



The Development of Telemedicine: Challenges and Prospects for Ukraine

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Abstract: Background: The prevalence of modern telecommunication technology development and the introduction of new distance healthcare methods have fueled the growing interest in telemedicine. This work analyses the progress of telemedicine in Ukraine and identifies the main development factors, constraints, and considers foreign countries' experience with the implementation of telemedicine services. **Methods:** An analysis of the scientific literature and regulatory documents, a study of the current legislation framework, and a comparative analysis of telemedicine service in Ukraine and in the world were performed. **Results:** As a result of the study, it has been determined that telemedicine improves healthcare accessibility and service quality in remote regions and with the personnel who are on combat duty and for individuals with chronic non-communicable diseases, over 70% of healthcare organizations did not use unified telemedicine systems, and only 37% of health staff have been trained for telemedicine. Over 70% of teleconsultations were performed during the pandemic/wartime and the amount of telemonitoring services has increased from 8% to 26%, the biggest obstacles are the weak digitalization, shortage of practical experience, distrust from patients; it's effective in remote and war regions where there is no necessity for a personal survey of the patient, better treatment adherence and telerehabilitation, a positive role in drug safety can be played by digital pharmacovigilance. **Conclusion:** The wide application of telemedicine could be vital for improving the sustainability of the healthcare system of Ukraine, but is accompanied with a necessity of the legislative change, healthcare digitalization and of training of relevant specialists.

Key Words: Telemedicine, eHealth, Ukraine, Remote Consultation, Digital Health, Telerehabilitation

INTRODUCTION

Telemedicine is one of the methods which can represent highest potential in new medicine. This is because of teleconsultations, increase in non-communicable chronic disease burden, and the imbalance of subspecialists [1]. In global medical practice too, telemedicine consultation is recognised as the best choice for continuing patient care to ensure quality health care services [2].

The COVID-19 pandemic and the full-scale war in Ukraine substantially accelerated the demand for telemedicine services due to population displacement, destruction of medical infrastructure, and limited access to healthcare in frontline and remote regions [3–5]. Under these conditions, telemedicine became an important mechanism for maintaining continuity of care and improving access to medical consultations.

But despite its great benefits, the application of telemedicine in Ukraine has a lot of obstacles. The primary barriers include a lack of regulation, a decline in technical support, as well as low levels of medical services awareness among the personnel [3]. Other relevant aspects are the lack of high speed internet access, irregular access to digital tools and electronic systems, and cybersecurity [6]. Factors impeding the implementation of telemedicine in Ukraine are low digital literacy among the population, distrust of patients in remote consultations and often incomplete training of medical personnel [7].

That is why the study of development directions of telemedicine in Ukraine in the situation of a full-scale invasion becomes extremely relevant: it allows forming a correct policy on its application, changing clinical protocols

providing high-quality telemedicine services. According to the results of study, analysis on telemedicine services should enable to evaluate the quality of their provision and promote development and implementation of these methods in the practice of Ukrainian health care.

Objectives of the work are to analyze telemedicine in Ukraine, to determine obstacles for its development, to investigate ways which could improve availability of telemedicine and compare implementation of this form with other countries. Despite the growing number of publications on telemedicine, limited attention has been paid to the combined analysis of legal, organizational, technical, and educational barriers affecting telemedicine implementation in Ukraine during wartime conditions. In addition, insufficient evidence is available regarding the integration of international telemedicine practices into the Ukrainian healthcare system. Therefore, this study aims to evaluate current telemedicine development in Ukraine and identify strategic directions for healthcare policy modernization and digital transformation.

Literature Review

A review of international sources revealed that the development of telemedicine services is one of the most attractive trends in contemporary medicine [8]. Accordingly, according to a report of WHO, telemedicine services attenuates the percentage of hospital admission, reduces the exacerbation of chronic diseases in patients and increases satisfaction from medical services provided [9, 10]. In this context, telemedicine technologies are being progressively adopted for patient care in European Union (EU) countries. Electronic medical gadgets are taken advantage of, and so is artificial intelligence in clinical-decision algorithms and prediction of possible complications [11,12]. In this way, it has been advantageous to facilitate communication between physicians, hospital staff and patients and other parties in the treatment process [13,14].

