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## THE POTENTIAL OF DIGITAL TECHNOLOGIES IN IMPROVING THE PROCESS OF TRAINING AND RETRAINING OF MILITARY DOCTORS

**Abstract.** The issue of improving the process of training and retraining of military doctors is determined by changes in the security environment of the state today, and the need to develop the military medical sector in the conditions of long-term resistance to Russian aggression. This article highlights the potential of using digital technologies to improve the process of training and retraining of military doctors. The results of a survey of trainees at the Ukrainian Military Medical Academy (a higher military medical educational institution that provides training, retraining and advanced training of specialists in almost all specialties for the Armed Forces of Ukraine and other military establishments of Ukraine) are presented. It is shown that for the implementation of changes in the system of training and retraining of military doctors the Academy provides for a number of measures: introducing innovative changes in the content and methodology of education; introduction of flexible technology for planning and organizing the educational process, focused on personalization of learning; development of international scientific and scientific-medical collaborations. Based on the conducted research, it was determined that in the conditions of active hostilities in Ukraine, it is digital technologies that make it possible to quickly introduce changes in the process of training and retraining of military doctors by improving the educational

and informational environment. It was established that improving the readiness of military doctors to use digital technologies in their professional activities requires their end-to-end use in the entire training system. The article provides examples of the use of digital technologies in the process of training and retraining of military doctors.

**Keywords:** digital technologies; military doctors; the potential of digital technologies; training and retraining of military doctors.

**Problem statement.** The system of medical support of the Armed Forces of Ukraine is an integral component of the defense capability of our country. Today, in the conditions of long-term resistance to Russian aggression, active hostilities in the east and south of our country, proper training and retraining of military doctors is of great importance. At the same time, to ensure compatibility in matters of medical support with the armed forces of the North Atlantic Treaty Organization (NATO), in the context of Ukraine's cooperation with NATO in the military sphere, also requires the improvement of training and retraining of military doctors. A powerful tool for the necessary changes in this training process in accordance with the challenges of the times, is the use of potential of digital technologies.

The main areas of improvement of the process of training and retraining of military doctors are highlighted in such key documents as the Implementation Agreement between the Cabinet of Ministers of Ukraine and NATO regarding the implementation of NATO projects on medical rehabilitation (Decision of the Cabinet of Ministers No. 49, March 12, 2020); annual national program under the auspices of the Ukraine-NATO Commission (Decree of the President of Ukraine No. 203/2020, May 26, 2020); Strategy for the development of the Medical Forces of the Armed Forces of Ukraine until 2035 (Order of the General Staff of the Armed Forces of Ukraine No. 100, March 12, 2020), according to which, in order to achieve an effective, coordinated, resource-oriented system of medical support for the Armed Forces of Ukraine, considerable attention should be paid to the implementation of a wide range of projects, including: provision of training of military doctors in accordance with established NATO standards; mastery and use by military medical personnel of the best world experience in the practice of providing medical care; the functioning of the system of training and retraining of military medical workers of the defense forces in matters of tactical medicine in accordance with NATO algorithms; implementation of modern technologies for providing medical care and treatment of the wounded in the activities of the military medical services in accordance with the standards of medical care, clinical protocols and other industry standards in the field of health care of NATO member states (Annual national program, 2020; Ukraine's path to the alliance, 2022). At the same time, none of the NATO countries currently has such experience of actions in the framework of large-scale long-term armed aggression (NATO countries, 2023), and such experience of our country in many aspects of the medical field is unique. That is why the analysis of domestic medical experience and its timely and adequate introduction into the system of training and retraining of military doctors is an urgent task. The prospect of using digital technologies to implement the outlined tasks determines the relevance of research aimed at clarifying the effective directions of using digital technologies in improving the process of training and retraining of military doctors at all levels of military medical education.

**Analysis of recent research and publications.** Today, in Ukraine, as in many other leading countries of the world, digitalization of education is the need of the hour. The topic of digitization of education is associated with the names of such scientists as M. Abysova (Abysova, 2023), L. Bilousova (Bilousova, 2019), N. Dukhanina (Dukhanina, 2022), A. Kiv (Kiv, 2023), N. Thakur (Thakur, 2022) and at al. The authors note that digitalization of education is one of the key directions of transformation of the modern education system and involves the end-to-end use of digital technologies in the educational process in order to ensure its openness, quality and accessibility. N. Dukhanina and H. Lesyk emphasize that the digitalization of education is a paradigm shift in the communication of scientists, educators, and education seekers with the outside world and a high-quality internal tool for optimizing the educational and scientific environment (Dukhanina & Lesyk, 2022).

