Assessment of the impact of artificial intelligence technologies on the development of Ukrainian medicine in war conditions

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Abstract

The ongoing conflict in Ukraine has had a significant impact on the country's healthcare system. The war has resulted in a shortage of medical personnel, equipment, and supplies, making it difficult for healthcare providers to deliver quality care to those in need. In recent years, there has been a growing interest in the use of artificial intelligence (AI) technologies to improve the efficiency and effectiveness of healthcare delivery in Ukraine. to evaluate the impact of artificial intelligence technologies on the development of Ukrainian medicine in war conditions. In our review, we involved English studies from common databases such as PubMed/MEDLINE, Google Scholar, Web of Science, Scopus, and the Cochrane Library with the keywords "Abdominal aorta," "operations," "aortic branches," combined with keywords, involving " anesthesia." The end date for this review is November 2022. One potential scientific novelty in this area could be the development of a predictive model that uses artificial intelligence to forecast the impact of various AI technologies on the Ukrainian healthcare system in war conditions. This model could take into account factors such as the availability of resources, the prevalence of specific medical conditions, and the capabilities of existing healthcare infrastructure. Overall, assessing the impact of AI technologies on Ukrainian medicine in war conditions requires careful consideration of both their potential benefits and risks. By implementing these technologies responsibly and ethically, it may be possible to improve healthcare delivery for those affected by conflict while also advancing the field of medicine more broadly.

1. Introduction

The war has resulted in the displacement of millions of people, the destruction of healthcare infrastructure, and a shortage of medical personnel. In this context, the implementation of artificial intelligence [AI] technologies in the Ukrainian healthcare system can potentially improve the quality and accessibility of healthcare services [1]. This review aims to assess the impact of AI technologies on the development of Ukrainian medicine in war conditions [2].

AI technologies have the potential to revolutionize healthcare by enhancing the diagnosis, treatment, and prevention of diseases. In Ukraine, AI technologies have been implemented in various areas of healthcare, including radiology, pathology, and cardiology. For example, AI algorithms have been developed to analyze medical images and assist radiologists in detecting abnormalities [3]. This technology has the potential to reduce diagnostic errors and improve patient outcomes [4]. Similarly, AI algorithms have been used to analyze pathology slides and assist pathologists

in diagnosing cancer [5]. This technology can improve the accuracy and speed of cancer diagnosis, which is critical in war conditions where timely diagnosis and treatment can save lives [6]. Another area where AI technologies have been implemented in Ukrainian medicine is cardiology. AI algorithms have been developed to analyze electrocardiogram (ECG) data and assist cardiologists in diagnosing heart diseases [7]. This technology can potentially improve the accuracy of ECG interpretation and reduce the workload of cardiologists. Moreover, AI technologies have been used to develop predictive models for cardiovascular diseases. These models can assist healthcare providers in identifying patients who are at high risk of developing heart diseases and implementing preventive measures [8]. AI could also have an impact on telemedicine. Telemedicine involves using technology to provide remote healthcare services, such as video consultations with doctors or remote monitoring of patients' vital signs [9]. In war conditions where access to healthcare facilities may be limited or dangerous, telemedicine could provide a lifeline for patients. Advantage of AI in telemedicine is its ability to streamline administrative tasks [10]. By automating routine tasks such as appointment scheduling and patient record-keeping, healthcare providers can free up more time to focus on patient care [11]. This can also help reduce costs by minimizing the need for administrative staff. Despite the potential benefits of AI technologies in Ukrainian medicine, there are several challenges that need to be addressed. One of the major challenges is the lack of infrastructure and resources. The ongoing conflict has resulted in the destruction of healthcare infrastructure, and many healthcare facilities are operating under difficult conditions [12]. Moreover, there is a shortage of medical personnel, including radiologists, pathologists, and cardiologists. This shortage can potentially limit the implementation of AI technologies, as these technologies require trained personnel to operate and interpret the results [13]. Another challenge is the lack of data. AI technologies rely on large amounts of data to develop accurate algorithms. However, in Ukraine, there is a shortage of medical data, particularly in war-affected areas [14]. This shortage can potentially limit the development of AI algorithms and their implementation in Ukrainian medicine. Moreover, there are ethical concerns related to using AI technologies in healthcare. For example, there are concerns about the privacy and security of patient data [15]. AI algorithms require access to patient data, which can potentially be compromised if proper security measures are not in place. Moreover, there are concerns about the potential biases in AI algorithms, which can potentially lead to discrimination against certain groups of patients [16].

