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The impact of artificial intelligence on Ukrainian medicine: benefits and challenges for the future

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Abstract

The worldwide trend of digitisation across all aspects of society necessitates a fresh approach to the management system in the healthcare sector of Ukraine. The use of artificial intelligence (AI) tools in medicine opens up opportunities for transforming the healthcare sector by creating an effective and personalised approach to medical services.

Aims: The purpose of the study was a comprehensive analysis of the current role of artificial intelligence in Ukrainian medicine and the projected future impact of its development.

Methodology: The work was completed by utilising several common scientific methods of cognition: logical and structural analysis, abstraction, comparison, induction, and deduction, as well as concretisation and formalisation.

Results The benefits resulting from the active implementation of artificial intelligence technologies in medicine were analysed and evaluated in the article. The risks that will accompany the further rooting of AI in medical information systems were identified and a number of appropriate preventive measures were proposed. The experience of developed countries in the transformation of medicine through the use of artificial intelligence capabilities was studied. The feasibility and prospects of using AI technologies in various areas of healthcare were analysed. A number of tools and technologies were proposed to ensure an adequate level of security and protection of personal information.

Scientific Novelty: The principles for adapting the existing algorithms of the medical industry in Ukraine to meet the requirements of digitalisation have been formulated, the expediency of transformation in this area was substantiated.

Conclusion: It was substantiated that the increasing utilisation of artificial intelligence enables the ability to produce precise and efficient decisions within intricate analytical procedures. The results of the study may be of practical value for the process of optimising the modern medical industry in Ukraine in the context of globalisation of the introduction of artificial intelligence technologies.

Keywords: globalisation, digitalisation, digital medicine, remote medical technology, electronic systematisation, data validity.

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Introduction

Increasing globalisation and integration processes are giving rise to new challenges that require appropriate dynamic adaptive changes in all spheres of life. The role of artificial intelligence is actively growing in the healthcare sector, performing a variety of functions, from automating current routine algorithms in medical practice to healthcare management processes.

Research Problem

Although the published works hold scientific value, numerous issues within the research field remain unresolved. In order to maintain the positive dynamics in the digital transformation of the healthcare industry in Ukraine, it is necessary to expand the possibilities for applying AI functionality in the national healthcare system, strengthen the security potential, and stimulate the efficiency of AI tools in terms of practical technologies for remote medical care and control. Achieving this goal is possible if there is an adequate level of foundation in the form of an effective public administration system and the priority of sustainable development principles.

Research Focus

Artificial intelligence technologies currently have significant potential to optimise the management and practical aspects of healthcare activities by solving a number of systemic problems. For example, AI-based algorithms allow for optimal clinical decision-making, minimise the workload of medical staff, find application in the diagnostic process, and even predict the epidemic spread of diseases. At the same time, there is a need to create dynamic models for the use of AI tools and establish a strict framework for controlling the security and confidentiality of processes.

Literature review

Researchers in a range of scientific disciplines are currently exploring the matter of optimizing Ukraine's modern healthcare industry. Many modern scientists are dedicated to analysing how AI can digitally optimise the healthcare sector and actively seek practical means to implement these advancements. For example, M. Saenko considers that the main function of artificial intelligence in medicine is to create smart algorithms for performing tasks using the capabilities of human intelligence [1]. A. Kolesnikov and O. Karapetian study the concept of management in the medical field from the perspective of complexity and difficulty of the problem, using AI tools [2]. At the same time, A. Hryshchenko and Ya. Zimbovskyi and their colleagues emphasise that artificial intelligence algorithms are able to process large amounts of information at high speed, which allows for the implementation of analytical algorithmic processes in minimal time. The researchers argue that this feature of AI not only accelerates the pace of research but also increases the accuracy of the obtained results [3].

Analysing the essence of the process of transformation of the medical sphere of Ukraine with the help of AI tools, O. Stoika, S. Kreshchuk, and V. Khvostivskyi [4] examine it in a vectorial context, which includes the purpose, means, and communication capabilities of the process. Scientists argue that first of all, artificial intelligence, creates significant innovative opportunities for remote medical support for problematic populations. At the same time, researchers emphasise that the potential and capabilities of artificial intelligence tools can only be fully revealed through the synergy of determining factors - social, economic, and environmental - which is the essence of the concept of sustainable development.