Prospects for the use of digital technologies in medical education are reflected in the scientific works of Yu. Iliasova (Iliasova, 2022), O. Olar (Olar, 2013), M. Abràmoff (Abràmoff, 2023), A. Hayat (Hayat, 2021), W. Zhou (Zhou, 2024) and at al. Scientists claim that the spread of digital technologies in medical education was facilitated by their implementation in virtually all areas of health care: medical digital information system, telemedicine, medical digital diagnostics, medical robotics, etc. (Iliasova & Shevchenko, 2022; Olar et al., 2013; Abràmoff et al., 2023; Hayat & Bhatti, 2021; Zhou et al., 2024).

The use of digital technologies in military medical education is devoted to numerous studies by practicing teachers and doctors, such as N. Kozak (Kozak, 2019), V. Murashko (Murashko, 2022), V. Savytskyi (Savytskyi, 2022), N. Khomutetska (Khomutetska, 2021) and at al. Military medical practitioners point out that the use of digital technologies today is the key to ensuring high-quality training of medical specialists in accordance with modern challenges. In particular, O. Rudynskyi, N. Kozak, S. Chusta note that, taking into account the peculiarities of the professional activity of military medics, the implementation of thematic improvement cycles in an online format for doctors of the Armed Forces of Ukraine (hereinafter – Armed Forces of Ukraine) and other power structures is of particular importance today, and as well as health care institutions of the Ministry of Health of Ukraine (Rudynskyi et al., 2019). L. Ruschak, V. Murashko, I. Sereda emphasize the importance of optimizing patient protection (in particular, in diagnostic radiology), which can be achieved by means of digital technologies in X-ray diagnostics (Ruschak et al., 2022). N. Khomutetska, A. Holub believe that training with the use of digital technologies is gradually becoming a new educational standard that penetrates all structures that conduct training and retraining of military doctors (Khomutetska & Holub, 2021). At the same time, V. Savytskyi, T. Kutz, N. Sydorova points out that medicine, as a purely practical field, in the direction of wide use of digital technologies in the educational training and retraining of military doctors for a long time remained rather conservative, using certain capabilities of these technologies, for example, during the testing of recruits (Savytskyi et al., 2022). However, today the disclosure and use of the potential of digital technologies to solve the urgent tasks of modern military medicine to improve the process of training and retraining of military doctors adequate to the requirements of wartime is gaining special relevance.

The **purpose** of the study is to clarify the effective directions of using digital technologies in improving the process of training and retraining of military doctors.

### **Research Methods**

In order to achieve this aim, we employed a mixed-method research design: theoretical – analysis of medical and pedagogical works, systematization of views and achievements of scientists (to identify the state of development of the problem, determine the potential of digital technologies in improving the process of training and retraining of military doctors); analysis of psychological and pedagogical research, as well as study of regulatory documents; empirical – conducting a questionnaire; statistical – quantitative and qualitative analysis of survey results.

**Results of the Research.** The Ukrainian Military Medical Academy (hereinafter referred to as the Academy) is the only higher military medical educational institution in Ukraine that provides training, retraining and advanced training of specialists in almost all specialties for the Armed Forces of Ukraine and other military formations of Ukraine. At the same time, the Academy is both a scientific and medical center of the Ministry of Defense of Ukraine. Such a leading position of the educational institution in the field of military medicine necessitates a quick response to today's challenges, and therefore the end-to-end implementation of digital technologies in all areas of the Academy's activities is officially enshrined in the Development Strategy of the Ukrainian Military Medical Academy (Development Strategy, 2019).

As part of solving the task aimed at determining the state of readiness of military doctors to use digital technologies in their own professional activities and the need for this training, a pilot survey of the Academy's trainees was conducted. 127 participants took part in the survey. As a result of the survey, it was found out, in particular, that 95.28% of participants need to increase the level of competence in the use of digital technologies, because the trainees are aware that the process of digitalization of the

medical field causes new requirements for military doctors, in particular, it involves knowledge of digital tools and the awareness to work with them. According to the results of the survey, it became clear that trainees actively use digital technologies: during preparation for training – 86.61% of participants; for self-education – 40.16% of participants; in order to support professional communication – 35.43% of participants; 31.50% for monitoring (analysis) of the latest achievements in the field of medicine.

