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UDC 614.2+378+37.091.3:004.8**THE STUDY OF ETHICAL, LEGAL, AND REGULATORY ASPECTS OF THE USE OF ARTIFICIAL INTELLIGENCE IN MEDICINE AMONG STUDENTS OF IVANO-FRANKIVSK NATIONAL MEDICAL UNIVERSITY**

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Abstract. Artificial intelligence (AI) has had a significant impact on all areas of our lives, and its integration into various fields of science and medicine in particular is only increasing every day, contributing to the improvement of diagnostics and clinical decision-making, but also into its educational component. However, along with its numerous advantages, AI brings with it many challenges related to accuracy, ethics, and data security. To study the attitude of students at Ivano-Frankivsk National Medical University to the ethical, legal, and regulatory aspects of AI use in medicine, the results of a survey of sixth-year students studying “Medicine” were analyzed. It was found that all respondents had experience using AI-based programs and used them constantly or periodically and the average time of use was 1-5 hours per week. Respondents from both faculties used these programs for learning, most often to find explanation or search for additional materials. Students from both faculties assessed the impact of AI on the healthcare system as neutral or positive: it will make medicine more accessible and will not affect the cost of medical services or will reduce it. At the same time, a third of foreign students believed that the cost of services would increase. This contrast in views can be explained by differences in experience and varied perceptions of the healthcare system: Ukrainian students apparently perceive AI as an optimization tool that does not require additional costs for the patient, while foreign students may associate technological innovations with commercialization and a potential increase in the cost of services.

Ukrainian students did not expect the use of AI to affect the relationship between doctors and patients. Instead, almost half of foreign students believed that the use of AI technologies would improve such relationships, while another third was convinced that it would worsen them. The respondents agreed that the accuracy of diagnoses made with the help of AI cannot be fully trusted, and that the final decision should always remain with the doctor. The vast majority of students from both faculties agreed that patients have the right to refuse the use of AI-based diagnostic or treatment methods. Respondents are not ready to entrust their medical data to artificial intelligence. An even greater number believe that AI should not disclose such information to either insurance or pharmaceutical companies. The main danger that students saw was the vulnerability of AI-based software to potential cyber threats. Significantly fewer respondents believed that such software could be secured, slightly more often among local students than among students of the foreign citizens training faculty. Respondents were more likely to see the use of AI as a source of new risks than as a tool for reducing medical errors. Students were unanimous in their opinion that the use of AI in medicine should be strictly regulated, and that the treatment methods developed by it should be subject to rigorous testing. We believe that changes are needed in approaches to curriculum development that include the use of AI and highlight the direct and indirect impact of these tools on the medical context. Further studies are needed to explore effective methods of combining digital technologies with the development of communication skills and emotional intelligence in future healthcare professionals.

Keywords: public health, artificial Intelligence, educational process, medical students.

Introduction. The appearance of artificial intelligence (AI) has had a significant impact on all areas of our lives, and its integration into various fields of science and medicine in particular is only increasing every day [1-4]. The use of AI-based software in healthcare has driven a whole range of changes, from diagnosis and clinical decision-making to disease outcome prediction. At the same time, the application of such technologies reduces the burden on the healthcare system by reducing costs and staff workload [5]. The deep integration of AI not only into medicine but also into its educational component has enormous potential: improving and optimizing teaching methods, personalized learning experiences, improving learning outcomes, the ability to focus more on understanding complex medical concepts, and, as a result, improving the quality of healthcare delivery in the future [6, 7]. However, despite the numerous advantages that AI brings to the

healthcare system, there are also a number of potential vulnerabilities and weaknesses. Most often, these relate to the accuracy of AI diagnostic capabilities, input data security, confidentiality and ethical issues, over-reliance on technology, and potential dehumanization [8-10].

With the growing implementation of AI in medicine, it is important to study the perceptions of these advantages and disadvantages by medical students, their concerns and expectations. This understanding will make it possible to identify gaps in knowledge and improve educational measures tailored to the needs of students [11].

The aim of the study. To study attitudes toward ethical, legal, and regulatory aspects of the use of artificial intelligence in medicine among students at Ivano-Frankivsk National Medical University.

Materials and methods. Data collection was carried out at the Department of Public Health of Ivano-

Frankivsk National Medical University in February 2025. The study was conducted among sixth-year students of the Medicine program who agreed to participate after signing an informed agreement form. The author's questionnaire, developed using Google Forms, included the following sections: demographic characteristics of respondents; experience with AI; assessment of the impact of AI on the accessibility and quality of medical services; views on the ethical and security aspects of AI use; advantages and disadvantages of AI in medicine.

