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FEATURES OF AI IN PRACTICAL MEDICINE: THE VIEW OF PRE-SERVICE DOCTORS

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The relevance of the use of artificial intelligence (AI) in medicine is growing due to the potential of these technologies and the ability to improve the quality of medical research, optimize clinical processes and the possibility of reducing the costs of medical care.

The aim of the article is to investigate the impact of artificial intelligence (AI) on practical medicine from the point of view of pre-service doctors, using the example of a survey conducted among students of the Bogomolets National Medical University. Quantitative methods were used to collect data, in particular, questionnaires of 52 respondents.

The results showed that 57.7% of students believe that the main role of AI in medical research is faster analysis of large volumes of data, and 25% pointed to the optimization of clinical trials. Among ethical issues, 23.1% of respondents noted responsibility for diagnostic errors as the most serious problem.

Conclusion: the results of the study indicate that students recognize the significant potential of AI in medicine, while emphasizing the need for comprehensive training of medical professionals to integrate new technologies, taking into account ethical and practical challenges.

Key words: artificial intelligence, medical education, ethical issues, healthcare technology, diagnostic automation.

Марушко Юрій, Хомич Ольга, Умрик Марія, Струтинська Оксана, Злобинець Антоніна. Особливості використання штучного інтелекту в практичній медицині: погляд студентів медиків

Актуальність використання штучного інтелекту (ШІ) в медицині зростає через потенціал цих технологій та здатність поліпшувати якість медичних досліджень, оптимізовувати клінічні процеси та можливість знизити витрати на медичне обслуговування.

Мета – дослідити вплив штучного інтелекту (ШІ) на практичну медицину з точки зору майбутніх лікарів, на прикладі опитування, проведеного серед студентів Національного медичного університету України імені О.О. Богомольця. Для збору даних застосовано кількісні методи, зокрема анкетування 52 респондентів.

Результати показали, що 57,7% студентів вважають основною роллю ШІ в медичних дослідженнях швидший аналіз великих обсягів даних, а 25% вказали на оптимізацію клінічних випробувань. Серед етичних питань 23,1% респондентів відзначили відповідальність за помилки в діагностиці як найвагомішу проблему.

Висновок: результати дослідження свідчать про те, що студенти визнають значний потенціал ШІ в медицині, водночас підкреслюючи необхідність комплексної підготовки медичних фахівців до інтеграції нових технологій, враховуючи етичні та практичні виклики.

Ключові слова: штучний інтелект, медична освіта, етичні проблеми, технології охорони здоров'я, автоматизація діагностики.

Formulation of the problem. In modern medicine, the rapid development of artificial intelligence (AI) creates new opportunities for improving diagnosis, treatment and organization of medical services [1, 2]. AI plays a key role in increasing the accuracy of disease detection, optimizing medical imaging, accelerating clinical trials and developing new drugs, as well as significantly saving time and reducing costs in the healthcare system [3, 4].

Modern machine learning algorithms make it possible to analyze huge volumes of medical data, which increases the personalization of treatment and early diagnosis of diseases [5]. For example, AI is successfully used in cardiology to detect cardiovascular diseases and arrhythmias, in gastroenterology to detect polyps, and in neurology to diagnose epilepsy. The use of AI in endocrinology for continuous monitoring of glucose levels and automatic regulation of insulin levels is particularly promising. Also, AI is changing approaches to medical imaging, providing more accurate analysis of MRI, CT, ultrasound and other images, which contributes to the timely detection of pathologies. At the same time, it helps improve the clinical trial process, allowing for faster and more efficient development of new drugs. The use of AI also contributes to the automation of administrative processes, reducing the burden on doctors and optimizing the resources of medical institutions. This, in turn, makes it possible to reduce the costs of medical services and provide patients with more affordable and high-quality care. An article by Jonathan Fowler emphasizes the importance of implementing technology to reduce healthcare costs. He emphasizes that artificial intelligence and telemedicine can significantly improve the efficiency of health services, reducing costs and improving access to treatment for patients [6].