Overall, the impact of telemedicine for patients with non-infectious chronic pathologies is regarded as highly favourable. It was established, that the use of telemedicine tools had a positive effect in patients with HC, T2DM, CP and OA and comorbid ones [15-18]. Physicians could also react promptly to changes and avert complications by remotely monitoring the patient's signs, such as: blood pressure, blood glucose and other vital parameters. This decrease led to a reduced number of hospitalizations, and shortened the duration of them [19,20]. In the care of patients with renal failure, telemedicine services have decreased the rate of hospitalized cases by 10–15% and duration of exacerbations by 15–20% [21,22]. This is an indication that telemedicine has evolved into a legitimate form of health care.

Telemedicine is also very significant in the military medicine service [23]. The practice of foreign countries confirms that the military using telemedicine services, in addition to reducing time for consulting a specialist and accelerating the process of making diagnosis and triage

organization of patients [14,23]. In operational circumstances, one has no opportunity to have multiple specialists available nor always e-resources available. Nevertheless, utilization of these confers a better access to healthcare [24,25]. The telemedicine service also enhances the medical treatment of difficult and remote regions. Pharmacovigilance in a digital environment in such conditions allows for rapid monitoring of the safety of prescribed medications and rapid detection of possible side effects among military patients [26].

In Ukraine, the research is oriented towards studying quality and provisions of telemedicine services in primary health care [3]. Academic researches on the regulation of providing telemedicine services in Ukraine, standardization and integration thereof into the healthcare system of our country [27,28] are numerous. However, the impact of medical telecommunication service on providing and quality and access to care, especially in war conditions where is, emergency mode and limited recourse remain critical [29]. Under these circumstances, with mass destruction, massive lack of personnel and the uncertainty of routes for patients which forces to use telemedicine services, such services can be very important when considering their effect at the global level [29,30].

The research of telemedicine usage and its availability is still very current. This is especially useful in conflict since there is so much movement of people and disruption to logistics. This analysis will provide us with the opportunity to explore the future potential of telemedicine considering present-day issues like war, and pandemics. Although previous studies have examined individual aspects of telemedicine implementation, limited evidence is available regarding the integrated assessment of legal regulation, digital infrastructure, personnel preparedness, and telemedicine accessibility in Ukraine under wartime conditions. Furthermore, insufficient attention has been devoted to comparing Ukrainian telemedicine practices with international healthcare models in the context of healthcare system resilience and post-crisis recovery. The present study addresses these gaps by combining regulatory analysis, literature review, and international comparative evaluation.

The selection of scientific publications and regulatory documents was performed according to predefined relevance criteria. Only sources directly related to telemedicine implementation, digital healthcare systems, legal regulation, telehealth infrastructure, and healthcare accessibility were included in the analysis. Regulatory documents were selected from official governmental sources, including the Verkhovna Rada of Ukraine and the Cabinet of Ministers of Ukraine. International recommendations and policy documents were obtained from official WHO and EU digital health resources.

To improve data validity, duplicate publications and non-authoritative sources were excluded. The relevance and credibility of the selected documents were independently evaluated based on publication source, scientific relevance, regulatory significance, and applicability to the Ukrainian healthcare context.

METHODS

The materials for the study were represented by scientific articles, international recommendations (for Digital Medicine and Telemedicine) and Ukrainian regulatory ones concerning eHealth. The regime is based on three principal documents: the law of Ukraine No. 3301-IX “On Amendments to Some Legal Acts of Ukraine Concerning the Operation of Telemedicine” [31]. Law of Ukraine “Foundations of Ukrainian Legislation on Health Protection” 33 with the addition of Article 35–6 [32]. Resolution of the Cabinet of Ministers of Ukraine No. 411 [33]. This review of the literature contributed to identifying the legal aspects for telemedical service (e.g. data protection regulations, technical standards) and to test which requirements are valid in different settings (e.g. training approach with medical doctors).