A total of 91 respondents participated in the survey: 45 students from the Faculty of Medicine and 46 students from the Foreign Citizens Training Faculty. Among the Ukrainian students surveyed, two-thirds (68.2 %) were female, while among foreign students, there were almost equal numbers of female and male respondents (53.3 % and 46.7 %, respectively). This distribution was in accordance with the gender distribution at the faculty. The average age of the Ukrainian students surveyed was 22.9±0.17 years, and that of the foreign students was 24.3±0.36 years.

Statistical processing of the obtained material was carried out by calculating the frequency of distribution of factors per 100 respondents and the standard error (±m) for relative values, and the assessment of the reliability of the difference in data in the comparison groups and verification of the null hypothesis was carried out by calculating Pearson's chi-square (χ^2) criterion.

Research results and their discussion. It was found that 100.0 % of respondents from both faculties had experience using artificial intelligence-based programs (Chat GPT from Open AI, Bard from Google, Bing Chat from Microsoft), and the average time of use was 1-5 hours per week. Respondents from both faculties used these programs for learning on a regular or periodic basis (100.0 % of the medical faculty and 95.6 % of the FCTF). These results may indicate that students already consider AI to be one of the key participants in the educational process [12-14].

The main advantages of using such programs for learning, according to students, were that AI provides explanations (72.7 % among Ukrainians and 77.8 % among foreigners) or offers additional materials (27.3 % among Ukrainians and 15.6 % among foreigners). The responses

obtained are consistent with the findings of other researchers. Users noted that AI provided easily accessible information on requested topics, explained complex concepts in simpler ways, adapted learning materials to individual student needs, and improved distance learning [1, 6, 15, 16]. At the same time, AI is prone to misinformation: it does not answer the question directly asked, the information is often inaccurate and unverified, it fabricates very plausible evidence with references to non-existent sources, and the answers lack detail [17-19]. Therefore, it is important to verify and confirm information obtained with the help of AI-based programs. Moreover, such applications should not be overused due to the potential risk of addiction and a decline in critical thinking skills [8, 16, 20].

In their subjective assessment of the impact of AI on the healthcare system, residents and students of the foreign citizens training faculty had similar views ($p>0.05$) and described it as neutral (50.0 % and 46.7 %, respectively) or positive (47.7 % and 46.7 %, respectively). At the same time, the results of similar studies [6, 10, 13, 14] revealed a much more optimistic assessment of the impact of AI on healthcare: in their opinion, this approach will improve the quality of medical services, optimize the work of doctors, and be cost-effective. The vast majority of respondents (73.3 % of local students and 84.4 % of foreign students) agreed with the statement that AI will make medicine more accessible. Regarding the impact on the cost of services, the opinions of the respondents were not unanimous: the absolute majority of Ukrainian students believed that the use of AI-based programs would not affect the cost of medical services (52.3 %) or would reduce it (40.9 %), while the opinions of foreign students differed significantly (Fig. 1), with a third of them (33.3 % vs. 6.8 %, $p=0.009$) believing that the cost of services will increase. This contrast in views can be explained by differences in experience and varied perceptions of the healthcare system: Ukrainian students apparently perceive AI as an optimization tool that does not require additional costs for the patient, while foreign students may associate technological innovations with commercialization and a potential increase in the cost of services.

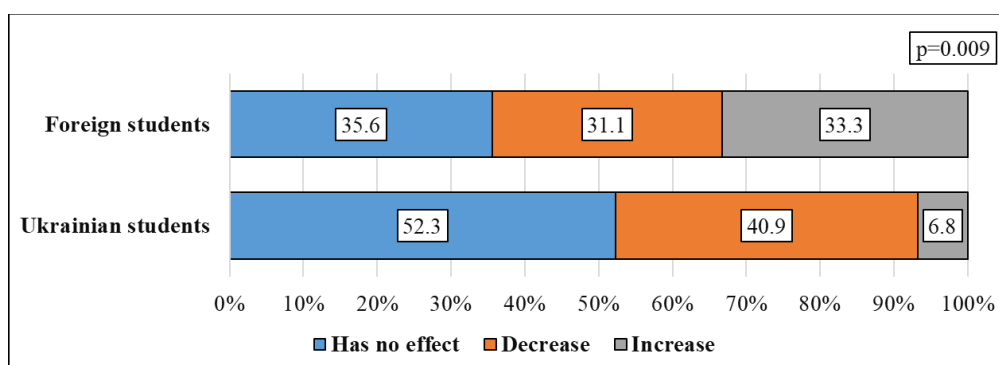


Fig. 1. Respondents' assessment of the impact of AI-based programs on the cost of medical services

Opinions were polarized among respondents regarding the impact of AI on doctor-patient relationships ($p=0.012$). Thus, every second local student (52.3 % compared to 22.2 % of foreign students) was convinced that the use of such software would not affect interpersonal communication at the "doctor-patient" level (Fig. 2). On the other hand, more than 40 % of students from the

foreign citizens training faculty (42.2 % compared to 22.7 % of Ukrainians) believed that the use of such technologies would improve the relationship between doctors and patients, and almost the same proportion (35.6 % compared to 25.0 %, respectively) were convinced that it would worsen it.

