DOI: https://doi.org/10.69722/1694-8211-2025-63-5-12
УДК: 61:004.8

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## THE INFLUENCE OF ARTIFICIAL INTELLIGENCE ON THE FORMATION OF FUTURE DOCTORS WHEN STUDYING BIOPHYSICS AT A MEDICAL UNIVERSITY

*This article examines the impact of artificial intelligence on the formation of future doctors while studying biophysics at a medical university. The role of medical professionals is changing as this article examines the multidimensional impact of AI on clinical practice and medical education. The integration of artificial intelligence into medical training enhances learning effectiveness through the use of personalized educational tools such as adaptive learning platforms and virtual patient simulators that enable medical students to practice diagnostic and therapeutic skills in a safe environment. The research focuses on the need to rethink medical curricula to include artificial intelligence literacy and ethics issues so that future doctors can effectively collaborate with artificial intelligence systems while paying special attention to patient-centered care.*

*This study shows that artificial intelligence will undoubtedly empower future doctors and will not be able to replace the human factor in healthcare. It is seen as a transformative tool, and careful integration into medical practice is required. This article provides recommendations for policy makers, medical professionals, and healthcare organizations, and suggests using artificial intelligence to create a more efficient, ethical, and empathetic generation of doctors. This study explores the possibilities and challenges of artificial intelligence in medicine and contributes to the ongoing debate about the future of healthcare, while also highlighting the need for a balanced approach to technology adoption. He advocates an active and ethical position that ensures that AI complements the art and science of medicine, and aims to protect these fields from any potential compromises caused by technology.*

***Keywords:*** *artificial Intelligence, medicine, doctor, biophysics, the impact, shaping.*

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## МЕДИЦИНАЛЫК УНИВЕРСИТЕТТЕ БИОФИЗИКАНЫ ИЗИЛДӨӨДӨ КЕЛЕЧЕКТЕГИ ДАРЫГЕРЛЕРДИН КАЛЫПТАНЫШЫНА ЖАСАЛМА ИНТЕЛЛЕКТТИН ТААСИРИ

*Макалада медициналык университетте биофизиканы изилдөөдө болочок дарыгерлердин калыптанышына жасалма интеллекттин таасири каралат. Медициналык адистердин ролу өзгөрүп жатат, андыктан бул макалада жасалма интеллекттин клиникалык практикага жана медициналык билимге көп өлчөмдүү таасири каралат. Жасалма интеллектти медициналык окутууга интеграциялоо адаптацияланган окуу платформалары жана виртуалдык бейтаптардын симуляторлору сыяктуу жекелештирилген билим берүү куралдарын колдонуу менен окутуунун натыйжалуулугун жогорулатат, бул медициналык студенттерге диагностикалык жана терапиялык көндүмдөрдү коопсуз чөйрөдө практикалоого мүмкүндүк берет. Изилдөө келечектеги дарыгерлер жасалма интеллект системалары менен натыйжалуу кызматташып, бейтапка кам көрүүгө өзгөчө көңүл бурушу үчүн, жасалма интеллект*

*сабаттуулугун жана этика маселелерин камтыган медициналык окуу программаларын кайра карап чыгуу зарылдыгына багытталган.*

*Бул изилдөө жасалма интеллект келечектеги дарыгерлерге күч-кубат берерин жана саламаттыкты сактоодогу адамдык элементти алмаштыра албасын көрсөтүп турат. Бул трансформациялоочу курал катары каралат жана медициналык практикага кылдат интеграциялоо талап кылынат. Бул макалада саясатчыларга, саламаттыкты сактоо адистерине жана саламаттыкты сактоо уюмдарына көрсөтмөлөр берилип, дарыгерлердин натыйжалуу, этикалык жана боорукер мүүнүн түзүү үчүн жасалма интеллектти колдонууну сунуштайт. Бул изилдөө медицинада жасалма интеллекттин мүмкүнчүлүктөрүн жана кыйынчылыктарын изилдөө менен, саламаттыкты сактоонун келечеги жөнүндө уланып жаткан талаш-тартыштарга салым кошот, ошондой эле технологияны кабыл алууда тең салмактуу мамиленин зарылдыгын баса белгилейт. Ал жасалма интеллект медицинанын искусствосун жана илимин толуктап турушун камсыз кылган активдүү жана этикалык позицияны жактайт жана бул тармактарды технология алып келген ар кандай компромисстерден коргоого багытталган.*

