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MEDICAL STUDENTS' PERCEPTION OF THE ROLE OF ARTIFICIAL INTELLIGENCE IN HEALTHCARE

PERCEPCIJA STUDENATA MEDICINE O ULOZI VEŠTAČKE INTELIGENCIJE U ZDRAVSTVU

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Summary

Introduction. Artificial intelligence is defined as a part of computer science capable of manipulating extensive data through machine learning. The aim of this study is to investigate medical students' perceptions regarding the use of artificial intelligence in the field of healthcare. **Material and Methods.** This research was conducted as a cross-sectional study using the Computer Assisted Web Interviewing technique for data collection by surveying students through social networks. The sample consists of 160 students who were surveyed in November 2023. The aim was to provide answers to the question of how students perceive the use of new technology – artificial intelligence in the field that represents their future profession. **Results.** The results have shown a well-developed awareness among students regarding the potential application of artificial intelligence in the medical field, emphasizing a positive perception of the benefits that artificial intelligence can bring. They have also recognized the importance of incorporating artificial intelligence training into medical education. Students have expressed concerns, primarily about potential misuse of artificial intelligence and ethical issues related to its use in medicine. **Conclusion.** Medical students are aware not only of the benefits but also the risks associated with the implementation of artificial intelligence in medicine.
Key words: Artificial Intelligence; Professional Role; Students, Medical; Attitude; Medicine

Sažetak

Uvod. Veštačka inteligencija definisana je kao deo računarske nauke, sposobna da putem mašinskog učenja manipuliše obimnim podacima. Cilj rada je ispitivanje percepcije studenata medicine o upotrebi veštačke inteligencije u oblasti zdravstva. **Materijal i metode.** Istraživanje je spovedeno kao studija preseka, uz korišćenje tehnike prikupljanja podataka anketirajući studente preko društvenih mreža (*Computer-assisted web interviewing*). Uzorak je činilo 160 studenata koji su anketirani novembra 2023. godine. Cilj je bio pružanje odgovora na pitanje kako studenti percipiraju upotrebu nove tehnologije – veštačke inteligencije u oblasti koja je njihov budući profesionalni izbor. **Rezultati.** Rezultati su pokazali razvijenu svest studenata o potencijalu primene veštačke inteligencije u medicinskom sektoru, ističući pozitivnu percepciju benefita koje veštačka inteligencija može doneti. Takođe su prepoznali važnost uključivanja obuke o veštačkoj inteligenciji u medicinsko obrazovanje. Studenti su iskazali i zabrinutost, pre svega oko mogućih zloupotreba veštačke inteligencije i etičkih pitanja u vezi sa upotrebom veštačke inteligencije u medicini. **Zaključak.** Studenti medicine svesni su benefita ali i rizika koji donosi primena veštačke inteligencije u medicini.
Ključne reči: veštačka inteligencija; profesionalna uloga; studenti medicine; stavovi; medicina

Introduction

With technology continually advancing, the use of Artificial Intelligence (AI) is becoming a standard means to enhance society in various fields. As the authors note, it 'employs heuristics and represents knowledge,' contributing to easier problem-solving and improved learning [1]. The literature also says that the deployment of these large models has deeply transformed the society, representing one of the most significant transformations in the history of society [2].

In this context, is certainly interesting to research the way young people perceive the significance of artificial intelligence. As suggested by research data, every second millennial believes they will work with robots and use artificial intelligence [3]. Considering that today's medical students will become key figures in the future healthcare system, it is important to understand how they perceive the role of AI in their field. By exploring their attitudes, beliefs, and opinions, we expect to gain insights into how young medical professionals perceive these technological changes and envision the integration of artificial intelligence into their future professional experience.