However, along with the potential benefits, the implementation of AI in medicine raises a number of challenges, such as ensuring the privacy of patient data and ethical questions about the fairness of algorithms.

The aim of the article – explore the impact of artificial intelligence (AI) on practical medicine from the perspective of pre-service doctors.

Materials and methods. 52 students of the 3rd year of the Bogomolets National Medical University, an analysis of the age and gender structure of this group was carried out. According to the received data, 76.9% (40 students) are women, while men make up 23.1% (12 students). The age structure shows that 82.7% of students are in the age category from 18 to 25 years old, 13.5% (7 students) are from 25 to 35 years old, and 3.8% of students are over 35 years old.

A specialized questionnaire was developed to raise awareness of the use of artificial intelligence (AI). The questionnaire included 10 questions aimed at evaluating the effectiveness of using AI in medical practice. The questions were divided into 5 categories: disease detection and diagnosis, medical imaging, clinical trials and drug development, saving time and reducing costs in the field of health care.

The online questionnaire was developed with using Google Forms to collect data about the target group. We have ensured that only anonymous information is provided to participants. The questionnaire was opened in August-September 2024.

Research results. In today's world, artificial intelligence (AI) is widely used in many areas of human activity, including health care. Its integration into medicine opens up new opportunities for improving diagnostics, optimizing treatment processes, and increasing the efficiency of medical workers. Studying the attitude of pre-service doctors towards the use of AI is an important step in preparing them to work in a rapidly changing digital environment [7, 8].

Figure 1 presents directions for the use of AI in practical medicine. The main areas of use of AI in medicine are: detection of diseases and their diagnosis, medical imaging and clinical trials and drug development, saving time and reducing costs in the field of health care.

AI plays a key role in detecting diseases and improving the diagnostic process. The use of AI makes it possible to significantly speed up and increase the accuracy of diagnosis in various fields of medicine, such as cardiology, gastroenterology, neurology and endocrinology [9, 10]. In other areas of medicine, AI also shows high potential in increasing the effectiveness of treatment. Thanks to machine learning algorithms, it is possible to analyze huge volumes of medical data, which opens up new opportunities for early detection of pathologies and provides a more personalized approach to the patient. This allows not only to diagnose the disease faster

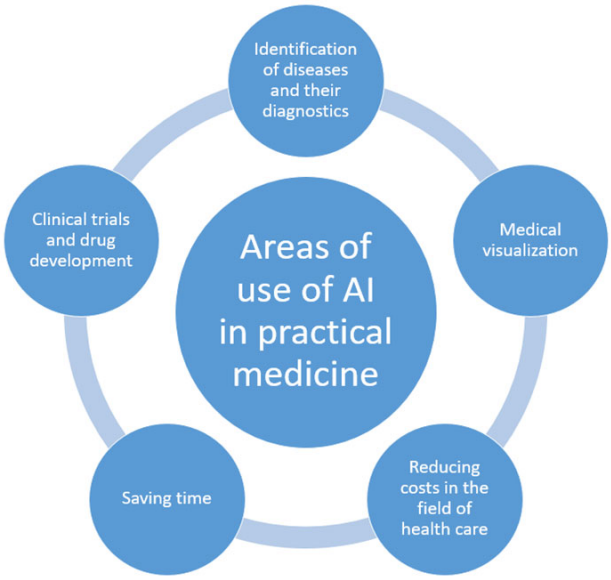

Fig. 1. The main areas of use of AI in medicine

and more accurately, but also to adapt the treatment according to the individual characteristics of each patient, which ultimately improves the results of therapy [11].

Students of medical faculties received 2 questions from the questionnaire developed by us, which relate to this topic.