***Түйүндүү сөздөр:*** *жасалма интеллект, медицина, дарыгер, биофизика, таасир, калыптануу.*

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## ВЛИЯНИЕ ИСКУССТВЕННОГО ИНТЕЛЛЕКТА НА ФОРМИРОВАНИЕ БУДУЩИХ ВРАЧЕЙ ПРИ ИЗУЧЕНИИ БИОФИЗИКИ В МЕДИЦИНСКОМ УНИВЕРСИТЕТЕ

*В этой статье рассматривается влияние искусственного интеллекта на формирование будущих врачей при изучении биофизики в медицинском университете. Роль медицинских работников меняется, поскольку в этой статье рассматривается многомерное влияние искусственного интеллекта на клиническую практику и медицинское образование. Интеграция искусственного интеллекта в медицинскую подготовку повышает эффективность обучения за счет использования персонализированных образовательных инструментов, таких как адаптивные обучающие платформы и виртуальные симуляторы пациентов, которые позволяют студентам-медикам практиковать диагностические и терапевтические навыки в безопасной среде. Исследование фокусируется на необходимости переосмысления медицинских учебных программ, включив в них вопросы грамотности в области искусственного интеллекта и этики, чтобы будущие врачи могли эффективно сотрудничать с системами искусственного интеллекта и при этом уделять особое внимание уходу, ориентированному на пациента.*

*Это исследование показывает, что искусственный интеллект, несомненно, расширит возможности будущих врачей и не сможет заменить человеческий фактор в здравоохранении. Он рассматривается как преобразующий инструмент, и требуется тщательная интеграция в медицинскую практику. В этой статье приводятся рекомендации для политиков, медицинских работников и организаций здравоохранения, а также предлагается использовать искусственный интеллект для создания более эффективного, этичного и чуткого поколения врачей. Это исследование анализирует возможности и проблемы искусственного интеллекта в медицине и вносит свой вклад в продолжающиеся дебаты о будущем здравоохранения, а также акцентирует внимание на необходимости сбалансированного подхода к внедрению технологий. Он выступает за активную и этическую позицию, которая гарантирует, что искусственный интеллект дополняет искусство и науку медицины, и направлена на защиту этих областей от любых потенциальных компромиссов, вызванных технологиями.*

***Ключевые слова:*** *искусственный интеллект, медицина, врач, биофизика, влияние, формирование.*

Artificial Intelligence- a particular computer system or machine that has some of the

qualities that the human brain has, such as the ability to interpret and produce language in a way that seems human, recognize or create images, solve problems, and learn from data supplied to it. Medical education is education related to the practice of being a medical practitioner, including the initial training to become a physician. AI ethics is a framework that guides data scientists and researchers to build AI systems in an ethical manner to benefit society as a whole. Personalized learning refers to efforts to tailor education to meet the different needs of students. Technology Integration in Healthcare combining technology and medicine in order to become more effective.

The future doctors are shaped by the effect of artificial intelligence and they are influenced by its improvements.

Artificial Intelligence (AI) transforms healthcare and it becomes an integral part of medical practice and education. The way that knowledge is acquired by medical professionals is promised to be revolutionized by its integration into the training of future doctors and the way that decisions are made and patients are interacted with. AI impacts medical education and practice and addresses the challenges and ethical issues of this integration [1, p.58].