The majority of the surveyed trainees of the Academy (97.64%) supported the opinion that it is appropriate to use digital technologies for their own professional improvement and promotion, and among the promising directions for the use of these technologies, they noted: free access to digital tools (which enables, for example, completion of urgent tasks at a convenient time, regardless of the place of stay; to carry out a live video broadcast, capture and distribute video materials in a timely manner; to research various pathologies, diseases or help in the rehabilitation of a patient using virtual reality technology, etc.) – 90.55% of participants; access to digital resources (for example, e-libraries, platforms for checking medicinal products, etc.) – 89.76% of trainees; access to medical online courses, trainings, seminars – 86.61% of trainees; access to virtual international professional associations – 82.68%.

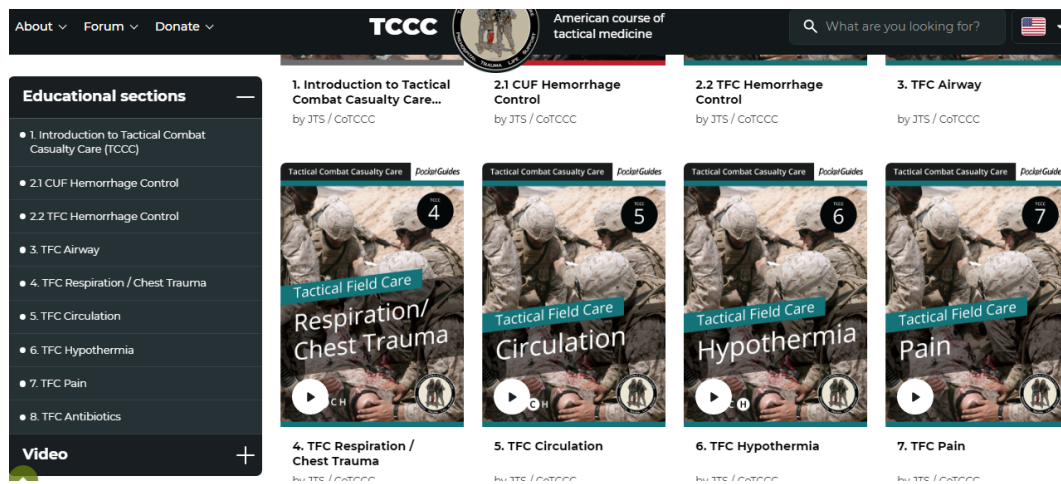
It is worth considering separately the reasons that make it difficult for listeners to use digital technologies. The participants indicated their own insufficient preparation for the use of digital technologies, in particular: for working in virtual reality conditions (for example, sharing the experience of conducting complex operations, etc.) – 95.28% of participants; for the organization of an open space for group communication and collective activity (for example, processing information necessary for decision-making, managing the process of joint work or managing communication, etc.) – 63.78%; to master new digital services that provide free access to online courses, trainings, etc. (for example, the platform for instant messaging and digital distribution of information “Discord”) – 66.93% of trainees, etc. Thus, the conducted analysis shows that the trainees of the Academy assess their own readiness to use digital technologies in professional activities as a whole as insufficient. Improving the readiness to use these technologies requires the end-to-end use of digital technologies in the entire system of training and retraining of military doctors.

Please note that in order to implement changes in the system of training and retraining of military doctors in a timely manner, adequate to today’s situation, the development strategy of the Ukrainian Military Medical Academy in the field of education envisages a number of measures, in particular, *the introduction of innovative changes in the content and methodology of education* (Development Strategy, 2019).