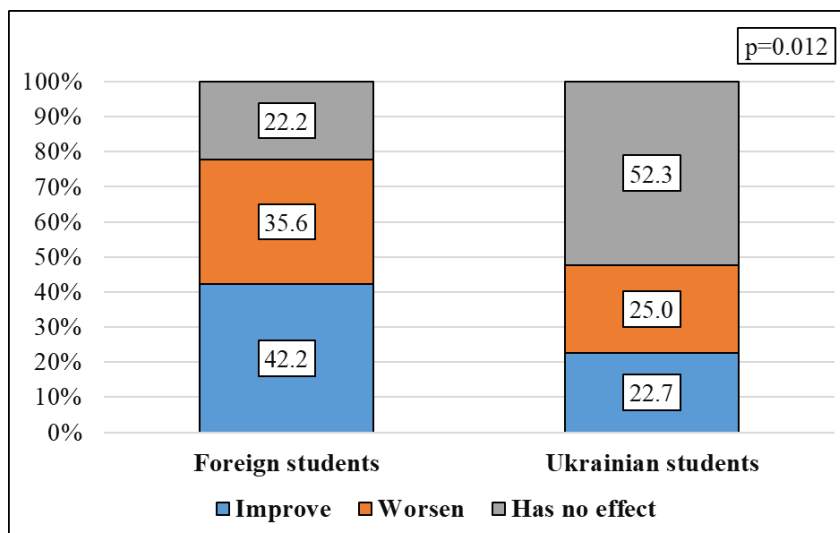


Fig. 2. Respondents' assessment of the impact of AI-based programs on doctor-patient relationships

The results obtained in other studies were more similar to the responses of foreign students, as their respondents also more often believed that the use of AI programs would reduce the humanistic approach, negatively affect relationships, and could undermine patient trust in doctors [10, 14, 21].

An important aspect of the application of AI technologies in healthcare is their ethical component. Most respondents (81.8 % of Ukrainian and 82.2 % of foreign) are convinced that the accuracy of diagnoses made with the help of artificial intelligence cannot be fully trusted, and that the final decision on diagnosis and treatment should always remain with the doctor (100.0 % of respondents from both faculties). The vast majority of respondents from both faculties (93.2 % of Ukrainian and 95.6 % of foreign) agreed that patients have the right to refuse the use of AI-based diagnostic or treatment methods. This is consistent with the opinion of other scientists that AI and doctors should cooperate as partners, not competitors, in medical practice [22]. Also interesting is the opinion of Paranjape K. et al. (2019) that doctors should focus on providing the humanistic component of care, considering the biopsychosocial approach, and entrust the technical details to AI [23].

There are also many doubts about the security of patient data confidentiality and potential leaks. Among respondents from both faculties, answers to this question were almost evenly divided: 56.5 % of foreign students and 50.0 % of local students considered such risks to be more than likely. Two-thirds of respondents (68.2 % of Ukrainians and 77.8 % of foreigners) would not trust their medical data to artificial intelligence, and even more (84.8 % and 73.3 %, respectively) are convinced that AI should not share such information with either insurance or pharmaceutical companies. The main danger that students saw was the vulnerability of AI-based software to potential cyber threats (65.9 % of local and 84.4 % of foreign applicants). Significantly fewer respondents believed that such software could be secured, slightly more often among local students (58.7 %) than among students of the foreign citizens training faculty (44.4 %). Such concerns were quite common in the results obtained by other researchers [1, 8, 10, 24]. To maintain data confidentiality, they suggest using a third party to store information, like double-blind

studies, and ensuring that AI does not collect additional data that is not necessary for performing its immediate tasks [1].