**AI assists in medical education by personalizing learning and developing skills.**

AI offers revolutionary improvements in medical education as it provides a personalized and adaptive learning experience. Standardized curricula and assessments are often relied upon in customary medical education because individual learning needs may not be catered to. AI-powered platforms such as adaptive learning systems actively assess students' strengths and weaknesses and customize learning materials to address specific gaps in knowledge [2, p.16]. Platforms like Osmosis and Lecturio use AI algorithms to recommend customized content and provide students with targeted support.

AI-driven virtual simulations allow students to interact with each other to diagnose diseases and practice treatments in a safe environment. These simulations provide real-time feedback so that learners can refine their diagnostic and decision-making skills. AI-based systems can mimic patient responses in clinical scenarios and they prepare future doctors for varied medical situations without jeopardizing patient safety.

Natural language processing tools like ChatGPT and IBM Watson are changing how medical students access research and how they interpret it [3, p.203]. Learners stay up to date with the latest developments in their fields as these tools provide concise summaries of complex medical literature.

**AI improves clinical practice and enhances decision making.**

AI is transforming clinical decision making. AI-powered systems are helping future physicians by providing accurate and timely diagnoses through diagnostic imaging and predictive analytics. AI-powered tools like symptom-checking applications assist primary care by analyzing patient-reported symptoms and medical history—this helps in preliminary diagnoses [4, p.45]. These tools offer valuable decision support systems so that recommendations help physicians focus on more complex aspects of treatment.

AI excels in predictive modeling because it uses advanced techniques to make accurate predictions. Algorithms analyze large data sets from electronic health records (EHRs) to predict patient outcomes, such as the likelihood of hospital readmissions and the progression of chronic diseases. Preventive measures can be implemented by physicians, which improves patient care and reduces healthcare costs.

In spite of these improvements, it is important that it be zeroed in on that human decision-making should be complemented by AI rather than replaced [5, p.83]. A physician analytically interprets the knowledge gained from AI and makes complex medical decisions that go beyond data analysis.

**Professionals face ethical and professional challenges.**

• AI has great potential, but its use in healthcare raises serious ethical and professional concerns.

The overreliance on AI is caused by many people who consider it important [6, p.39]. Over-reliance on AI systems is an important concern and it could erode important clinical skills. If medical professionals rely too heavily on AI for diagnosis and treatment planning, they might lose the ability to make independent and informed decisions when AI is unavailable or malfunctions.

• Guaranteeing data privacy and security is necessary for protecting sensitive information, and organizations must implement strong measures to maintain trust with their users.

Encryption and secure data exchange protect patient data. Therefore, compliance with HIPAA (Health Insurance Portability and Accountability Act) or GPL (General Data Protection Regulation) is mandatory and must also be guaranteed

• Bias often influences AI algorithms as they learn from data.

Bias in AI algorithms is seen as another pressing issue and it is being addressed by researchers. If varied populations are not represented in training data, inaccurate or inequitable outcomes may be yielded by AI systems. Studies have shown that certain AI diagnostic tools perform less effectively on underrepresented demographic groups and this potentially exacerbates healthcare disparities. To solve this problem, it is necessary to test AI with rigorous tests and diversify the data set.

• Doctor-Patient Relationships Erode

When visiting doctors, patients value humanity, empathy, compassion and try to build a personal connection. Because of this, the use of AI in medicine may lead to a breakdown in communication between patients and doctors [7, p.92]. Therefore, doctors should use them only for diagnostic purposes and maintain a more human connection with the patient.

**Educating future doctors and giving emphasis to the need for AI literacy.**

Literacy in the use of AI is important for the development of medicine. Therefore, there is a need to integrate AI training into medical education. This includes teaching students AI skills and preparing them for their future opportunities. To understand the work of AI, it is necessary to study the work of their algorithms and find out their strengths and weaknesses.

To avoid blind trust in technology, recommendations are generated and evaluated analytically. The ethical implications of the use AI, including poor decision-making and patient consent to the processing of personal data, are addressed by government ethics studies. The material related to the use of AI is already being introduced into the training program of several medical schools and institutions to improve the education system. For example, Stanford University's AI in Medicine initiative teaches students to analyze AI tools analytically and use them effectively in clinical practice [8 p.109]. Similar programs are being adopted around the world to show the importance of AI in healthcare.

