective in their work environment. De Simone *et al.*<sup>[18]</sup> (2022) in a study titled "Knowledge, attitude, and practice of artificial intelligence in emergency and trauma surgery, the ARIES (The Artificial Intelligence in Emergency and Trauma Surgery) project: an international web-based survey" conducted in France concluded that only 10% of samples used robotic surgery. 50% had good knowledge, and 38.5% had a positive attitude toward AI. Swed *et al.*<sup>[19]</sup> (2021) conducted a study in Syria titled "Knowledge, attitude, and practice of artificial intelligence among doctors and medical students," and after examining the opinions of 1494 people, they stated that only 23.7% of them had knowledge and awareness

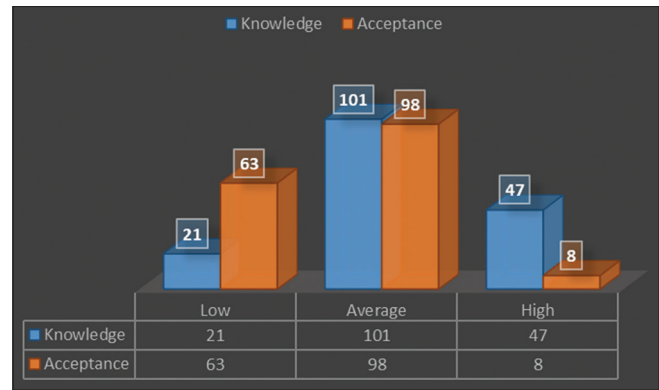


Figure 1: Frequency distribution of research units according to the level of knowledge of artificial intelligence and its acceptability

Table 3: Investigating the relationship between demographic characteristics and the level of knowledge of the research samples regarding artificial intelligence and its acceptability

Demographic characteristics	Knowledge Mean±SD	Test result	Acceptability Mean±SD	Test result
Gender				
Male	9.69±3.25	<sup>a</sup> P – 0.22	82.42±14.19	<sup>a</sup> P – 0.18
Female	9.33±2.74	t – 0.77	80.46±13.29	t – 0.90
Marital Status				
Single	9.59±3.18	<sup>a</sup> P – 0.46	83.11±12.17	<sup>a</sup> P – 0.44
Married	9.48±2.94	t – 0.54	80.16±14.49	t – 0.08
Education				
General physician	10.68±2.86	<sup>b</sup> P – 0.006	84.82±17	<sup>b</sup> P – 0.01
Specialist	8.92±2.75	F – 5.34	78.89±12.85	F – 4.78
Subspecialist	10.13±3.60		85.84±11.63	
Age				
18–24	12.17±1.85	<sup>c</sup> P – 0.006	82±18.47	<sup>c</sup> P – 0.017
25–34	10.77±2.92	Z – 17.16	85.77±16.08	F – 2.85
35–44	8.56±2.45		77.56±10.98	
45–54	9.35±3.01		79.83±12.87	
55–64	9.13±3.74		85.09±13.28	
65 and more	10.80±3.11		95.20±16.05	
Variable				
Mean±SD		Test result		Test result
work experience				
1078±6.67		R=0.491		R=0.29
		dP=0.05		dP=0.16

<sup>a</sup>Independent-samples test, <sup>b</sup>ANOVA (Analysis of variance), <sup>c</sup>Kruskal–Wallis, <sup>d</sup>Spearman's

Table 4: Multiple linear regressions demographic characteristics and the level of knowledge of the research samples regarding artificial intelligence and its acceptability

Model		Coefficients <sup>a</sup>		t	Sig.	
		Unstandardized coefficients	Standardized coefficients			
		B	Std. Error	Beta		
1	(Constant)	1.717	0.172		9.982	0.000
	Age	-0.032	0.047	-0.078	-0.684	0.495
	Gender	-0.095	0.076	-0.099	-1.248	0.214
	Education	-0.052	0.076	-0.073	-0.685	0.494
	Work experience	0.015	0.006	0.207	2.416	0.017

<sup>a</sup>Dependent variable: knowledge and acceptability

about AI and its applications. In the study of Ahmed *et al.*<sup>[15]</sup> (2021) in Pakistan titled “Knowledge, attitude, and practice of artificial intelligence among doctors and medical students in Pakistan,” it was reported that 74% of doctors and 68.8% of medical students had a basic knowledge of AI, but only 27.3% of doctors and 19.4% of medical students had acceptable knowledge of AI applications in medicine.

Pauwels and Del Rey<sup>[20]</sup> (2021) conducted a study in Brazil entitled “Attitude of Brazilian dentists and dental students regarding the future role of artificial intelligence in oral radiology” and concluded that, after increasing knowledge about AI, concerns about the replacement of oral radiologists by AI decreased. In a study conducted by Maassen *et al.*<sup>[21]</sup> in Germany (2021) entitled “Future Medical Artificial Intelligence Application Requirements and Expectations of Physicians in German University Hospitals,” the vast majority of doctors expected that the future of medicine would be a mixture of humans and AI, but also requested a scientific evaluation before routine use of AI-based systems. Physicians were mostly optimistic that AI applications could detect drug interactions to significantly improve patient care, but were clearly cautious about AI-supported psychiatric diagnosis. According to the researcher, the difference in the tools used and whether it was done in a developed or developing country is the most important reason for obtaining different results. Among the other reasons for the differences, we can point to the educational nature of the studied centers, the type of training, and the level of attention paid by managers and healthcare planners in the country.

Another result of the study was that the level of knowledge of the physicians working in Aja medical centers in Tehran regarding AI and the level of its acceptance had a significant relationship with education and age, so the knowledge of AI was higher in the participants with a general doctorate education and in younger age, and the acceptability of AI was more in the participants with a subspecialty and older age. In line with this finding of the present study, in the study of Swed *et al.*<sup>[19]</sup> (2021) in Syria, the level of education of the participants had a significant relationship with knowledge and awareness, and people with bachelor’s level education had more knowledge and awareness about AI, but in the study conducted by De Simone *et al.*<sup>[18]</sup> (2022) titled “Knowledge, attitude and use of artificial intelligence in trauma and emergency surgery, ARIES project: an international web-based survey” knowledge, attitude, and use of AI had no significant relationship with none of the demographic characteristics of the participants. A demographic factor cannot be definitely determined to be related to the knowledge of AI and its acceptance, but it seems that newly arrived students and younger

people have more information about it due to easier access to the resources and technologies of the world. It is necessary for the policymakers of the health system to improve the knowledge and methods of working with this technology in the medical staff in addition to providing the infrastructure.

### Limitations and recommendation

The completion of the questionnaires can depend on the mental status and the level of fatigue of the samples. Due to the heavy workload of doctors, it was possible to complete the questionnaires with low accuracy, so the researchers tried to attract the attention of the samples to complete the questionnaires accurately by explaining the importance of this study.

### Conclusion

The results of the study showed that the knowledge and acceptability of the use of AI in the medical care team were at an average level. However, due to the importance of using AI in medical sciences and the inevitable application of this concept in the near future, especially in military organizations, it is necessary for the policymakers of the health system to improve the knowledge and methods of working with this technology in the medical staff in addition to providing the infrastructure.

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### Conflicts of interest

There are no conflicts of interest.

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