There is a growing interest in the scientific community regarding the role of AI in medicine [4]. The rapid evolution of AI technology has opened new possibilities in diagnosis, therapy, research, and the organization of medical data. Medicine is therefore considered a field with great potential in terms of utilizing artificial intelligence. Based on their previous experience, the authors note that artificial intel-

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ligence has demonstrated its value in the domain of administrative and clinical tasks, reducing medical errors in diagnostics, increasing efficiency and impartiality in task performance, mitigating healthcare workforce shortages, enhancing the capacity for medical data search, analyzing images in radiology and histopathology, interpreting electrocardiograms and heart diseases, minimizing human errors, aiding in drug treatments and surgeries, making prescription decisions, integrating health data, educating users, as well as contributing to pandemic and epidemic prevention [3]. Furthermore, the authors state that the confirmed ability of AI to synthesize large volumes of patient data and generate reports has been established. Additionally, its proven equivalence with medical professionals in terms of performance has been demonstrated for simple radiological, dermatological, and pathological diagnostic tasks [2]. In addition, it is important to note that the literature emphasizes that such integration of AI into processes related to medical practice eases the workload for healthcare professionals, contributes to reducing potential burnout, and enhances the patient experience [3]. It is also mentioned that artificial intelligence has been incorporated into numerous education programs in the field of medical education [3]. The authors also highlight a significant piece of information, pertaining to the registration of 71 medical devices related to artificial intelligence in the field of oncology, all of which have received official Food and Drug Administration (FDA) approval [5]. These devices are not intended for performing traditional diagnostic procedures independently, but they are rather considered as integrative tools to be used based on the assessment of medical professionals. The application of AI in medical rehabilitation is expanding [6]. For the full effectiveness of using artificial intelligence in medicine, it is necessary to work on building trust among healthcare professionals in terms of actual capabilities and potential outcomes in this field [7].

Numerous studies have been conducted among medical students to explore their attitudes and opinions regarding the potential use of AI in medicine. Some research results indicate that there is an awareness among students about the potential of artificial intelligence in healthcare. To this end, they also showed willingness to use AI independently, both in their professional roles and in their personal lives [3]. Pang Yi Xuan (2023) et al. report the results from several studies conducted among medical students regarding the use of AI in healthcare. One study in the U.S. revealed that the majority of students have positive attitudes towards the use of AI in medicine. They believe that its use can be beneficial for patient care. Another study conducted among pathologists showed a positive perception regarding the use of AI in pathology as it would increase efficiency and quality in the

field of pathology. Furthermore, these authors report that students in another study also had predominantly positive attitudes towards the use of AI in pathology and radiology. This includes research conducted in Timisoara among students of technical sciences and humanities, as well as research conducted in multiple U.S. states (ibid.). A large-scale study involving over three thousand participants from 63 countries on all continents [8] showed that predominantly medical students do not perceive the use of artificial intelligence in their field as a 'competitor' but rather as a 'partner.' A study conducted in Canada [9] revealed that medical students consider radiology as the top choice for specialization in medicine, but over 67.7% of them fear that AI will reduce the demand for radiologists in the future. Results of another study [10], which evaluated 19 published studies on the views of medical students and radiology residents on nearly all continents toward the use of AI in medicine – radiology, showed that opinions among students are divided. However, the authors report that there is still evidence that students demonstrate interest and optimism regarding the use of AI. A study conducted with healthcare professionals in Saudi Arabia on a sample of 250 participants [11] showed that the majority of them are afraid of the effects of using AI in healthcare.

They believe that AI will replace employees. An interesting piece of information from the above study is that only 8% of the participants received some training or systematic information on this topic [10]. Nevertheless, 87% of the ones trained on the use of AI in medicine and radiology consider the training useful. Another study also shows that students recognize the importance of incorporating AI training into medical education [3]. Information obtained from the study indicating that students who have accepted to attend trainings on the use of AI for professional purposes have a more positive attitude and feel more confident in its practical application seems particularly important. Therefore, the authors believe that AI education for medical students can help improve their views about the role of AI in healthcare.

Although the benefits of using artificial intelligence in medicine are evident, there is a valid concern about its negative effects. These concerns primarily stem from the sensitive nature of the medical profession itself [4], particularly in the process involving the management of patients' medical records, which contains personal information that must be protected. In this regard, strict ethical requirements, privacy demands, and data protection standards need to be applied rigorously [2]. At the same time, there is also a patient concern about the possibility of unauthorized use of their data for commercial purposes.