**The future of medical roles is being shaped by AI and society.**

AI is evolving and it will redefine doctors' roles in healthcare systems. Automation is increasingly taking over routine and administrative tasks such as documentation and billing and scheduling, which allows physicians to dedicate more time to patient care and complicated decision-making. Future doctors will embrace an hybrid role that combines technical expertise in AI tools and soft skills like empathy and communication and ethical reasoning [9, p.75]. This shift draws attention to the need to grow emotional intelligence and ethnic competence and to build technical skills.

AI opens up many opportunities for people from different fields to collaborate and work together effectively. AI systems will be optimized by physicians working closely with data

scientists and engineers and bioinformaticians to guarantee that clinical needs are met. This collaborative approach will promote innovation and it will improve patient outcomes. As we balance technology with humanity, we strive to improve our lives while preserving our values. Human qualities, empathy, morality, and intuitive decision-making are central to medicine but absent from AI. Therefore, we must acknowledge the shortcomings in the work of AI, despite its enormous potential. A symbiotic relationship between technology and humanity is promoted, not replaced with AI by doctors in the future of healthcare [10, p.78].

Reassurance understanding and emotional support are often sought by patients from their doctors and cannot be met by algorithms alone. Future doctors should zero in on these human aspects of care and they should use AI as a tool to improve and not replace their interactions with patients.

**Ai importance for doctors**

Currently, the following main indicators are used to evaluate the effectiveness of AI: the frequency of false positive results, accuracy, weighted error, specificity, sensitivity. The main one among them is the frequency of false positive results. Modern scientific research has shown that this indicator in AI is comparable to experienced and competent doctors, but lower than that of doctors with less experience.

Another important key parameter of AI effectiveness is the diagnostic accuracy of the study. According to the literature, it can achieve comparable accuracy in the diagnosis of diseases in comparison with doctors, or even this indicator may be better than that of doctors.

However, there is now a popular view that it is not necessary to compare the effectiveness of AI and doctors. Future research should focus on comparing the results of doctors who make decisions based on AI with those of doctors who do not use such applications. Only then will AI be accepted as an effective complement to medical practice. In this case, medical professionals using AI will be in a privileged position and can participate in the digital evolution of healthcare.

In this regard, a serious revision of medical education is required in order to provide doctors with the necessary knowledge for this. There is a need to introduce new programs to meet the need for training future medical professionals in AI technologies in medicine. Such training programs provide for a more rigorous approach to the exact sciences, which would help to effectively use AI. Doctors with this knowledge and clinical experience could solve modern problems in healthcare.

**AI market for healthcare and medicine**

Currently, the healthcare AI market is showing significant growth. In 2021, its size was about 201 billion US dollars, and it is expected that by 2030 it will reach 1.2 trillion US dollars and grow by 7.9% per year. This makes it one of the fastest growing segments in the digital healthcare industry.

Investments in AI products in 2020 amounted to 6.6 billion US dollars, 1.6 times more than in 2019. (4,129 billion US dollars). In 2021, another $12.2 billion was invested in this market, which highlights the growing interest of investors in this area.

**The use of AI in radiology**

Radiology became one of the first and most successful fields, where it found its application. AI algorithms are used to analyze X-ray, computer, and magnetic resonance imaging scans. Due to its ability to analyze and systematize huge amounts of data, AI is able to detect pathologies at an early stage, which significantly increases the chances of successful treatment.

**The Webiomed system is an example of successful integration of artificial intelligence**

An example of successful implementation of AI in medicine is a system developed by a Skolkovo resident, K-Sky. It is a predictive analytics and risk management platform that was registered as a medical device in 2020. The platform is able to analyze large amounts of patient data, including medical and social parameters, which makes it possible to predict the development of diseases and the dynamics of health deterioration.