The issue of utilising artificial intelligence in Ukrainian healthcare is complex in nature. It has been thoroughly studied in the works of modern scientists N. Artamonova, O. Myrna, Yu. Pavlichenko [5], who, along with the significant advantages of AI tools, highlight a number of risks that arise when it is actively implemented in medical information systems. Certain conceptual issues of implementing AI capabilities in the healthcare system in Ukraine are considered in the works of researchers O. Serebrennikova, L. Fomina, A. Horbatiuk, and O. Kuleshov [6]. However, the aspects related to the analysis of the algorithm for the successful implementation of artificial intelligence capabilities in the healthcare sector of Ukraine, as well as the effective management of its functionality to increase the speed and efficiency of healthcare processes, remain insufficiently researched and require further scientific consideration.

Research Aim and Research Questions

The purpose of the study was to analyse the current impact of artificial intelligence technologies on medicine in Ukraine, highlighting the advantages and dynamics of conceptual long-term priorities. A hypothesis was formed regarding the safety and expediency of delegating a significant part of human functions in the field of medicine to AI technologies.

Objectives of the article:

- What functionalities are created by the use of AI technologies?

- What are the risks and challenges of using AI tools?
- Can artificial intelligence replace the human factor in the healthcare industry?

Research Methodology

General Background

In the course of the research, a set of general scientific methods of cognition was applied, particularly, methods of logical and structural analysis, abstraction, comparison, induction, and deduction, as well as concretisation and formalisation. The theoretical and methodological basis of the work was formed taking into account the priority principles of conducting comprehensive research, based on a systematic approach. It was composed of a set of relevant publications of domestic and foreign scholars on the research topic in professional journals, monographs, and materials of scientific conferences. The principle of comprehensiveness allowed analysing the object and subject of study as a system, with a corresponding set of interrelationships.

The methods of analysis and synthesis were used to identify the factors and stages of development of the object under study, as well as its defining elements. The experience of foreign countries in implementing AI technologies in national medical systems, positive and negative aspects of the existing experience were analysed. A synthesis of the priority factors for shaping the development of the AI system in the studied area was carried out.

The method of comparison was used in the course of the study to determine the specifics of the development and features of AI technologies in the medical field. The specifics included the complexity of transforming the neighbourhood thinking and established paradigms of the management system in medicine, as well as the known level of distrust on the part of medical staff. The efficiency of humans and AI in terms of speed and quality of routine tasks in the medical field were compared, as well as the capabilities of electronic medical record systems and traditional data storage.

The deduction was used to develop proposals for optimising the processes of managing AI capabilities in medicine. The inductive method was used in the process of forecasting indicators of future development.

The abstract-logical and dialectical methods of scientific knowledge, as well as the method of scientific abstraction, were used in the study to formulate theoretical generalisations, to clarify the conceptual apparatus, to identify the main concepts and categories, and draw conclusions.

The method of formalisation was applied in the research process at the stage of identifying priority vectors for optimising the AI system in medicine, as well as in the process of forming the results of scientific research aimed at active practical use in the process of establishing a system of effective public administration in the field of healthcare with the involvement of AI capabilities.

The general scientific method of specification was used to position the effectiveness and feasibility of increasing the role and expanding the functionality of AI technologies in the process of transforming the healthcare industry.

Data Analysis

A general intellectual analysis of theoretical studies, comparison of their results in the comparative aspect with the identification of priority factors of influence, analysis of differences, refinement of the theory.

Research Results

Benefits of AI in medicine

The widespread adoption of artificial intelligence technologies across all aspects of society and economy necessitates a transformation in the information and communication model of the national healthcare system [15]. AI-based technologies enable the analysis of large amounts of informative data in a short time frame, provide preventive planning of therapy and prevention programmes, and allow the use of remote, non-contact, but effective, medicine [16-18].