1.1 The impact of artificial intelligence technologies in medicine during the war conditions

1.1.2 AI in cardiology during the war.

AI has been making significant strides in the field of cardiology, especially during times of war. The use of AI in cardiology has been instrumental in improving the diagnosis, treatment, and management of cardiovascular diseases [CVDs] in military personnel. In this article, we will explore the various ways in which AI has been used in cardiology during times of war [17].

One of the primary applications of AI in cardiology during war is the use of machine learning algorithms to analyze ECGs. ECGs are a critical diagnostic tool used to detect and diagnose various heart conditions. However, interpreting ECGs can be challenging, especially in the field, where access to specialized medical personnel may be limited [17]. Machine learning algorithms can analyze ECGs and provide accurate diagnoses, even in the absence of a specialist. Another application of AI in cardiology during war is the use of wearable devices to monitor heart health. Wearable devices such as smartwatches and fitness trackers can collect data on heart rate, blood pressure, and other vital signs [18]. This data can be analyzed using AI algorithms to detect early signs of CVDs and provide timely interventions. AI has also been used to develop predictive models for CVDs. These models use data from electronic health records, medical imaging, and other sources to predict the likelihood of developing CVDs [19]. Predictive models can help identify high-risk individuals and provide targeted interventions to prevent the onset of CVDs. In addition to diagnosis and treatment, AI has also been used in cardiology during war to improve the management of CVDs [20]. AI-powered decision support systems can help healthcare providers make informed decisions about patient care. These systems can analyze patient data and provide recommendations for treatment, medication, and follow-up care [21].

Finally, AI has been used to develop virtual assistants that can provide personalized support to military personnel with CVDs. Virtual assistants can provide information on medication, lifestyle changes, and other aspects of CVD management. They can also provide emotional support and connect patients with healthcare providers when needed. In conclusion, AI has been instrumental in improving the diagnosis, treatment, and management of CVDs in military personnel during times of war. The use of AI in cardiology has enabled accurate diagnoses, timely interventions, and personalized care for patients with CVDs. As AI continues to evolve, we can expect to see even more significant advancements in the field of cardiology, both during times of war and in peacetime.

1.1.3 AI in emergency medicine during the war.

AI has the potential to revolutionize emergency medicine during the war, where quick and accurate decision-making can mean the difference between life and death. In conflict zones, access to medical care is often limited, and healthcare providers are faced with challenging conditions and a shortage of resources [22]. AI technologies can help alleviate some of these challenges by providing real-time data analysis and decision support. One of the main advantages of AI in emergency medicine during war is its ability to analyze large amounts of data quickly and accurately. For example, AI algorithms can analyze patient vital signs, medical history, and other relevant data to identify patterns and predict potential complications [23]. This can help healthcare providers make informed decisions about treatment and prioritize patients based on their level of urgency. In addition, AI technologies can assist in the triage process, which is critical in emergency medicine during war. Triage involves assessing patients' conditions and prioritizing their treatment based on the severity of their

injuries or illnesses [24]. AI algorithms can analyze patient data and provide real-time recommendations on triage decisions, helping healthcare providers make more informed decisions [22]. AI can also be useful in emergency medicine during the war by providing decision support for medical procedures. For example, AI algorithms can analyze medical images such as X-rays or CT scans to identify abnormalities that may be missed by human interpretation. This can help healthcare providers make more accurate diagnoses and determine the most appropriate treatment options. Finally, AI can be useful in emergency medicine during war for remote monitoring of patients. Remote monitoring systems can collect data on vital signs, medication adherence, and other aspects of patient care [25]. This data can be analyzed using AI algorithms to detect early signs of complications and provide timely interventions.