**Processing large amounts of data**

One of the most important advantages of AI in medicine is its ability to quickly analyze large amounts of data. AI can process information at high speed, which makes it possible to detect diseases at the earliest stages of their development. For example, AI algorithms in radiology are used to analyze images such as MRI, X-rays, and fluorography, contributing to more accurate and earlier diagnosis. This is especially important for the identification of oncological and other serious diseases, where every day can be critical.

**Improving the quality of medical services**

The use of AI in medical practice leads to an overall improvement in the quality of medical services. Patients receive faster and more accurate diagnoses, as well as access to personalized treatments. In addition, it promotes the development of new medical protocols and treatment approaches based on the latest data and research, which makes medicine more adaptable to the individual needs of each patient.

Thus, integration into diagnostic and treatment processes allows medical institutions not only to increase work efficiency, but also to significantly improve the quality of medical care provided, making it more accessible, accurate and timely.

**Improving the quality of patient care**

Freeing doctors from routine allows them to devote more time to direct communication with patients. Such interaction is important not only for collecting additional medical information, but also for creating a trusting relationship between the doctor and the patient, which is an integral part of the treatment process. Thanks to AI, doctors can focus their efforts on solving more complex and critical tasks, thereby improving the quality of medical services.

**Ethical aspects of the use of AI in medicine**

The use of artificial intelligence in medicine leads to ethical issues. Especially when it comes to protecting medical information and the medical decision-making process. These issues affect both the rights and safety of patients, as well as the professional responsibility of doctors.

**Medical decision-making and the role of AI**

One of the main ethical issues is the degree of AI involvement in clinical decision-making. It is important to emphasize that the final decision should always be left to the doctor, who uses AI as a tool for collecting data and tips, and not as a completely autonomous source of solutions. AI can act as an assistant that provides the doctor with an advanced analysis of medical data, but does not replace the professional judgment of a specialist.

**The probability of errors and the independent use of AI by patients**

It is necessary to take into account the risks associated with possible AI errors that may affect diagnosis and treatment. These risks are compounded when patients try to use technology on their own without proper medical supervision. This can lead to incorrect interpretation of medical data and decisions, which makes it necessary to have an intermediate in the form of a qualified medical specialist.

**Technologies underlying AI in medicine**

Machine learning: This data analysis method allows algorithms to learn from large amounts of medical information and make decisions comparable to those of experts.

Natural Language Processing (NLP): NLP allows AI to analyze and interpret textual information such as medical records, scientific articles, and patient data. This helps doctors find the information they need faster and make informed decisions.

Computer vision: This technology is used to analyze medical images. Computer vision algorithms can detect anomalies that may be invisible to humans.

Deep learning: Deep learning based on neural networks allows both modeling complex biological processes and predicting treatment outcomes.

**The use of AI in medicine brings many benefits:**

Improving diagnostic accuracy: AI is able to analyze huge amounts of data and detect pathologies at an early stage, which significantly improves diagnostic accuracy.

Saves time and resources: And automates routine tasks such as data analysis, allowing medical staff to focus on more complex tasks.

Personalization of treatment: And helps to develop personalized treatment plans that take into account the individual characteristics of the patient and increase the chances of a successful recovery.

Accelerating scientific research: And accelerates the process of developing new drugs and therapies, which is especially important in the context of global epidemics and pandemics.

**Conclusion.**

The landscape of medicine is being reshaped by AI and unmatched opportunities to improve education and improve clinical decision-making and redefine the roles of future doctors are being offered. Important challenges are posed by its integration into healthcare, including ethical concerns and data security issues and the risk of over-reliance on technology.

Medical education must evolve to effectively harness AI's potential and it should equip future doctors with the necessary technical, ethical, and interpersonal skills so they can navigate this rapidly changing field. Integrating AI into medicine complements the human experience, improves patient care and generally develops modern medicine.

This paper concentrates on the urgent need for a proactive and ethical framework to guide AI integration and advocates for mindful collaboration among policymakers and educators and healthcare professionals. Future doctors will improve their skills and compassion with AI—AI will not define the future of medicine alone.

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