The research was carried out in 2024 to 2025. The literature search was conducted using PubMed, Scopus, Google Scholar, and official governmental and international healthcare organization websites. The search strategy included combinations of the following keywords: “telemedicine”, “digital health”, “eHealth”, “teleconsultation”, “telerehabilitation”, “Ukraine”, “wartime healthcare”, and “remote patient monitoring”. Publications published between 2015 and 2025 in English or Ukrainian were considered for analysis. Three primary methodologies were employed: literature review, regulatory document analysis and international experience. The literature review focused on trends of the digital transformation of healthcare, remote care models, the development of online telemedicine services and how to implement them (2015–2025 publications). International papers were examined such as WHO global strategy on digital health 2020–2025 and European interoperability framework for eHealth. Inclusion criteria comprised peer-reviewed scientific publications, official legal and regulatory documents, WHO and governmental reports, and studies addressing telemedicine implementation, digital healthcare infrastructure, legal regulation, or telemedicine accessibility. Exclusion criteria included non-peer-reviewed publications, duplicated studies, conference abstracts without full-text availability, and sources not directly related to telemedicine implementation or healthcare digitalization.

The comparative analysis included examples from US, EU countries, Canada, Israel. In each country was analyzed how the telemedicine services is set up, how are the payments arranged and how digitally developed the medical facilities are. The way doctor-patient relation is set up was looked at. The questions studied were ranging from licensing, standards of medical information to how telemedicine is integrate into the national health program. Barriers of telemedicine development highlighted in the literature were studied in detail: Law requirements, available technical infrastructure, financial support for AI solutions, doctor's digital competence, and user trust. Collected data were structured into themes; law and regulation, infrastructure, interoperability, security, digital literacy, and

organizational barriers. Comparative synthesis of all identified information enabled a detailed comparison and contrast between the Ukrainian model and foreign examples. Through this approach study became more open and verifiable.

The techniques mentioned above provided the information about telemedicine development in Ukraine. It was possible to compare the Ukrainian model with others from different countries, identify where they are different and where improvements could be made. The result from this process was the basis for further recommendations regarding further development of telemedicine in Ukraine.

There are limitations on a comparative analysis, such as differing health care systems and organization, digital development of facilities, funding systems and legal environment of countries. Moreover, the study was performed mainly using secondary data and information from public sources that may restrict the applicability of the results.

FINDINGS

Telemedicine in Ukraine has been found to develop unevenly. For Central and Western Ukraine this value is 1.8–2.3 times higher than for the East and South [30,34]. In over half of the medical centers near large cities remote consultations are held even. Only slightly above one-third of rural centers have the relevant provision. In terms of stable Internet access for high-speed data services only one-third of rural centers in India have it, showing a great divide between urban and rural areas.

The weaknesses of the legal framework and digital infrastructure in Ukraine have already been demonstrated. Over 70% of hospitals and clinics are not connected to a standardized telemedicine system. quality e3 of care is not consistent. Facilities have varying digital systems, and not all of them shield personal information. Institutions experience 50% of an incompatibility between their IT systems vs. EMRs [30,35]. Legal regulation remains incomplete. This impedes the expansion of telemedicine.

A comparison with the level of development of telemedicine and health in some leading countries, which is a priority of Ukraine, shows that our country remains ahead. Telemedicine is covered as part of insurance programs in the US and Canada, so has consistent funding. In the EU, The emphasis is on data protection and standards of security as well as systems that are interoperable. In Israel, applications for mobile devices and tele monitoring are extensively used for chronic illness [7,36]. In Ukraine, telemedicine is at an early stage. While regulations have somewhat been modernized by Law No. 3301-IX and Resolution No. 411, institutions appear to be not digitally prepared for this model of work. Many institutions struggle with technical problems and low digital skills, often coupled with staffs of health care workers who no longer enjoy the trust they once had from their patients. Only about a third of doctors are specially trained. Public knowledge is less than 40% [37,38]. The establishment of an effective telemedicine