1.1.3 AI in surgery during the war.

AI has revolutionized the healthcare industry in recent years, and its potential in surgery medicine during the war cannot be overstated. With the increasing number of conflicts around the world, medical personnel are facing unprecedented challenges in providing quality care to injured soldiers [26]. AI technology can help address some of these challenges by providing faster, more accurate diagnoses, and improving surgical outcomes. One of the most significant advantages of AI in surgery medicine during the war is its ability to analyze vast amounts of data quickly [9]. In a battlefield scenario, medical personnel often have limited time and resources to diagnose and treat injuries. AI can help by analyzing medical images such as CT scans, X-rays, and MRI scans to identify injuries accurately and quickly [27]. This can save valuable time and help medical personnel prioritize treatment for patients who need it most. Another benefit of AI in surgery medicine during the war is its ability to assist surgeons during complex procedures. AI-powered robots can be used to perform surgeries, which can be particularly useful in situations where human surgeons are not available or where the risk of infection is high [28]. These robots can also be used to perform surgeries remotely, allowing medical personnel to provide care to injured soldiers in remote locations. Remote surgical assistance is another area where AI can be beneficial during times of war. With many medical professionals unable to travel to conflict zones due to safety concerns, remote surgical assistance using telemedicine technology has become increasingly popular [29]. By using AI-powered robots that are controlled remotely by surgeons located elsewhere, medical professionals can perform surgeries without putting themselves at risk. AI-powered robots also have the potential to perform surgeries autonomously without human intervention. While this technology is still in its early stages, it could prove invaluable in situations where there are no available medical professionals on-site [30]. AI can also be used to improve post-operative care for injured soldiers. By analyzing patient data such as heart rate, blood pressure, and oxygen levels, AI can help medical personnel identify potential complications early on and take appropriate action. This can help reduce the risk of complications and improve patient outcomes. In addition to these benefits, AI can also be used to improve training for medical personnel. AI-powered simulators can provide realistic training scenarios

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for surgeons and other medical professionals, allowing them to practice complex procedures in a safe and controlled environment. This can help improve their skills and confidence when treating injured soldiers on the battlefield.

2. Materials and methods

We conducted a review of English studies using common databases such as Pubmed/MEDLINE, Google Scholar, Web of Science, Scopus, and the Cochrane Library. The search was conducted using the keywords "artificial intelligence," "War," "Ukraine," and the end date for the review was November 2022. We collected studies using each set of keyword combinations to create an unbiased collection of publications. We excluded studies and articles that were not peer-reviewed, as well as proposals, procedures, letters, and opinions. The references included in this paper were chosen because they are relevant to our topic. The focus of this paper is to evaluate the impact of artificial intelligence technologies on the development of Ukrainian medicine in war conditions, specifically the implementation practices.

3. Results and Discussion

We conducted a search using our search strategy, which resulted in 6109 articles. We then screened these articles to select those that were relevant to our topic. After excluding articles based on title and abstract screening, we conducted a full-text screening of 347 articles. Ultimately, we used 31 articles to gather information about our topic and write this review. **Figure 1**

Research results
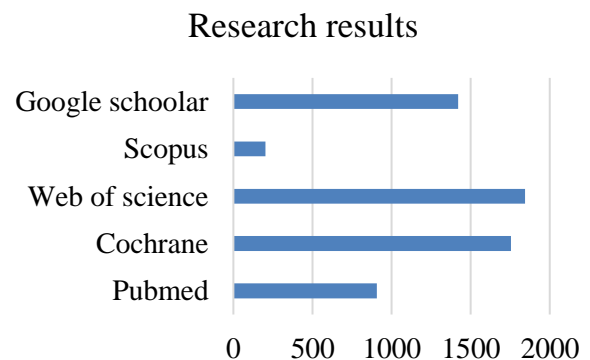
Figure 1. Results of our search

The impact of AI technologies on the development of Ukrainian medicine in war conditions is a topic that has gained significant attention in recent years. With the ongoing conflict in eastern Ukraine, the healthcare system has been under immense pressure to provide quality care to those affected by the war [31]. The use of AI technologies has been seen as a potential solution to some of the challenges faced by healthcare providers in this context. Assessment of the impact of AI technologies on Ukrainian medicine in war conditions requires an understanding of the current state of healthcare in Ukraine and the potential benefits and challenges associated with implementing AI technologies. Ukraine's healthcare system has been struggling for many years due to underfunding, corruption,