Q.1: *In your opinion, what is the greatest potential of using AI in practical medicine?*

The largest percentage of respondents (36.5%) chose disease prediction as the main area of application of AI. This shows that students understand the importance of preventive medicine and the role of AI in the early detection of diseases. Thanks to the analysis of large volumes of data, AI is able to predict the risks of disease occurrence, which allows doctors to intervene in a timely manner and prevent the development of pathologies. In second place (26.9%) students singled out the analysis of medical images. AI has already demonstrated effectiveness in this field, helping doctors detect abnormalities in X-rays, MRIs and CT scans more quickly and more accurately. It is an important tool for increasing the accuracy of diagnosis and reducing the burden on medical professionals. Development of new medicines received 19.2% of votes. This indicates an interest in the use of AI in the field of pharmacology, where algorithms can accelerate the process of discovering new drugs and optimize their selection based on molecular data. Personalized medicine received the fewest votes (17.4%). Although this direction is also considered promising, its complexity and the need for a deeper individual approach are still perceived as challenges. However, students recognize that AI has great potential in creating individualized treatment plans based on patients' genetic data and medical history.

Thus, the results of the survey demonstrate the diversity of students' views on the use of AI in medicine, which indicates their interest in various directions of its development.

Q.2: *What advantages of AI do you see in medical diagnostics?*

The largest percentage of respondents (53.8%) noted the speed of data processing as the main advantage of using AI in medical diagnostics. This shows the students' awareness of how important speed is in diagnosis, especially in critical cases. Thanks to its ability to process large amounts of data in a minimal amount of time, AI allows doctors to receive results of tests and images faster, which shortens the waiting time of patients for a diagnosis and makes it possible to start treatment earlier. In the conditions of modern medicine, where every minute can be decisive, this advantage is extremely important. In second place (34.6%), students singled out a decrease in the burden on the doctor. The use of AI allows the automation of many routine processes, such as the interpretation of laboratory test results or the analysis of medical images, reducing the amount of time that doctors spend on these tasks. This frees up more time for doctors to focus on making important clinical decisions and working with patients. The high accuracy of the results received 11.6% of the votes, which shows that students recognize the accuracy that AI can provide in diagnostics. AI algorithms are able to analyze data with a minimal probability of error, which is especially important in cases of complex diagnoses or rare diseases, where

human error can have significant consequences. AI avoids subjective factors such as fatigue or lack of experience, making diagnosis more accurate and reliable. Thus, the students' answers emphasize the key advantages of AI in medical diagnostics: high speed of data processing, the ability to reduce the burden on doctors and increase the accuracy of diagnostic results, which in general contributes to the improvement of the quality of medical care.

In the field of medical imaging, AI significantly increases the *efficiency of medical image processing* thanks to its powerful algorithms [2, 3]. AI is able to analyze medical images with exceptional speed and accuracy, detecting abnormalities that may go unnoticed by the human eye. This allows for more accurate and timely diagnosis of various diseases.

AI algorithms are actively used to detect early signs of cancer, pneumonia and other diseases. AI can analyze medical images, including MRIs, ultrasounds, cardiograms, computed tomography (CT) scans, and other diagnostic techniques. The use of AI in medical imaging allows doctors to obtain more detailed information about the patient's condition and improves the quality of medical services. Students of medical faculties were asked two questions related to this topic.

Q.1: *What risks and problems may arise when implementing AI in medical practice?*

The majority of respondents (61.5%) identified the incorrect interpretation of results as the primary risk associated with the implementation of AI in medical practice. This underscores students' concerns that even the most advanced algorithms can make mistakes or analyze data incorrectly, leading to incorrect diagnoses or incorrect treatment. The human factor remains important, as doctors must monitor and verify the results obtained by AI to avoid critical errors in clinical practice. In second place (19.2%), students singled out data privacy violations as a significant problem. The use of AI requires the processing of large volumes of personal medical data, which may increase the risk of its leakage or unauthorized access. This is especially true in the age of digital technologies, where protecting patient privacy is an important ethical and legal concern. Therefore, it is necessary to ensure the appropriate level of cyber security and compliance with privacy standards. Dependence on technology received 13.5% of votes. Students see a risk that over-reliance on AI could reduce doctors' decision-making and clinical data interpretation skills. Automation of processes can lead to a decrease in the amount of time that doctors spend on their own analysis of information, which can negatively affect the development of their professional competencies in the long term. Implementation and maintenance costs received 5.8% of the vote. This testifies to students' awareness of the economic side of the issue. The implementation of new technologies, such as AI, requires significant financial resources for their purchase, integration into medical institutions, as well as ongoing maintenance. High costs can be a barrier to the widespread use of AI in healthcare systems, especially in countries with limited resources. Thus, the results of the survey demonstrate that students understand the various risks associated with the implementation of AI in medical practice. They consider the possibility of errors in the interpretation of data, the threat of privacy, dependence on technologies and high costs for their implementation to be the main problems.