The use of artificial intelligence proficiencies stimulates the actualisation of the process of implementing the concept of sustainable development in the healthcare sector. This concept promotes the synergy of the main spheres of life - economic, social, and natural, and acts as a guarantor of transparency, reliability, and relevance of information and communication support for management processes in the medical field [19]. It is clear that the introduction of AI technologies into practical social processes is not always perceived by society with positivity, and this trend is especially evident in medicine. The emotional aspect of communication continues to hold significance, with doctors being uniquely equipped to fully address it.

To streamline and automate several processes in the field of medicine, the best option for optimising the functioning of the [20-22]. Modern electronic information systems provide quick access to reference and statistical information, as well as collection and consolidation of the necessary data sets.

Risks of AI application in the medical industry

It should be noted that the active introduction of AI systems in the medical industry in different countries has highlighted a number of process risks, including the complexity of documentation standardisation and unification in different areas of activity and diverse organisations, the unwillingness of staff to innovate and optimise information processing, the lack of appropriate software, and the need to ensure a high level of security for personalisation and data transfer [23, 24]. In this regard, there is currently a need to develop advanced digitalisation tools involving AI that can implement a secure format of communication and data consolidation in the field of medicine [25-27]. The issue is extremely relevant and requires priority attention, as a wide range of remote medicine capabilities, as well as the effectiveness of implementing management models for the digitalisation of the healthcare sector, depend on digital transformation.

Despite its undeniable benefits, digital healthcare involving artificial intelligence, particularly, is accompanied by significant risks and challenges. For example, shared databases available to many users create preconditions for personal information leakage and even invasion of privacy, and therefore data confidentiality is a significant problem, as the use of artificial intelligence requires access to significant amounts of confidential information. Also, ethical issues regarding the use of artificial intelligence in the field of medicine, namely the reproductive medicine, remain relevant. There is also always the possibility of a scenario in which the AI technology algorithm will change the direction of implementation in unacceptable vectors.

It should be noted that AI technology algorithms require a large amount of information from various sources, which are usually dispersed and stored in different systems. This situation significantly increases the risk of errors. We should also not overlook the fact that the set of factors that form the integral values of a particular medical indicator is often quite large, so there is a high probability of a false result of observations.

At present, it is convincing that AI can process information data arrays faster and more efficiently than human resources. The general possibilities of using artificial intelligence technologies in the field of medicine are shown in Fig. 1. It should be noted that the functionality of AI tools is not limited to analytical information processing or visualisation of research results. AI technologies are capable of making decisions based on algorithmic chains, participating in the development of medicines, and even functioning as robot companions for ongoing patient care [28–30].