and inadequate infrastructure [32]. The ongoing conflict has only exacerbated these issues, leading to a shortage of medical personnel, equipment, and supplies. One potential benefit of implementing AI technologies in Ukrainian medicine is improved efficiency and accuracy in diagnosis and treatment. AI algorithms can analyze large amounts of data quickly and accurately, allowing healthcare providers to make more informed decisions about patient care [23]. This can be particularly useful in war conditions where medical personnel may be overwhelmed with patients and need to make quick decisions. Another potential benefit is improved access to healthcare for those living in remote or conflict-affected areas. Telemedicine, which uses AI-powered tools such as chatbots or virtual assistants, can provide remote consultations and support for patients who may not have access to traditional medical services. Ukrainian medicine. One major challenge is the lack of infrastructure and resources needed to support these technologies. Many hospitals and clinics lack basic equipment such as computers or internet access, making it difficult to implement even basic AI tools. Ahuja et al. [33] studied the future role of physicians in medicine and how it will be affected by the implementation of artificial intelligence. They found that AI is set to revolutionize the healthcare industry by analyzing the vast amounts of data generated by patients and healthcare institutions. This technology will support and enhance physicians' work, allowing them to spend more time with patients and improve their care. Although AI is unlikely to replace physicians, it is crucial for medical professionals to learn about AI technology and its potential benefits. Failure to do so may result in physicians who cannot use AI being replaced by those who can. Basu et al. [34] performed a review to study how AI can change can the medical sciences and its future. They found that although AI has the potential to solve many of healthcare's major issues, there are still significant obstacles preventing this from becoming a reality. The primary challenge is the lack of adequate and representative data. Despite the development of promising technologies and machine learning algorithms, we cannot fully realize the potential of AI in healthcare without sufficient data. To achieve this, the healthcare industry must digitize medical records, standardize data infrastructure, and establish a secure system for protecting patient confidentiality and obtaining consent. Without these fundamental changes and collaboration within the healthcare industry, it will be difficult to fulfill AI's true promise in improving human health. To study the implications of AI in healthcare applications, Bohr et al. [35] performed a study that investigated the effect of AI in different medical fields. Regarding Patient-care assistance, AI can enhance the efficiency of healthcare professionals and promote patient autonomy and well-being. By treating each patient as a unique system, tailored approaches can be implemented based on available data, which is particularly crucial for vulnerable populations such as the elderly. For instance, virtual health assistants can remind patients to take their medication or suggest exercise routines for optimal outcomes [36]. Affective computing is a promising field that enables machines to interpret and analyze human emotions and behavior, allowing patients to remotely interact with devices and access their biometric data while feeling cared for by an empathetic system [37]. This approach can be applied in both home and hospital settings to alleviate work pressure on healthcare workers and improve patient outcomes. Concerning complication management, patients generally cope well with the discomfort and complications of mild illnesses. However, it is crucial to manage symptoms for certain conditions to prevent further progression and alleviate more severe symptoms. This is particularly important in infectious diseases, where identifying biomarkers in trauma patients could help prevent future wound infections and enable healthcare workers to take appropriate measures. This was suggested in a study published in the Journal of Trauma and Acute Care Surgery [38].

A recent survey revealed that although primary care practitioners recognize the potential advantages of AI, they remain highly doubtful about its significant involvement in their profession's future. The primary concern is the absence of empathy and ethical issues that may arise between AI and patients [39]. Although it may be accurate presently, it is simplistic to believe that this technology will remain stagnant and not advance further. People tend to favor efficient and innovative solutions that minimize the impact on their daily routines. Additionally, with the continuous advancements in smart healthcare materials, the potential for progress is even greater [40]. Finally, there are concerns about the ethical implications of using AI technologies in healthcare. For example, there are concerns about privacy and data security, as well as the potential for bias in algorithms that could lead to unequal treatment of patients.

4. Conclusions

1. Artificial intelligence technologies have the potential to significantly improve the quality of healthcare in Ukraine, particularly in war conditions where resources are limited and medical professionals are overburdened.
2. The implementation of AI technologies in Ukrainian medicine requires careful planning and consideration of ethical, legal, and social implications.
3. Successful implementation of AI technologies in Ukrainian medicine will require collaboration between government agencies, healthcare providers, technology companies, and other stakeholders.
4. AI technologies can help improve diagnosis accuracy, treatment planning, patient monitoring, and resource allocation in Ukrainian healthcare settings.
5. The use of AI technologies can also help reduce medical errors and improve patient outcomes in war conditions where access to medical care is often limited.
6. However, there are also potential risks associated with the use of AI technologies in healthcare settings, including privacy concerns and the potential for bias or discrimination.
7. Overall, the assessment of the impact of artificial intelligence technologies on the development of Ukrainian medicine in war conditions highlights both opportunities and challenges for improving healthcare delivery in this context.

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