Material and Methods

Our research is a cross-sectional study aimed at determining the perceptions of medical students regarding the role of artificial intelligence in healthcare, and the frequency of using new digital technologies by this population. A questionnaire was

designed for the purposes of the study to investigate students' perceptions of AI use in medicine. The scale consists of 13 items, where participants assess their level of agreement on a five-point Likert scale (1 = strongly disagree, 5 = strongly agree). Over 10 items assessed students' perception of possible benefits of artificial intelligence in medicine (e.g., 'Artificial intelligence could reduce healthcare costs'), while four items relate to the concerns of future doctors in terms of using new digital technologies (e.g., 'I am concerned that healthcare workers might lose their jobs in the future'). All questionnaire items demonstrate good reliability ($\alpha = 0.711$ to $\alpha = 0.888$).

General questions pertain to socio-demographic variables: Gender (male/female), Year of study (Y1 / Y2 /Y3 /Y4 /Y5 /Y6 /graduate), University they attend (University of Belgrade / University of Novi Sad / University of Niš / University of Kragujevac / University of Pristina, temporary settled in Kosovska Mitrovica). The use of artificial intelligence by medical students was examined through the frequency of current use of artificial intelligence (very often (daily) / often (several times a week) / rarely (several times a month) / very rarely (several times a year) / do not use artificial intelligence), the dominant purpose (education / improvement of business activities / entertainment / other), and information sources about artificial intelligence (social media / internet search / family and friends / faculty / other).

Categorical data were presented using frequencies and percentages, while mean and standard deviation were used for the description of numerical data. Reliability was tested using the Cronbach's alpha coeffi-

cient. Statistical analysis was conducted using IBM SPSS Statistics for Windows, Version 25.0 (IBM Corp., Armonk, NY, USA).

Results

The study included 160 medical students in Serbia, 81.9% of which were female. Moreover, 28.7% of the participants were in their Year 1 of study, 13.1% in Year 2 year, 11.2% in Year 3, 12.5% in Year 4, 16.3% in Year 5, 11.3% in Year 6, and 6.9% were graduate students of medical faculties. The sample encompassed students from five universities: University of Belgrade (50.6%), University of Novi Sad (16.3%), University of Niš (13.1%), University of Kragujevac (9.4%), and University of Priština (10.6%). General participant information is presented in **Table 1**.

A total of 81.9% of medical students use artificial intelligence, with 7.5% using it daily. This technology is used several times a week by 34.4% of participants; 26.3% use it several times a month, while 13.7% of students use artificial intelligence several times a year. Almost half of the students (42.5%) gather information about this technology through social media. Predominantly, students use artificial intelligence for entertainment purposes (57.2%). One third of the participants (28.2%) primarily use artificial intelligence for educational purposes, as shown in **Table 2**.

Students' perception of the importance of using artificial intelligence in medicine was assessed through 14 items describing beliefs and concerns regarding the use of this technology in medicine. Students believe that artificial intelligence can signifi-

Table 1. Respondents' general information
Tabela 1. Opšti podaci o ispitanicima

	N/*Br.* (%)
Gender/*Pol*	
Male/*Muški*	29 (18.1%)
Female/*Ženski*	131 (81.9%)
Year of study/*Godina na studijama (G)*	
Y/*G*1/I	46 (28.7%)
Y/*G*2/II	21 (13.1%)
Y/*G*3/III	18 (11.2%)
Y/*G*4/IV	20 (12.5%)
Y/*G*5/V	26 (16.3%)
Y/*G*6/VI	18 (11.3%)
Graduate/*Apsolvent*	11 (6.9%)
University/*Univerzitet*	
University of Belgrade/*Univerzitet u Beogradu*	81 (50.6%)
University of Novi Sad/*Univerzitet u Novom Sadu*	26 (16.3%)
University of Nis/*Univerzitet u Nišu*	21 (13.1%)
University of Kragujevac/*Univerzitet u Kragujevcu*	15 (9.4%)
University of Pristina temporary settled in Kosovska Mitrovica *Univerzitet u Prištini sa privremenim sedištem u Kosovskoj Mitrovici*	17 (10.6%)

Table 2. Use of artificial intelligence
Tabela 2. Upotreba veštačke inteligencije