The importance of the transformation of the content, methodology of education, as well as the methods and forms of training and retraining of military doctors is indicated by researchers, military doctors-practitioners A. Holub, N. Kozak, T. Kuts, O. Rudynskyi, V. Savytskyi, N. Khomutetska, S. Chusta et al. The authors note, in particular, that solving the urgent problems that Ukraine is facing today requires the development of an adequate organizational structure for the training of military doctors, who must quickly adapt to changes in the surrounding situation. In this context, specialists in the field of health care emphasize the principle of “Education throughout life”, because the profession of a doctor is a continuous, selfless process of continuous development and professional improvement (Rudynskyi et al., 2019; Savytskyi et al., 2022; Khomutetska, & Holub, 2021; Kozak et al., 2023). One of the main regulatory documents on this issue is the Resolution of the Cabinet of Ministers of Ukraine “On Approval of the Regulation on the System of Continuous Professional Development of Medical and Pharmaceutical Workers” (No. 725, July 14, 2021). The Resolution states, in particular, that continuous professional development is carried out at various events, in particular, master classes, trainings, medical internships, etc. The above-mentioned Resolution became especially relevant after the beginning of the large-scale invasion of the Russian Federation into Ukraine, since a significant number of medical workers were urgently mobilized to the ranks of the Armed Forces and other components of the defense forces, who needed the fastest possible acquisition of competences in the organization of medical support for troops (forces) and the provision of medical aid to the wounded from various types of combat injuries (Kozak et al., 2023). One of the powerful means of proper training and retraining of military doctors turned out

to be master classes, trainings, internships of specialists, which are held both offline and online. In such a mixed format, for example, a master class on rehabilitation and physical therapy was held on July 15, 2023. The classes were conducted by experienced instructors of the freelance physical therapy and rehabilitation group of the operational group of the “Kharkiv” troops, which includes military doctors and physical rehabilitators with extensive experience in physical therapy and rehabilitation of servicemen who have suffered injuries, damage to the musculoskeletal system, and are recovering from injuries, etc. (Master class on rehabilitation, 2023). The use of digital technologies in events held in a mixed format ensures high information saturation and activity of all participants in real time, in a remote or mixed format. The use of specialized applications, chat bots of the event ensures personalized provision of educational services to each listener, namely: personal recommendations from the organizers, which are formed on the basis of the preferences of the participant in the areas of work of the event, additional video and text informational materials, etc.

In the context of the principle of “Lifelong Learning”, the use of digital technologies opens up wide opportunities for independent learning and research. For example, within the framework of the project “American course of tactical medicine for the military” a platform was presented (<https://tccc.org.ua/>), which contains a selection of materials on the use of medical equipment during the provision of assistance to wounded servicemen in combat conditions. These materials contain a detailed description of medical equipment (in particular, a combat medic’s bag, etc.); requirements for medical kits; description of their use depending on the situation on the battlefield and much more. All materials posted on the platform can be discussed with colleagues in the “Forum” section. Also, the platform presents a series of video materials that reproduce various stages of helping wounded soldiers (Fig. 1).



**Figure 1.** Collection of the standardized training programs of the course of combat assistance to wounded servicemen (<https://tccc.org.ua/>)

In the process of continuous development and professional improvement, the use of digital technologies is multifaceted. For example, during the presentation of new drugs, specialists can check the effectiveness of drugs using specialized digital resources. In particular, on the “Dokazovo” platform (<https://www.dokazovo.in.ua/>), such a check of drugs provides additional information on the practice of using drugs in different countries, in particular, Germany, Great Britain, etc.

Thus, in the conditions of dynamic changes, continuous self-education of military doctors becomes a leading factor in their professional success – the ability to quickly orientate in any crisis situation; make non-standard decisions; to learn and develop throughout life, because innovations in the medical field are dynamically implemented in various forms, in particular:

- medical technological innovations related to the use of new methods of prevention, diagnosis, treatment and rehabilitation of the patient based on existing drugs or new combinations of their use;
- medical-pharmaceutical innovations related to the use of new drugs, competitive in terms of the main parameters of medical effectiveness;
- organizational innovations (for example, during the medical sorting of fighters, which is carried out at each stage of providing medical aid and evacuation, etc.);
- information technology innovations aimed at automating the processes of collection, processing, and analysis of information flows in the medical field (Mochalov, 2014).

Please note that the changes introduced at the Academy include the *introduction of innovative, flexible technology for planning and organizing the educational process, focused on the personalization of learning*, in particular, the creation of conditions for free access to information, provision of disciplines with interactive training programs, multimedia complexes, etc. (Development Strategy, 2019).