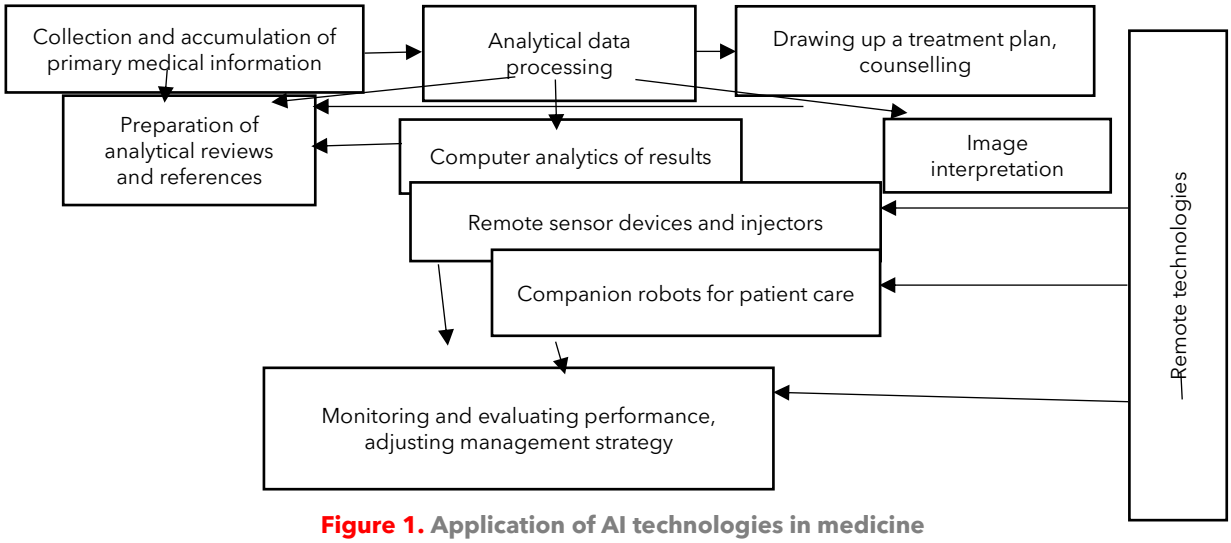

Figure 1. Application of AI technologies in medicine

Source - author's development

Analysing Fig. 1, it should be noted that there are a number of interconnections between the processes of collecting, processing, and issuing information using AI capabilities, which form a factor in the efficiency of the medical communication process since the accuracy and speed of making diagnostic and consulting decisions depends on the interconnected processes of data accumulation and analytics. It becomes obvious that all processes in medicine involving AI, including remote technologies, should be regularly monitored to assess their effectiveness and adjust the management strategy for their use. Particular attention is paid to AI's capabilities in interpreting medical images (ultrasound diagnostics, magnetic resonance therapy, X-ray diagnostics, etc.), which significantly reduces the risk of medical errors.

The analysis of scientific activities in the field of the use of artificial intelligence in medicine convincingly demonstrates a significant progressive interest in the subject of research on the part of researchers and its relevance in the context of the global digitalisation of all spheres of life. The scientific and methodological foundation of the research is laid by scientists whose works focus on aspects of the impact of AI on optimising the functionality of medicine, improving the quality of healthcare services, ensuring an adequate level of protection and confidentiality of information and communication resources using AI, as well as the specifics of adapting AI tools to medicine in emerging economies. The main opportunities, risks, and future prospects for the use of AI technologies in the Ukrainian healthcare sector are shown in Table 1.

Table 1. Advantages and challenges of introducing artificial intelligence into Ukrainian medicine, future prospects

Advantages	Challenges	Prospects
An alternative to skilled personnel in the routine processes of the medical sector	Resistance of medical staff, change of their functions, need for additional training	The doctor is engaged in intellectual activity, makes decisions, while AI is responsible for routine processes and participation in diagnostics
Accumulation of medical and related information in a single database for efficient and fast decision-making	Risks of leakage of confidential personal information, disclosure of medical secrets	Reliable data protection system and cybersecurity guarantee
Possibility of remote diagnostics and patient monitoring	Data dispersion, risk of wrong decisions	Creation of a unified secure information system that generates integral values of a certain medical indicator
Computer analytics of research results and image interpretation	Availability of an old technical resource base, incompatibility with AI capabilities	Updating the material and technical base of primary medical research

Source: author's own development based on analysis: [8,10,11]

A significant number of publications on the topic under consideration in this study are available in scientific journals. Among them, it is advisable to highlight the works of O. Sichkoriz, L. Lototska, T. Kolach, which substantiate the principles of effective implementation of artificial intelligence capabilities in the field of healthcare [7]. At the same time, O. Mintser, V. Romanov, I. Galelyuka, O. Voronenko [8] emphasise the importance of ensuring an appropriate level of confidentiality and data protection in the process of medical transformation through AI tools. Sapci and N. Sapci highlighted the basic conceptual capabilities and advantages of using artificial intelligence technologies in the medical field [9]. And researchers M. DeCamp and S. Lindvall with co-authors highlight the need to adapt the national regulatory framework and management mechanism in the industry to the requirements of the global digital transformation of the medical sector in their works [10].

Some aspects of the digitalisation of the modern healthcare system are reflected in the scientific works of researchers S. Secinaro, D. Calandra, A. Secinaro [11]. The issue of possible risks and negative consequences of the use of AI tools is addressed by Y. Park and G. Jackson and colleagues [12]. The vectors of reforming medical information systems with the help of AI technologies and finding ways to preventively avoid possible risks are paid attention to in their works by M. Ahmed, S. Barua, and S. Begum [13]. Analyses of the results of practical experience in the use of artificial intelligence in medicine in foreign countries are presented in the works of Y. Guo, Z. Hao, and co-authors [14]. A comparative analysis of the approaches of the above-mentioned scientists to the problem of AI in medicine is given in Table 2.