Obviously, the application of AI in healthcare has ushered in a new era of technology and medical innovation. At the same time, more than half of local respondents (60.9 % vs. 40.0 % of foreign respondents, $p>0.05$) see this as a ground for new risks rather than a tool for reducing medical errors. The results of similar studies are also not unanimous: on the one hand, according to scientists, AI technologies can increase the accuracy of diagnosis, which will help reduce the number of medical errors [25], on the other hand, there is a possibility of the opposite effect, since AI algorithms may include unreliable factors [14, 26]. In other words, the use of AI-based software requires a responsible and ethical approach [27]. In our study, applicants from both faculties (81.8 % of local and 73.3% of foreign) also agreed that, in any case, the use of AI in healthcare should be strictly regulated, and treatment methods developed with the help of such technologies should be subject to even stricter testing than those developed by humans (75.0 % of Ukrainian and 80.0 % of foreign students).

Conclusions. The results demonstrate that students have an optimistic but cautious view of the application of AI in medicine. Students' attitudes toward the introduction of AI in medicine are predominantly neutral or positive, with expectations of improved access to medical services without changing their cost. At the same time, there is a difference in the perception of the impact of AI on the patient-doctor relationship: foreign students expect improvements, while Ukrainian students do not predict any impact of AI on these aspects of interaction. Most respondents are not inclined to fully trust AI diagnostic decisions, emphasizing the key role of the doctor. A significant proportion of participants expressed concern about the security and confidentiality of medical data, opposing its transfer to third parties. Ukrainian students are more likely to see AI as a source of potential risks, while foreign students see it as a tool for reducing errors. Both groups agree on the need for strict regulation and increased control over the use of AI in healthcare.

Prospects for further research. Future research should focus on identifying optimal approaches for

integrating artificial intelligence into medical education curricula, with consideration for professional ethics and patient-centered care. Further studies are needed to explore effective methods of combining digital technologies with the development of communication skills and emotional intelligence in future healthcare professionals.

Conflict of interest: absent.

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ДОСЛІДЖЕННЯ ЕТИЧНИХ, ЮРИДИЧНИХ ТА РЕГУЛЯТОРНИХ АСПЕКТІВ ВИКОРИСТАННЯ ШТУЧНОГО ІНТЕЛЕКТУ В МЕДИЦИНІ СЕРЕД ЗДОБУВАЧІВ ОСВІТИ ІВАНО-ФРАНКІВСЬКОГО НАЦІОНАЛЬНОГО МЕДИЧНОГО УНІВЕРСИТЕТУ

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Резюме. Штучний інтелект (ШІ) стрімко інтегрується не лише в медицину, сприяючи вдосконаленню діагностики та прийняттю клінічних рішень, а й в її освітній компонент. Проте разом із численними перевагами ШІ привносить з собою чимало

викликів, пов'язаних із точністю, етикою та безпекою даних. З метою вивчення ставлення здобувачів Івано-Франківського національного медичного університету до етичних, юридичних та регуляторних аспектів використання ШІ в медицині було проаналізовано результати опитування студентів ОПП «Медицина», які навчаються на шостому курсі. Встановлено, що всі респонденти мали досвід використання програм на основі ШІ та постійно чи періодично використовували його для навчання, найчастіше – для пояснення або пошуку додаткових матеріалів. Вплив ШІ на систему охорони здоров'я загалом студенти медичного факультету та факультету підготовки іноземних громадян оцінили як нейтральний чи позитивний, зокрема зробить медицину доступнішою та не впливатиме на вартість медичних послуг або ж зменшить її. Водночас третина іноземних студентів вважали, що вартість послуг зростає. Вітчизняні студенти не очікували впливу використання ШІ на взаємовідносини між лікарями і пацієнтами. Натомість майже половина іноземних студентів вважали, що застосування технологій ШІ покращить такі стосунки, ще третина були переконані, що погіршить. Опитані погодились, що не можна повністю довіряти точності діагнозів, які поставлені з допомогою ШІ, а кінцеве рішення завжди має залишатися за лікарем. Респонденти не готові довіряти свої медичні дані штучному інтелекту, насамперед через вразливість програмного забезпечення на основі ШІ до кіберзагроз. Респонденти частіше вбачали у застосуванні ШІ поле для виникнення нових ризиків, аніж інструмент для зменшення числа медичних помилок. Одношайними студенти були у відповіді щодо застосування ШІ у медицині, який має перебувати під строгим контролем, а розроблені ним методи лікування мають піддаватися суворому тестуванню. Вважаємо, що необхідні зміни у підходах до розробки навчальних програм, які включатимуть використання ШІ та висвітлюватимуть прямий і непрямий вплив цих інструментів на медичний контекст.

Ключові слова: громадське здоров'я, штучний інтелект, освітній процес, студенти-медики.

Конфлікт інтересів: відсутній.

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