The successful provision of educational cycles with digital support (multimedia complexes, video materials, etc.) today is facilitated by the development of Web 2.0 services. Such services are distinguished by developed didactic functionality and provide an opportunity to create an open educational space for the training and retraining of military doctors, within which various digital materials are placed, for example, educational and methodological manuals, educational and methodological materials in accordance with the programs of military medicine cycles; lecture materials; electronic educational and methodical resources; recommendations (regarding screening tests, X-ray diagnostics and much more). Placement of fragments of video recordings of specialists' activities acquires special value. For example, video recordings of providing aid to wounded servicemen according to protocols used in combat, in particular, CABCDE or MARCH (Fig. 2), are useful. For example, the MARCH protocol describes the sequence of actions for providing emergency first aid to a wounded person both on the battlefield and at the stage of evacuation (from the English mnemonic for Massive – stopping bleeding, Airways – ensuring the airways patency, Respiration – ensuring respiratory functions, Circulation – full examination of the wounded; Head injury / Hypothermia / Hypovolemia – head injury / hypothermia / hypovolemia).



Figure 2. Video fragment of “MARCH algorithm” (Field medical assistance, 2022)

Digital video recording of the process of rescuing a soldier is the basis for further discussion of the situation at classes during the training and retraining of military doctors; makes it possible to familiarize military doctors with real medical practices in a timely manner; to compare the theoretical material with

which the trainees get acquainted in the classes with the real process of providing assistance, in particular, according to the MARCH protocol indicated above.

The relevance of creating an open educational space for the training and retraining of military doctors is due to the fact that today the methods of combat operations and, types of weapons are dynamically changing with the result, that military medicine is being transformed. Thus, up to 100 combat clashes can take place during the day; the enemy actively conducts sabotage activities, assault actions. Ignoring the laws and customs of warfare, the enemy delivers massive strikes, as a result of which fighters receive complex, multifactorial injuries. A characteristic feature of firearms of the latest generation is the ability to cause more severe combined injuries and hit a larger number of servicemen, which is achieved by increasing the speed of the striking projectile, using ready-made striking elements or cluster ammunition, using new principles of detonation, using weapons based on high technologies (Rusyn et al., 2022). In this context, it is important to quickly accumulate, analyze and share relevant practical experience of providing medical care, as well as timely and adequate reflection of this experience in the information support system of the process of training and retraining of military doctors. The implementation of such measures makes it possible to bring the trainees' activities as close as possible to the realities of professional activity, to study in detail the important points of assistance, for example, when studying changes in the nature of combat injuries of soldiers due to the spread of new types of weapons.

In the conditions of modern war, fighters will receive complex injuries, the specific weight of multiple and combined wounds increases, the frequency of injuries to vessels and vital organs increases, etc. At the same time, such injuries can be accompanied by shock and massive bleeding (Rusyn et al., 2022). There is often a need for a multi-disciplinary medical specialist examination of military personnel (with the participation of doctors of relevant specialties). It is the use of video broadcasting that makes it possible to involve specialists in a timely manner to make a qualified decision on the tactics of medical intervention or treatment, in particular, in military and field conditions.

Innovations widely introduced by the Ukrainian Military Medical Academy also concern *scientific, scientific-technical and innovative activities* that are aimed at the development of international scientific and scientific-medical relations, ensuring active participation in the educational process, in international scientific programs and events (Development Strategy, 2019) (for example, participation in international scientific and practical conferences in cooperation with educational military medical institutions of NATO countries, etc.). One of the main normative documents on this issue is the order of the Cabinet of Ministers of Ukraine "On the Approval of the Strategy for the Development of Medical Education in Ukraine" (No. 95, February 27, 2019), which emphasizes the importance of increasing the requirements for those seeking medical education, namely: participation in international training programs, conferences, seminars; increase in publishing activity at various levels, in particular, at the international level. Such scientific, scientific-technical and innovative activity in the process of training and retraining of military doctors is a unique opportunity to master new approaches to patient management in order to improve the quality of medical services, which concern, in particular: assistance to victims (for example, in the case of the use of new types of weapons of mass destruction – radio frequency, geophysical, etc.); use of the database of new drugs, new medical equipment, etc.

The use of digital technologies in scientific, scientific-technical and innovative activities brings many useful opportunities. On the one hand, the powerful functionality of modern IT devices makes it possible to conveniently, at any moment of time, regardless of the positioning of a military doctor, participate virtually in various scientific and methodical events, including international ones. On the other hand, the use of specialized software tools to support dialogue in a multilingual space facilitates convenient direct and indirect international communication with colleagues. Thus, the use of digital technologies contributes to the activation of participants in the educational process in events of various levels, including international ones; and also becomes a necessary condition and a leading factor for uniting specialists from different countries to support business relations for mutually beneficial cooperation and partnership in the future.