Table 2. Scientific approaches to the implementation of artificial intelligence in Ukrainian medicine

Scientist	Topic and direction of work	Approach to the application of AI in medicine	Approach to data protection and confidentiality
O. Sichkoriz, L. Lototska, T. Kolach [7]	AI technologies as a subject of study for medical specialists	Maximum application possibilities in various areas of the industry	Limited data personalisation in single sign-on systems
O. Mintser, V. Romanov, I. Galelyuka, O. Voronenko [8]	Synergy of AI and engineering and technology solutions	Remote diagnostic and supervisory devices (monitors, injectors, touch sensors)	Emphasis on the development of cyber defence technologies simultaneously with AI technologies

A. Sapci, H. Sapci [9]	Training of medical specialists in industry-specific AI technologies	Changes in the professional functions of medical staff	Data accumulation in a single system, access only for qualified specialists
M. DeCamp, C. Lindvall [10]	Hidden opportunities and risks of AI in medicine	The need for strict control and constant monitoring of AI tools by humans	Hidden risks of information leakage require a strict system of control and protection, including through regulatory and legal regulation
S. Secinaro, D. Calandra, A. Secinaro [11]	Wide variations in the application of AI in the healthcare system	AI technologies should be delegated to simple and non-confidential processes in the industry	AI does not have access to personalised medical information, which minimises risks
Y. Park, G. Jackson [12]	Application of AI in clinical trials	AI is most effective at different stages of clinical trials	Protection of medical secrets through special cybersecurity programmes
M. Ahmed, S. Barua, S. Begum [13]	Human-AI interaction in medical information processing	Finding ways to avoid and minimise the occurrence of medical errors	A person controls the process of using medical information by AI technologies
Y. Guo, Z. Hao Z. [14]	Analytics of the use of AI capabilities in medical systems in different economic and social conditions	Comparison of efficiency, search for the optimal model of AI tools application in medicine	The priority of protecting the confidentiality of medical data and liability for their leakage is enshrined in legislation

Source - author's development

Despite the general interest of scientists in the research issue, certain aspects of the theoretical and practical direction of the implementation of AI technologies in the field of medicine today require deeper consideration and attention from the scientific community. Regardless of the significant scientific and practical achievements of scientists, there is currently a need to develop research work on the issue, primarily to ensure a sustainable positive trend in the digitalisation of the medical industry, as well as to prevent possible risks to the confidentiality and reliability of the information in the healthcare sector.

AI technologies make it possible to automate the vast majority of routine processes in the healthcare sector, significantly increasing the speed and efficiency of their implementation. particularly, this applies to the visualisation of medical images, interpretation of research results, and accumulation of diverse medical information. AI allows synthesising data from electronic health records and unstructured data to predict the patient's health status, having the ability to recognise and analyse informative data of various types [31,32]. AI technologies can also process natural language, read clinical text from various sources, classify and code medical terms and concepts [33-35].

The potential capabilities of AI allow for effective predictive analytics, opening up opportunities for preventive intervention by analysing patterns and specific features of informative arrays [36,37]. With the help of AI technologies, it is advisable to implement pattern recognition systems in medical images, which will allow timely and accurate detection of anomalies [38,39]. Artificial intelligence is also productive in shaping the personalised medicine approach, which involves the analytical processing of genetic information, accumulation of individual diverse medical data, and optimisation of preventive medical recommendations.

It is now becoming clear that the future of medicine and the healthcare industry is directly determined by the level of progress in digital technologies and biomedical transformation (genetic testing, 3D printing, robotics, nanotechnology, etc.) [40,41]. A prerequisite for the successful development of the medical sector is the cooperation of doctors with the latest digital capabilities, while maintaining control over the former [42]. Such an approach will ensure the effectiveness of the process of integrating innovative scientific and technological developments into the daily functioning of medical institutions.