Q.2: *What skills should healthcare professionals have to effectively use AI in their practice?*

The largest share of respondents (65.4%) indicated that medical professionals should have knowledge of the principles of AI for its effective use in practice. This highlights the importance of understanding the basic principles of how artificial intelligence systems work, such as data analysis, processing algorithms, and decision making. Physicians need to understand how AI analyzes information to correctly interpret results, ensuring accuracy and efficiency of medical care. In second place (19.2%), students singled out understanding of machine learning algorithms as an important skill for healthcare professionals. This indicates the need to know the basic algorithms used for medical data processing, forecasting and analysis. Such knowledge helps doctors to better understand how diagnostic or prognostic models are formed and to be more critical when evaluating the results of AI work. Basics of programming received 9.6% of votes. Students believe that knowledge of programming is useful, but not mandatory. Understanding basic programming languages or coding basics can empower doctors to work with data and customize AI systems for specific medical tasks. It also allows for better communication with IT professionals and medical technology developers. The least number of votes (5.8%) received the opinion that there are no specific skills, which indicates that a small number of students consider the use of AI to be intuitive and not require deep technical knowledge. This may be due to the fact that modern AI systems are being created to simplify the work of medical professionals, with minimal need to interfere with their inner workings. Thus, the survey results indicate that students recognize the importance of technical knowledge and skills for the effective integration of AI into medical practice. The main focus is on understanding the principles of AI and machine

learning, which will allow doctors to more effectively use these technologies to improve the diagnosis and treatment of patients.

AI is significantly *changing approaches to clinical trials and the development of new drugs*. With the help of modern AI algorithms, it is possible to create new chemical compounds and select optimal medical drugs for the treatment of various diseases. AI makes it possible to analyze huge amounts of data about molecules, their structure and effects, which contributes to the faster and more accurate discovery of new medicines. In addition, AI has an important role in improving clinical trials [5]. However, in the US, new methods and drugs developed using AI are subject to review and approval by the FDA (US Food and Drug Administration). This agency conducts detailed evaluations of new medicines and technologies to ensure their safety, efficacy and quality before they are on the market and become available to patients.

Q.1: *What is the role of AI in medical research and development of new medicines?*

Most respondents (57.7%) pointed out that the main advantage of AI in the field of medical research and pharmaceutical development is its capacity to accelerate the analysis of extensive data sets. This highlights the ability of AI to process large amounts of scientific and clinical information in a short period of time, which significantly accelerates the process of studying medical indicators, interactions between drugs, as well as genetic and molecular data. Thanks to this, medical researchers can reach significant conclusions faster, which significantly reduces the time it takes to develop new drugs. In second place (25%), students singled out the optimization of clinical trials as an important role of AI in medical research. AI can help manage and analyze clinical trial data, including selecting appropriate candidates for testing new drugs, monitoring participant safety, and analyzing results in real time. This increases the efficiency of clinical trials, reduces costs and reduces the risk of failure. 9.6% of respondents believe that artificial intelligence does not play a significant role, which may indicate the existence of certain doubts about its impact on modern medical research. Perhaps some students believe that artificial intelligence technologies have not yet reached such a level of development as to significantly change the research methodology in pharmaceuticals or that traditional methods remain basic. The smallest percentage (7.7%) of respondents indicated that AI helps identify potential targets for therapy. This points to the importance of AI in molecular biology and pharmacology, where algorithms are able to identify new molecular targets for future drugs that may be more effective in treating certain diseases. Thus, students recognized the important role of AI in accelerating research and development of new medicines, especially in the context of data analysis and optimization of clinical trials, which opens new perspectives for the development of medicine and pharmacy.