Table 1: Summary of Key Findings on Telemedicine Implementation in Ukraine, Including Regional Disparities, Regulatory Challenges, Workforce Preparedness, and the Impact of COVID-19 and the War

Aspect	Basic data
Regional differences	Center and west: 1.8–2.3 times more often than east/south; frontline <30% of institutions; villages: 28% of outpatient clinics with internet access
Regulatory issues	>70% – no standards; 62% – weak data protection; 48% – platform incompatibility
Personnel and educational barriers	37% of medical professionals have undergone training; digital literacy among patients is 42%.
The impact of COVID-19 and the war	Remote consultations ↑ >3×; telemonitoring: 8→26%; destroyed regions ↑ 40–55%

Source: Filip *et al.* [36], Raunaq *et al.* [7], Havelikar *et al.* [40], Riabkov [30]

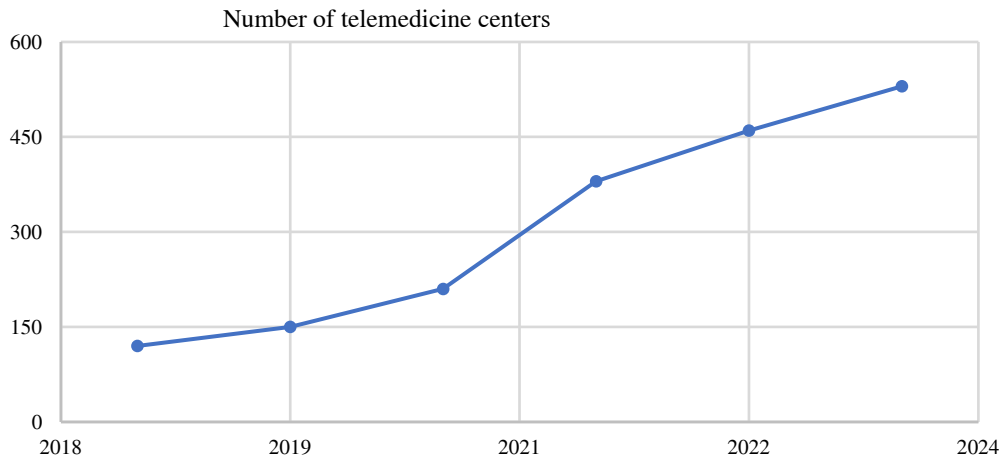


Figure 1: Trends in Telemedicine Implementation in Ukraine During 2020–2024, including Teleconsultation and Telemonitoring Dynamics across Pandemic and Wartime Periods

Source: Cabinet of Ministers of Ukraine [43]