AI technologies are transforming the way healthcare services are provided in the field of specialised care. Namely, they are highly effective in radiology and certain pathologies, in diagnosing diseases of the eyes, cardiovascular system, and oncology. In general, the innovative paradigm in medicine based on the use of AI is a gradual transition to "smart" actuators, as well as partial decision-making in critical situations without human intervention [43]. The conceptual basis of this process is the introduction of electronic medical records, remote electronic diagnostic devices, and sensor devices that allow optimising the system of medical care coordination, communication, and interaction. E-health technologies allow for the implementation of full integration processes of data accumulation, processing, and management, which makes it possible to formulate personalised medical decisions and

recommendations, implement real-time monitoring, and form diagnostic conclusions based on the received information [44,45].

Thus, at the current level of artificial intelligence technologies implementation in Ukrainian medicine, priority areas can be identified, including the development of mobile medical mini-monitors based on smart sensors; the use of interfaces for collecting and primary processing of medical information; the introduction of means of communication with remote medical centres and innovative means of remote diagnosis and administration of medicines in case of emergency [46].

To date, all the possibilities of artificial intelligence in the medical field have not been identified, but it is clear that at the current stage of development, it has significant advantages, including rapid processing of large amounts of information, no need to restore the resource, and the ability to be implemented in any field [47].

However, modern medicine is not ready to transfer full control of functional processes in the healthcare sector to AI. Participants in information and communication processes in the medical field must be confident in the reliable protection of personal data and medical secrecy. There is a need for a rigorous structured control system, which is positioned as an essential prerequisite for the safe and efficient use of AI proficiencies in medicine.

It should be noted that the benefits of implementing AI proficiencies in the healthcare industry significantly outweigh the existing challenges and risks. AI technologies form a large-scale mechanism for a fundamental transformation of medicine. Improvement of algorithms, development of strict ethical and confidential restrictions, and implementation of security measures in the field are currently the priority areas for optimising AI technologies in the healthcare sector.

Discussion

The vast majority of modern scientists comprehend the use of artificial intelligence capabilities as the basis for transforming the healthcare industry towards accessibility and high-quality services.

The digital transformation of the modern healthcare system necessitates, first and foremost, fundamental changes in the communication model. The new model, according to scientists B. Bhinder, C. Gilvary, N. Madhukar, O. Elemento [48], involves the cult of human-artificial intelligence interaction, which best meets the needs of modern society. J. Li and H. Liu [49] add that the best option is to create a specific product for a specific category, needs, and variation of medical communication. However, the works of a number of scientists highlight the potential risks and challenges of the widespread implementation of AI capabilities in medicine. Thus, according to the results of research by modern scientists O. Asan, A. Bayrak, A. Choudhury A. [50], remote monitoring systems with elements of artificial intelligence in the healthcare sector (wireless measuring smart sensors, smart drug injectors) are positioned as a priority subject of innovative engineering developments and practical use. However, the authors highlight the ethical aspects of the use of artificial intelligence in medicine, especially in the storage and use of confidential patient information, emphasising that none of the aspects of AI efficiency can be an alternative to personal information leakage.

At the same time, researchers B. Haibe-Kains, J. Helm, and co-authors [51,52] state that obtaining data from remote devices cannot fully solve the problem of diagnostic decision-making. According to the scientists, the primary problem is to resolve technical issues, because as the number of connected devices and the volume of information exchange increases, there is an elevated risk of unauthorised disclosure of participants' confidential personal information in medical communication. Thus, the effectiveness of AI is undeniable at the stage of primary data collection and processing, but the decision on diagnostics and treatment should be made by a doctor, according to scientists.

Scientists K. Keskinbora, T. Davenport, R. Kalakota [53, 54] assure that visualisation is the main trend in modern medical research transformation processes and ensures the efficiency and versatility of the process. According to the researchers, in the time of global digital transformation, the healthcare industry should initiate the growth of the role of AI, using its potential of unlimited functionality to simplify routine processes in medicine. The researchers propose an alternative model of medical communication in which AI and humans work in synergy to analyse and interpret data to derive reliable result and develop a treatment algorithm. Researchers emphasise the impact of AI-assisted process automation on the role of healthcare workers and medical specialists, possible changes in professional duties and skills, which may become a problem for modern society. This idea is developed by some scientists, namely, S. Sarwar, S. Graham, M. Chen and like-minded people [55-57], studying the predictive probability of a decrease in human knowledge and capabilities in the future, in the case of large-scale use of AI capabilities.