	N/*Br.* (%)
Frequency of using artificial intelligence/*Učestalost korišćenja veštačke inteligencije*	
Very often (daily)/*Veoma često (svakodnevno)*	12 (7.5%)
Often (several times a week)/*Često (nekoliko puta nedeljno)*	55 (34.4%)
Rarely (several times a month)/*Retko (nekoliko puta mesečno)*	42 (26.3%)
Very rarely (several times a year)/*Veoma retko (nekoliko puta godišnje)*	22 (13.7%)
I do not use artificial intelligence/*Ne koristim veštačku inteligenciju*	29 (18.1%)
Sources of information about artificial intelligence/*Izvori informacija o veštačkoj inteligenciji*	
Social media/*Društvene mreže*	68 (42.5%)
Internet search/*Pretraživanje interneta*	50 (31.2%)
Family and friends/*Porodica i prijatelji*	25 (15.6%)
Faculty/*Fakultet*	3 (1.9%)
Other/*Drugo*	14 (8.8%)
Artificial intelligence predominantly used for/*Dominanta upotreba veštačke inteligencije u svrhu*	
Education/*Edukacije*	37 (28.2%)
Improvement of business activities/*Unapređenja poslovnih aktivnosti*	8 (6.2%)
Entertainment/*Zabave*	75 (57.2%)
Other/*Drugo*	11 (8.4%)

Table 3. Students' perception of the importance of using artificial intelligence in medicine
Tabela 3. Percepcija studenata o značaju upotrebe veštačke inteligencije u medicini

Questionnaire items/*Stavke upitnika*	Min–Max *Min–Maks*	M/*M*	SD/*SD*	α/*α*
Artificial intelligence can significantly improve diagnostics in medicine. *Veštačka inteligencija može značajno poboljšati dijagnostiku u medicini.*	1 - 5	4.1	1.5	0.871
Artificial intelligence can effectively reduce medical errors. *Veštačka inteligencija može efikasno smanjiti medicinske greške.*	1 - 5	3.8	2.3	0.886
I am willing to rely on diagnoses made with the help of artificial intelligence./*Spreman/na sam da se oslonim na dijagnoze koje su postavljene uz pomoć veštačke inteligencije.*	1 - 5	2.3	1.2	0.855
Artificial intelligence has the potential to improve the efficiency of treatment. *Veštačka inteligencija ima potencijal da poboljša efikasnost lečenja.*	1 - 5	3.5	1.8	0.814
Artificial intelligence could reduce healthcare cost. *Veštačka inteligencija mogla bi smanjiti troškove zdravstvene nege.*	1 - 5	4.2	2.1	0.817
Artificial intelligence can efficiently support research in medicine. *Veštačka inteligencija može efikasno podržati istraživanja u medicini.*	1 - 5	4.4	2.2	0.878
Artificial intelligence could replace certain medical jobs. *Veštačka inteligencija mogla bi zameniti određene medicinske poslove.*	1 - 5	2.9	1.3	0.845
Artificial intelligence could improve the patient's experience during treatment. *Veštačka inteligencija mogla bi poboljšati pacijentovo iskustvo tokom lečenja.*	1 - 5	3.7	1.4	0.871
The use of artificial intelligence should be legally regulated. *Upotrebu veštačke inteligencije trebalo bi zakonski regulisati.*	1 - 5	4.6	2.4	0.846
It is ethically acceptable to use artificial intelligence in medical procedures. *Etički je prihvatljivo koristiti veštačku inteligenciju u medicinskim postupcima.*	1 - 5	2.8	1.1	0.711
Concerns about the potential misuse of artificial intelligence in medicine. *Zabrinut/a sam zbog moguće zloupotrebe veštačke inteligencije u medicini.*	1 - 5	4.3	2.7	0.888
Concerns that healthcare workers might lose their jobs in the future. *Zabrinut/a sam da bi u budućnosti zdravstveni radnici mogli ostati bez posla.*	1 - 5	4.1	2.2	0.856
Concerns about the protection of patients' personal data. *Zabrinut/a sam za zaštitu podataka o ličnosti pacijenata.*	1 - 5	3.8	2.4	0.755
The data used in artificial intelligence are secure enough. *Podaci korišćeni u veštačkoj inteligenciji dovoljno su sigurni.*	1 - 5	1.6	0.6	0.866