Q.2: *What are the ethical issues associated with the use of AI in medicine?*

Responsibility for errors in diagnosis (23.1%) was one of the most important ethical problems highlighted by students. The use of AI for diagnostic purposes raises the question of who will be responsible for misdiagnoses or wrong treatment – the doctor who trusted the system or the developers of the AI? This aspect is critically important, as errors in diagnosis can have serious consequences for the health of patients, and the separation of responsibility between man and technology is a complex issue. In second place (11.5%), students noted the need to inform patients about the use of AI. This highlights the importance of ensuring that patients have the right to know that their medical information and diagnoses are being processed using artificial intelligence. Transparency in the interaction between health professionals and patients is an important ethical aspect, as patients should have the opportunity to choose and fully understand the methods used for their treatment. Patients' rights to privacy received 9.6% of votes, which emphasizes the importance of protecting personal data in the process of using AI in medicine. Patients need to be confident that their medical data will be kept secure, without risk of leakage or unauthorized access. This ethical issue is especially important in the age of digital technologies, where maintaining privacy becomes a more difficult task. The largest percentage of respondents (55.8%) chose the answer all the answers indicated, which indicates that students understand the multidimensionality of ethical challenges associated with the use of AI. This highlights that issues of accountability, patient information and protecting their privacy are all equally important and interrelated aspects of implementing new technologies into medical practice.

AI can significantly *save time* in medical practice by organizing patient visits to doctors according to their requests. AI-based systems can automatically schedule appointments, redirect patients between different specialists, and manage queues [8]. This allows doctors to focus on clinical practice instead of spending time on administrative tasks.

Q.1: *How do you think AI can help manage chronic diseases?*

The majority of respondents (51.9%) believe that real-time symptom monitoring is the main contribution of AI to chronic disease management. This allows doctors and patients to constantly monitor important indicators, such as blood pressure, blood sugar level or heart rate, which helps to detect changes in the state of health in time. This approach promotes early intervention and reduces the risk of complications. In second place (30.8%) students highlighted the prediction of possible complications. Thanks to the analysis of big data and machine learning models, AI is able to predict potential exacerbations or complications of chronic diseases, which allows doctors to adjust treatment in advance or recommend preventive measures. Recommendations for lifestyle changes received 15.4% of votes. AI can analyze patients' behavioral and medical data to provide personalized advice on lifestyle improvements, such as adjustments to diet, physical activity or sleep patterns, which are an important aspect of chronic disease management. Only 1.9% of respondents believe that AI does not significantly help in the management of chronic diseases, which indicates a high level of confidence among students in the usefulness of these technologies to improve the treatment of chronic patients.

Q.2: *How can AI change the decision-making process in medicine?*

The largest percentage (44.2%) of respondents believe that AI can provide more data to discuss with the patient, underscoring the importance of access to complete and accurate information. AI can process a large number of medical indicators, offering doctors more evidence-based information for discussions with patients, which increases patient awareness and makes the decision-making process more collective. In second place (28.8%), respondents noted that AI can help reduce the role of a doctor's intuition. The use of objective algorithms and models can partially replace an intuitive approach in diagnosis or treatment, which can be both an advantage and a challenge for the medical profession, since a doctor's intuition is often based on experience. Adding objectivity to the analysis of results received 25.1% of votes. Students emphasize the importance that AI can increase the accuracy and scientific validity of diagnostic findings by reducing the influence of subjective factors or human error. Only 1.9% of respondents believe that AI will not change the decision-making process in any way, which indicates a general recognition by students of the significant role of these technologies in the future of medical decisions.

The latest technologies are being used to *reduce costs* in the field of health care, including reducing the cost of care and implementing individual virtual medical care [1, 2]. AI helps reduce costs by automating many administrative processes, such as patient record processing and queue management. The integration of telemedicine allows for more efficient use of hospital and polyclinic resources.