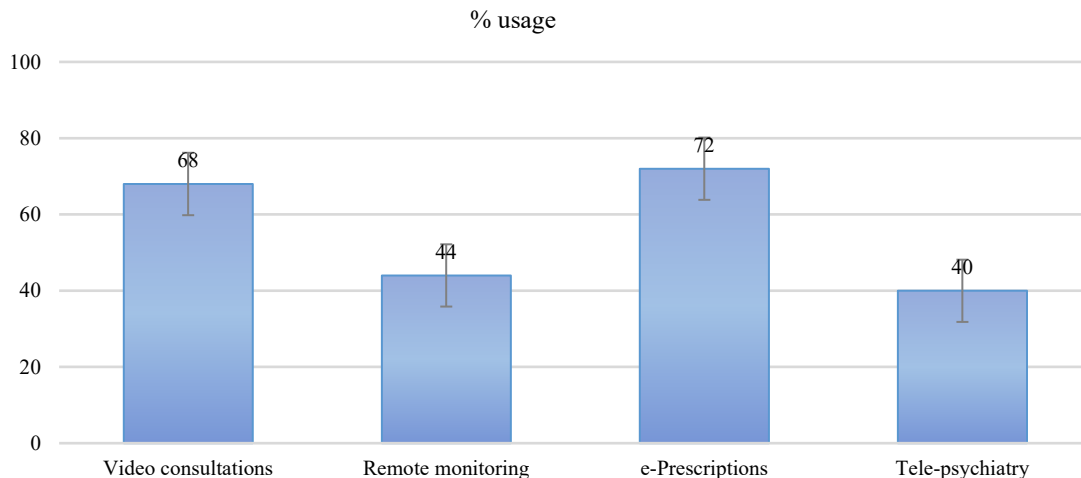


Figure 2: Distribution of Telemedicine Services Across Different Regions of Ukraine in 2023, with Emphasis on Service Utilization in Rural, Urban, and Conflict-Affected Areas

Source: Cabinet of Ministers of Ukraine [43]

system in Ukraine necessitates the implementation of transparent regulatory mechanisms that align with European standards of anti-corruption governance [39] (Table 1).

It is criticized that there isn't a comprehensive legal system available. A lot of people are worried about flimsy personal data safeguards. Integration of data in electronic medical records is generally complicated due to the adoption of heterogeneous platforms. This erodes the trust of health care providers and patients, and impedes the progress of telemedicine [30,40].

Our analysis indicates that telemedicine is highly affected by COVID-19 as well as the war. Figure 1 shows

that the volume of remote consultations in 2020–24 is close to three times higher. Among them, the proportion of telemedicine usage in chronic patients increased from 8 to 25%. In regions troubled by war or where a portion of the medical infrastructure is disrupted, telemedicine usage has increased 40–50%. This demonstrates that telemedicine is a crucial means to obtain medical services in time-critical circumstances [41,42].

In war-affected regions, telemedicine utilization increased by approximately 40–55%, reflecting the intensified reliance on remote healthcare services due to

infrastructure disruption and population displacement. In military medicine, it decreases waiting time for consultation from 6 to 8 h--to--1to2h. In psychiatry, telemedicine use boosts treatment compliance by 15–20% and results in a decrease of missed appointments by 25–30%. Telemedicine consultations have also been reported to enhance the rehabilitation of war victims. This contributes to the arrival of a smoother transition between healthcare components, and ultimately enhances recovery success [44,45] (Figure 2).

Ukraine already has a certain legislative baggage on telemedicine. The Telemedicine Development Strategy for Ukraine specifies the priorities of digital transformation and envisages the development of technical and clinical protocols until 2025. Based on MoH and eHealth system, integration of telemedicine services is a strategic activity with the purpose to increase availability and quality of medical assistance. However, in order to ensure the full functionality of telemedicine, it is necessary to develop interoperability standards and quality protocols as well as mechanisms of cybersecurity that have not been enough regulated yet [43,46]. Telemedicine can be considered a strategic innovation, the implementation of which requires a systematic approach to choosing a development model and assessing risks [47]. Ukraine is gradually adopting international best practice – but systems need to be developed and strengthened technically, through coordination with the healthcare system.

In conclusion, the role of telemedicine in Ukraine is gaining more importance to provide efficient and available medical service, in particular during crises. It must find answers to challenges and barriers, in regulatory, technical and organisational issues; it is necessary to strengthen the security of cyberspace and to reinforce the digital literacy of healthcare workers and to create confidence in health technology by the public. Ukraine has favourable circumstances for a further expansion of telemedicine, however the realization of this will depend on a modernization of the system in the infrastructure, legislation and clinical working methods.

DISCUSSION

These obtained data are consistent with international studies, and indicate specifics of telemedicine introduction into practice in Ukraine. In the telemedicine sector, as against the developed countries, healthcare professionals that are taking part in everyday telecommunication consultations operate under a precise and strict legal regime over quality of medical services together with licensed obligations and over information security [48,49]. In Ukraine, it is a field which is still incomplete especially with regard to quality standards, liability and funding mechanisms for telemedicine consultations. In addition, the problem of funding of telemedicine consultation on the regional basis remains unsolved in Ukraine, thus slowing down the widespread introduction. The effectiveness of telemedicine introduction into practice highly depends on state policy over the training of the specialists and introduction of information education [50].