An important role in the process of digital transformation of the military-medical industry, in particular in education, is played by the improvement of the system of implementation of the latest achievements, which is regulated by the Resolution of the Cabinet of Ministers of Ukraine “Some Issues of the Electronic Health Care System” (No. 411, April 5, 2018) and is also recorded in the Development Strategy of the Ukrainian Military Medical Academy (Development Strategy, 2019). The impetus for such large-scale changes is actually digital innovations, in particular: the electronic health care system (eHealth), which opened the possibility of creating a single medical space of the country, where every step of patient treatment is recorded in the system; video-Dot, telemedicine, which enables the doctor to quickly orientate him(-her)self in the clinical situation, quickly prescribe the appropriate treatment in conditions of time shortage. For example, during the patient’s stay in hospital treatment (in particular, the treatment of patients with multidrug-resistant tuberculosis and tuberculosis with extended resistance lasts 20 months, which makes hospitalization for such a long period impossible) and in order to obtain continuity of the prescribed regimen of a certain therapy, especially in the case of using new drugs, it is necessary to carry out daily control of the intake of drugs by the DOT supervisor (nurse or social worker). Today, this is conveniently implemented precisely through online communication during the patient’s medication administration through a web browser available to the patient and the DOT supervisor – video DOT (Garavand et al., 2020; Mohammadi et al., 2020; Lytvynenko et al., 2018).

Therefore, the implementation of the latest achievements in medical practice raises the communication process to a much higher level and digital technologies provide opportunities to variably and flexibly organize an open space for group communication and collective activity.

**Conclusions and Prospects for Further Research.** Thus, in the conditions of active hostilities in Ukraine, it is digital technologies that today make it possible to promptly introduce adequate changes in the process of training and retraining of military doctors by improving the educational and informational environment. It is promising to find out the pedagogical conditions that will ensure the effective acquisition by the trainees of those new competencies that a modern military doctor really needs.

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### ПОТЕНЦІАЛ ЦИФРОВИХ ТЕХНОЛОГІЙ У ВДОСКОНАЛЕННІ ПРОЦЕСУ ПІДГОТОВКИ І ПЕРЕПІДГОТОВКИ ВІЙСЬКОВИХ ЛІКАРІВ

**Анотація.** Проблема вдосконалення процесу підготовки і перепідготовки військових лікарів сьогодні зумовлена змінами безпекового середовища держави, потребою розвитку військово-медичного сектору в умовах тривалого спротиву російській агресії. У статті проведено дослідження проблеми використання цифрових технологій у вдосконаленні процесу підготовки і перепідготовки військових лікарів. Представлено результати опитування слухачів Української військово-медичної академії (вищій військово-медичній навчальній заклад, який забезпечує підготовку, перепідготовку та підвищення кваліфікації фахівців майже всіх спеціальностей для Збройних сил України та інших військових формувань України), спрямованого на визначення стану готовності військових лікарів до використання цифрових технологій у професійній діяльності та потреби у зазначеній підготовці. Показано, що для адекватного сьогоденній ситуації впровадження змін у систему підготовки і перепідготовки військових лікарів у стратегії розвитку Української військово-медичної академії передбачено низку заходів: внесення інноваційних змін у зміст і методологію освіти; упровадження гнучкої технології планування та організації освітнього процесу, орієнтованої на персоналізацію навчання; розвиток міжнародних наукових і науково-медичних зв'язків, забезпечення активної участі усіх учасників освітнього процесу в міжнародних наукових програмах та заходах. На основі проведеного дослідження визначено, що в умовах ведення активних бойових дій в Україні саме цифрові технології надають змоги оперативно ввести зміни у процес підготовки і перепідготовки військових лікарів шляхом вдосконалення освітньо-інформаційного середовища. Встановлено, що удосконалення готовності військових лікарів до використання цифрових технологій у професійній діяльності потребує наскрізного їх використання у всій системі підготовки і перепідготовки фахівців. У статті наведено приклади використання цифрових технологій у процесі підготовки і перепідготовки військових лікарів.

**Ключові слова:** цифрові технології; потенціал цифрових технологій; підготовка і перепідготовка військових лікарів; військові лікарі.