Legend: Min - Max = Minimum - Maximum, M = Mean, SD = Standard deviation, α = Cronbach's alpha coefficient.
Legenda: Min-Max = Minimalna vrednost – Maksimalna vrednost, M = Aritmetička sredina, SD = Standardna devijacija, α = Krombah alfa koeficijent

cantly improve diagnostics in medicine (4.1 (standard deviation (SD) = 1.5)) and reduce healthcare costs (4.2 (SD = 2.1)). The majority of medical students (4.4 (SD = 2.2)) highly agree with the statement 'Artificial intelligence can efficiently support research in medicine'. However, students believe that the data used in artificial intelligence are not secure enough (1.6 (SD = 0.6)), and they are not willing to rely on diagnoses made with the use of artificial intelligence (2.3 (SD = 1.2)). When it comes to concerns about the use of artificial intelligence for medical purposes, students express the greatest concern about the potential misuse of artificial intelligence (4.3 (SD = 2.7)), the possibility of healthcare workers losing their jobs (4.1 (SD = 2.2)), and the protection of patients' personal information (3.8 (SD = 2.4)). The data are presented in **Table 3**.

Discussion

The results of our study on the perception of medical students regarding the role of artificial intelligence (AI) in healthcare complement findings from extensive scientific literature. A review of relevant papers indicates that students are aware of the potential application of AI in healthcare [4]. Our research confirms this belief and points to a significant level of student involvement in the use of AI, illustrating the fact that over 80% of students actively use AI, with 7.5% on daily bases. Students in our study also believe that AI can significantly improve diagnostics, reduce healthcare costs, and support medical research. This positive perception indicates students' openness to the integration of AI into the medical field.

Although, students predominantly use AI for entertainment according to the data from our research, we can still say that there is a trend of its use for education purposes, which is in line with the results of other studies [8].

As we can see from the previous analysis, students recognize the importance of incorporating AI training into medical education, where students who have participated in AI training show a more positive attitude toward its use [3]. This indicates the need for the integration of AI educational programs into medical education to support students' positive attitudes and avoid prejudice while reducing misinformation. Interesting findings from other studies [3] highlight the positive attitudes of students toward the use of AI, particularly in medical fields such as radiology and pathology.

However, in addition to the positive perception of certain aspects of AI use in healthcare, our study also reveals some concerns among students. Participants express doubts about the reliability of data used in AI, emphasizing the fact that they are not secure enough. The students also express concern regarding the potential misuse of artificial intelligence. Some of these dilemmas have also been noted in other studies [7].

In addition, data from other studies, such as the one conducted in Canada [9], emphasize the concern of medical students about the possibility of job loss due to the introduction of AI into medical practice. Other studies indicate concern related to this topic not only among students [11] but also among healthcare professionals. This emphasizes the need for additional efforts to inform and empower students regarding the future of healthcare professions [9].

In terms of ethical dilemmas, there is a concern about the potential misuse of patient personal information [2].

The above studies can serve as a foundation for further consideration of introducing artificial intelligence into medical education, with a focus on areas that students recognize as crucial for improving healthcare practices.

Conclusion

The conclusion of our study on the perceptions of medical students about the role of artificial intelligence in healthcare complements the relevant literature and provides insights into the attitudes, optimism, but also concerns of students regarding this innovative technology.

The finding that young individuals in the area of medicine are highly aware of the potential application of artificial intelligence in the field of medicine is especially noteworthy. However, it has been revealed that they lack sufficient information about all the pros and cons of using artificial intelligence in medicine. We believe it is crucial to identify the importance of integrating AI training into medical education to fully leverage the potential of artificial intelligence to improve and advance medical practice. In addition, this approach could emphasize the importance of responsible and ethical use of artificial intelligence in medicine.

These studies provide a foundation for further consideration of integrating artificial intelligence into medical education, with a focus on areas that students recognize as crucial for improving healthcare practices. This highlights the need for ongoing research and development to strengthen positive perceptions and adequately address challenges arising from the use of artificial intelligence in medicine.

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