There are social obstacles in Ukraine too. Many patients are afraid of telemedicine. This limitation with digital literacy of doctors and patients is still a big barrier in telemedicine introduction [51,52]. Concepts on technology adoption theory showed that factors like trust and usefulness can be the predictors of success of telemedicine introduction [53-56].

Based on analysis, we suggest that Ukraine need complex approach. Law system must consist of information on organization of telemedicine service provision and what in law is considered as a telemedicine decision, also a clear funding model on reimbursement for consultations within insurance should be present. The technical part is the preparation of infrastructure, internet connection, unification of the equipment and integration of telemedicine into the e-health. High-priority actions of Ukraine could include the formation of unified state standards on telemedicine, expansion of the high-speed internet access in rural and frontier regions, integration of telemedicine platforms with the e-health system of Ukraine, introduction of the cybersecurity measures and permanent education of health care professionals.

We also consider an educational part significant as well. Doctors need to be trained and people's digital literacy needs to be improved. The PR on benefits and security of telemedicine is vital. Funding plan should be applied in order to improve it on the level of the healthcare facilities, and mainly on the rural, remote and front-line.

This will help to improve the performance and to develop use of telemedicine. As despite of difficulties, telemedicine promises to Ukraine to make medical aid accessible during war and rehabilitation phase; therefore this policy topic is highly important.

Limitations

This study has some limitations. Firstly, the study largely depends on the review of secondary literature and regulations using a narrative review method and hence lacks robust quantitative evaluation of outcomes. Secondly, the focus is on the Ukrainian healthcare system, as such, not all the results are applicable to other countries. Finally, possible literature selection bias can't be excluded, even though, the selection criteria were pre-defined.

Future Recommendations

- Create uniform nationwide standards for telemedicine that conform to EU regulations
- Increase broadband and digital infrastructure in rural areas and the frontline
- Enhance interconnection of telemedicine systems with the national eHealth system
- Enhance cyber security and personal data protection.
- Establish continuous training programs in telemedicine and digital competence for health professionals
- Enhance public awareness and confidence in remote healthcare services

CONCLUSIONS

The research concluded that telemedicine is the most promising way of providing access to healthcare in Ukraine. This is extremely significant during a period of war, as well as when the distribution of medical resources is unfair. It was found that different regions utilize telemedicine quite differently. There is more use of remote services in the central/western than eastern/southern regions.

It has been acknowledged that the regulatory architecture remains embryonic and needs further elaboration. Low digital literacy among both healthcare professionals and patients remains a significant barrier. It is reported that poor technical support interrupts the progression of telemedicine and application in clinical practice. Comparison with telemedicine systems in the US, Canada, the EU, and Israel demonstrates significant gaps in interoperability, reimbursement mechanisms, and technical standards in Ukraine.

Telemedicine has been demonstrated to be particularly effective in underserved or remote communities, military medicine, mental health, and rehabilitation. When there is an increase in the number of remote consultation and active use of telemonitoring in affected regions, such as occurred during 2020–2024, the high value of telemedicine importance is confirmed.

The need for systematic measures to implement telemedicine in the practice in Ukraine has already been proven. Priority policy measures should include harmonization of telemedicine legislation with European standards, expansion of digital infrastructure in rural and frontline regions, integration with the national eHealth system, improvement of cybersecurity mechanisms, and continuous professional training in digital healthcare. It is also necessary to transpose important legal framework and set up standards. Digital infrastructure has to be implemented, and these telemedicine platforms are to be embedded into the eHealth system. Finally, appropriate education actions should be set up, in order to increase healthcare providers' digital skills and the public confidence in telemedicine.

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Conflict of Interest

The authors declare no conflicts of interest.

Ethical Statement

This study used only publicly available literature and regulatory documents. No human participants, personal medical records, or confidential data were involved in the study.

Availability of Data and Material

The data will be available with the corresponding author and will be made available upon request via email.

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