However, most researchers still consider such risks to be the least likely. According to J. Li and H. Liu [49], AI technologies will not be able to replace the emotional component of the communication process in medicine, so the role of a specialist will not lose its credibility. In the future, AI technologies will perform important, but limited tasks, and the person will continue to hold the main responsibility and control function. R. Dias and A. Torkamani [58]. It is obvious that medical professionals must have significant adaptive capabilities and be ready for dynamic

changes. Scientists argue that when AI capabilities are used effectively, artificial intelligence systems can even help to strengthen cybersecurity: they recognise anomalies and new types of malware, alert on threats, and protect critical data. Cybersecurity is always about cooperation between humans and machines. Obviously, no modern cybersecurity tools using AI will work if conventional intelligence is not applied.

The integration of artificial intelligence into the medical industry is transforming the classical research landscape [59], accelerating data analysis, predicting disease progression, developing advanced diagnostic tools, and personalising medicine. It is obvious that over time, artificial intelligence will be introduced into all areas of activity and become the norm [60]. At this stage of its development, the obvious advantages of AI cannot hide the number of risks and dangers that will inevitably accompany its popularisation, as even partial replacement of humans with technology inappropriately can lead to a distrustful attitude of patients towards medical institutions [61].

Artificial intelligence can improve interaction with patients, particularly through personalised diagnostic and treatment methods. For example, AI algorithms can analyse huge amounts of data from various sources, such as medical records, genetic information, and image scans, to identify patterns and correlations that may not be obvious to clinicians. This allows healthcare professionals to make more informed decisions about a patient's diagnosis and treatment plan, particularly in oncology. For example, artificial intelligence can help identify specific genetic mutations in a patient's tumour, which can then be targeted with specialised therapies. This individualised approach to cancer treatment has the potential to improve patient outcomes and reduce side effects associated with traditional treatments [11, 21, 59].

It is worth noting that the prospect of AI's growing functional role in medicine is a prerequisite for significant changes in the industry structure. Particularly, some healthcare specialities will undergo reorganisation, as a significant part of the current work will be automated.

AI platforms operate with huge amounts of data, which enables them to identify drug targets and specific molecules that can be turned into medicines faster. Several biotechs have recently announced that they have discovered or developed drugs using AI and machine learning and have moved to the clinical trial stage. Among them are Exscientia, Verge Genomics, and Recursion Pharmaceuticals [32, 39]. By using generative AI in the drug discovery and development process, companies can save two to four years in preclinical drug development, depending on the complexity of the target, and increase the likelihood of drug success through better chemical composition selection. In addition, AI selects patients with a higher chance of a positive reaction to the drug during the trial process. The area of drug development and personalised treatment programmes are seen as promising areas that should be explored in more detail for further development of the topic.

The results of scientific research and studies of most of the scientists whose current works were analysed above are in line with the conclusions of the current work and convince of the need to form communication between the human factor and AI in the medical system using modern monitoring and control tools. The researchers argue that AI technologies provide medical professionals with reliable diagnostic and treatment suggestions, thus acting as a non-alternative decision support system. At the same time, scientists emphasise that implementing a management system to coordinate massive amounts of information can be a difficult task, and in case of a system error, there is a possibility that the devices may experience malfunctions or failures. It is also necessary to pay attention to the complexity of the interaction between devices from different manufacturers, as there are currently no international standards for integrating informative data for remote monitoring and diagnostic systems in the medical field using artificial intelligence tools. Researchers insist on the urgency of problems regarding the reliability and confidentiality of data obtained in this way, as well as ethical issues of using personalised information, for example, in the sensitive reproductive sphere.