Q.1: *How do you assess the readiness of medical institutions to implement AI technology?*

Half of the respondents (50%) consider that medical institutions are not well-prepared to adopt AI technology. This shows that many medical institutions are not yet ready to integrate modern technologies due to lack of necessary resources, insufficient technical training or insufficient infrastructure. Moderate readiness was indicated by 19.2% of respondents. This shows that part of the medical institutions have a certain level of preparation for the implementation of AI, but still need additional resources or infrastructure improvements to ensure the effective use of new technologies. There is not enough information – this opinion was expressed by 17.3% of respondents. This may indicate that some students or medical workers do not have complete information about the state of readiness of medical institutions for the implementation of AI, which complicates an objective assessment of the situation. High readiness was noted only by 13.5% of respondents. This shows that a minority of healthcare facilities are currently fully ready to implement AI, having the necessary resources and infrastructure to integrate new technologies into their practice.

Q.2: *What prospects for the development of AI in medicine do you see in the next 5 years?*

Expanding opportunities for personalized treatment received the highest percentage (32.7%) of votes. This indicates an expectation that AI will be actively used to create individualized treatment plans based on specific patient data, such as genetic information and medical history. A significant improvement in the accuracy of diagnostic systems was noted by 25% of respondents. This indicates the expectation that AI will improve the accuracy and reliability of diagnostic tools, reducing the likelihood of errors and providing better outcomes for patients. Increasing the availability of technology for small medical facilities received 26.9% of votes. This points to the hope that in the coming years, AI technologies will become more accessible to smaller healthcare facilities, allowing them to also take advantage of these innovations without the need for large investments. 15.4% of respondents expressed the opinion that there are no significant changes, which may indicate their uncertainty regarding the impact of artificial intelligence on the development

of medicine and indicate skepticism regarding the rapid implementation of changes in medical practice, which may be due to various factors, such as the slow development of technologies or barriers to their integration. Thus, the results of the survey demonstrate that students see different prospects for the development of AI in medicine, with an emphasis on personalized treatment, improving the accuracy of diagnosis and increasing the availability of technology, although some also believe that significant changes may not happen in the near future.

In an article by Jonathan Fowler, an expert in the field of health care, entitled "Technologies to reduce costs in the health care system: The role of innovation in improving access", it examines the key aspects of implementing modern technologies to optimize costs in the health care system. sphere The author emphasizes how the latest technologies, including artificial intelligence and telemedicine, can significantly reduce the costs of medical care and increase the availability of medical services [6].

As noted by Jonathan Fowler, an expert in the field of health care, "the implementation of technologies that reduce costs and improve the availability of medical care is critical to the sustainable development of the health care system" [6]. Fowler provides a detailed analysis of the ways in which automation and virtual consultations can ease administrative burdens, reduce the need for in-person doctor visits, and reduce patient transportation costs. It also emphasizes the importance of integrating these technologies into traditional medical practice to achieve savings and improve quality of care. The article discusses specific examples of successful technology implementations in various medical institutions that demonstrate their potential to reduce costs and improve treatment outcomes [6].

The use of AI in the medical field is accompanied by a number of challenges and limitations. The most significant of these include issues of access to data and protection of confidential patient information. Other important aspects are the possibility of bias in the data that can affect the results of the analyses, the risk of false diagnoses, and technical failures in the operation of the AI. Artificial intelligence raises serious questions about the right to privacy. This gives rise to the need to create new regulations that will regulate the protection of personal data and guarantee their security. In addition, possible ethical issues must be considered, such as ensuring transparency in AI algorithms and avoiding discrimination based on processed data. Thus, it is important to ensure that the introduction of AI in medicine is accompanied by clear mechanisms of control and protection of patients' rights.

Conclusions. Our study indicates that while students recognize the significant benefits of AI in medicine, they also identify critical challenges and ethical considera-tions. The insights from our survey, combined with existing literature, suggest a balanced approach to integrating AI into medical practice and education. This approach should focus on maximizing the benefits of AI while addressing its ethical and practical challenges to prepare pre-service healthcare professionals for the evolving medical landscape.

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