Machine intelligence algorithms learn to see patterns typical of diseases (haemorrhages, skin diseases, tumours, etc.), just as doctors see them. The key difference is that algorithms need many thousands of specific digitised examples to learn, but they still draw conclusions in a split second and highlight small details that a human might not have noticed. A large number of Ukrainian companies are actively creating devices based on artificial intelligence. Doc.ua [62] has also been working on a smart symptom checker, an AI-powered medical assistant that will simplify user interaction with medicine. The participating teams developed algorithms that allow the smart assistant to identify a disease based on a set of symptoms, recommend tests to be taken, and identify the doctor to see. And now Doc.ua is working on the active implementation of the smart symptom checker. Thanks to such developments, Ukrainians will be able to get closer to high-quality and affordable medical services.

The da Vinci robot assistant for surgeries is rapidly gaining popularity in Ukraine, while the US has long had many copies of it in every major hospital [63]. It is with its help that the most complex operations are performed on various parts of the human body, of course, with human control, but the bulk of the work is done by da Vinci. Thus, artificial intelligence tries to minimise the risk of human error. However, scientists are confident that the use of da Vinci and similar robots is the future of perfect medicine.

The conclusions of scientific research by modern researchers allow forming the belief that the use of artificial intelligence capabilities makes it possible to promptly inform and implement remote functions of the healthcare system. The main principle of effective implementation of AI technologies in medicine should be an unprecedented security policy in the global context.

Based on the results obtained in this study and the conclusions of the authors of the above-analysed papers, a continued growth in the prominence of artificial intelligence technologies is foreseeable in optimising the functioning of the Ukrainian healthcare industry. Such an approach will make it possible to significantly improve the quality of medical services, introduce innovative technological solutions and tools for digitalising analytical processes in the industry. Thus, the hypothesis formed in this study regarding the futility and expediency of delegating a significant part of human functions in the field of medicine to AI technologies has been proven as a result of the discussion.

Conclusions and Implications

The study examined the overarching effects of contemporary artificial intelligence technologies on medicine, assessed their role and place in the digital transformation of the healthcare sector. Data has significantly improved the efficiency of data collection processes, accumulating and analysing primary medical data played a leading role in improving the quality and accessibility of medical services. It was substantiated that artificial intelligence technologies are currently positioned as an active component of the system of the modern communication and information model in the medical sector of Ukraine.

The study has determined that the current level of development of scientific and technical innovations and telecommunications tools with the use of artificial intelligence capabilities makes it possible to introduce individual health monitors for problematic patients with chronic diseases, to supervise with the help of satellite robots, to conduct remote diagnosis of a patient, to provide emergency medical care with remote injectors and other actuators. Such innovative solutions are currently under development and require further development for future widespread use in medical practice.

The article proposed a number of preventive measures that should be taken in view of the risks arising from the general trend of introducing AI tools into the medical field. Possible negative consequences of the uncontrolled use of artificial intelligence capabilities were highlighted. The principles of adaptation of the existing algorithms of functioning of the medical industry in Ukraine to the requirements of digitalisation were formed, and the expediency of transformation in this direction was substantiated. It was determined that the main influence on increasing the efficiency of digital transformation of the medical sector of Ukraine with the use of AI capabilities should be exerted by an adaptive regulatory environment. The need to form dynamic models for the use of AI tools and establish a strict framework for monitoring the security and confidentiality of processes were established.

Based on the results obtained in the course of the study, priority areas for promising scientific research on the topic were proposed. It was substantiated that increasing the level of digitisation and unification of medical data created prerequisites for involving artificial intelligence capabilities in decision-making in complex analytical processes in the medical field.

The process of introducing artificial intelligence technologies into the modern healthcare system in Ukraine is accompanied by risks and challenges, but the implementation of effective interaction between the physical and virtual components of the process, the growth of investments in AI development, and the formation of a strict control system can minimise the likelihood of negative consequences. At the same time, the opportunities offered by the active involvement of AI resources in the medical sector are revolutionary in the development of medicine and can completely transform the healthcare industry.

Declarations

Author contributions

All authors have sufficiently contributed to the study and agreed with the results and conclusions.

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Ethical statement

This study does not require IRB approval as it does not involve human subjects/data.

Declaration of interest

No conflict of interest is declared by authors.

Data sharing statement

Data supporting the findings and conclusions are available upon request from the corresponding author.

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