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THE ROLE OF TELEMEDICINE AMID WORKFORCE AND DEMOGRAPHIC CHANGES IN UKRAINE

Introduction Russia's full-scale invasion has disrupted Ukraine's health care system, intensified demographic pressures, and deepened health workforce constraints. These changes have increased the economic relevance of telemedicine beyond its conventional role as a channel of remote consultation.

Aim: The study aims to substantiate the role of telemedicine as an economic instrument for maintaining access, continuity, resilience, and efficiency of medical care in Ukraine during war and post-war recovery.

Methods: The article applies a conceptual narrative review of peer-reviewed literature and institutional reports on telemedicine economics, digital health, demographic change, wartime migration, health workforce transformation, and recovery planning. The study uses analysis and synthesis, comparative analysis, logical-structural generalization, and conceptual modelling.

Results: Telemedicine is shown to influence the health care system through several economic channels: reduction of patients' indirect costs, partial substitution of face-to-face contacts, support for chronic disease monitoring, redistribution of specialist resources, and improved coordination through eHealth infrastructure. Demographic contraction, population ageing, internal displacement, refugee uncertainty, and regional heterogeneity increase demand for flexible models of care. Health workforce shortages make remote consultation, expert support, triage, and follow-up care economically relevant.

Conclusions: Telemedicine in Ukraine should be considered not as a temporary crisis response but as a component of healthcare system modernization. Its economic value depends on integration into clinical pathways, financing mechanisms, data governance, workforce policy, equitable digital access, and reliable monitoring of outcomes across regions and patient groups with unequal access to medical services and specialist care locally.

Keywords: telemedicine; digital health; health economics; workforce; demographic change; eHealth; Ukraine; post-war recovery; health system resilience; health care access.

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РОЛЬ ТЕЛЕМЕДИЦИНИ В УМОВАХ КАДРОВИХ І ДЕМОГРАФІЧНИХ ЗМІН В УКРАЇНІ

Вступ. Повномасштабна війна змінила умови функціонування системи охорони здоров'я України: зруйнована інфраструктура, міграція населення, старіння, кадровий дефіцит і нерівний територіальний доступ посилили потребу в гнучких моделях надання медичних послуг. У цих умовах особливого значення набуває пошук, економічний аналіз та обґрунтування цих моделей. У статті розглядається телемедицина як один із можливих інструментів досягнення гнучкості та стабільності системи охорони здоров'я в умовах війни та після військового відновлення в Україні.

Мета. Обґрунтувати телемедицину як економічний інструмент підтримання доступності, безперервності, стійкості та ефективності медичної допомоги в умовах війни, демографічних зрушень, трансформації медичних кадрів і післявоєнного відновлення.

Методи. Дослідження виконано як концептуальний наративний огляд наукових публікацій та аналітичних матеріалів щодо економіки телемедицини, цифрового здоров'я, міграції, демографічних втрат, кадрового забезпечення й реконструкції системи охорони здоров'я. Використано аналіз, синтез, порівняння, логіко-структурне узагальнення та концептуальне моделювання. Первинні емпіричні дані не збиралися, тому робота не оцінює причинні або грошові ефекти.

Результати. Телемедицина визначена як елемент адаптації медичної системи до обмеженої фізичної доступності послуг і нерівномірного розподілу медичних ресурсів. Її економічне значення полягає у зменшенні непрямих витрат пацієнтів, частковій заміні очних контактів, підтримці моніторингу хронічних захворювань, раціональнішому використанні спеціалістів і посиленні координації через інфраструктуру eHealth. Демографічне скорочення, внутрішнє переміщення, зовнішня міграція, старіння та регіональна неоднорідність формують асиметричний попит на медичні послуги, що підвищує значення дистанційних консультацій, маршрутизації пацієнтів і подальшого спостереження. Виокремлено компенсаторну, ресурсну, демографічну, відновлювальну та інституційну функції телемедицини, які пов'язують доступ до допомоги, продуктивність персоналу, гнучкість системи, планування відновлення та цифрове управління медичними процесами.

Висновки. Телемедицину доцільно розглядати не як тимчасову кризову практику, а як складову модернізації та післявоєнного відновлення системи охорони здоров'я України. Її ефект залежить від інтеграції в клінічні маршрути, фінансування, кадрову політику, управління даними, цифрову доступність і моніторинг результатів на регіональному рівні для пацієнтів.

Ключові слова: телемедицина; цифрове здоров'я; економіка охорони здоров'я; кадровий потенціал; демографічні зміни; eHealth; Україна; післявоєнне відновлення; стійкість системи охорони здоров'я; доступність медичної допомоги.

JEL Classification: I15; I18; H51; J11; J21; O33.

Russia's full-scale invasion of Ukraine has substantially transformed the operating conditions of Ukraine's health care system, simultaneously exacerbating infrastructural, demographic, workforce-related, and fiscal and economic constraints. The destruction of and damage to medical infrastructure, population displacement, and the increased demand for medical care among internally displaced persons, veterans, individuals with chronic diseases, and populations residing in areas with limited access to health services have shaped a new structure of demand for medical care. Under these conditions, telemedicine and digital health services are important not only as technological instruments of communication between physicians and patients, but also as elements of the economic adaptation of the health care system to wartime conditions and subsequent recovery.

The development of eHealth infrastructure in Ukraine has created an institutional foundation for scaling digital health solutions, including electronic medical records, electronic referrals, electronic prescriptions, and tools for remote interaction among patients, physicians, and health care institutions. The Ukrainian eHealth system has undergone substantial regulatory and technological institutionalization, which allows it to be regarded as a core institutional platform for the further development of digital health care (Malakhov,

2023). In wartime conditions, this infrastructure has acquired additional significance, as the physical accessibility of health care facilities has become uneven, while traditional channels for delivering medical care have been constrained by hostilities, disrupted logistics, population migration, and workforce losses.

In Ukraine's wartime context, telemedicine performs several interrelated functions. It supports the continuity of medical care in situations where face-to-face contact between patients and physicians is difficult or impossible; it also reduces part of the transaction costs of the health care system associated with patient travel, repeated visits, waiting times for consultations, and care coordination. Telemedicine solutions may partially mitigate territorial disparities in access to medical services, particularly in regions with damaged infrastructure or insufficient workforce capacity. Available empirical evidence on the use of telemedicine in Ukraine during the war indicates that remote consultations have become one of the mechanisms for maintaining access to medical care under crisis conditions (Narayan et al., 2024; Poberezhets et al., 2022). Under such conditions, the economic significance of telemedicine cannot be reduced solely to an assessment of the direct cost reduction associated with an individual consultation. International studies emphasize that the economic effectiveness of telemedicine and digital health interventions depends on the organizational model, scale of implementation, patient profile, cost structure, degree of integration with the conventional system of health care delivery, and capacity to substitute, rather than merely supplement, face-to-face services (McNamee et al., 2016; Snoswell et al., 2020; Wade et al., 2010). For Ukraine, the economic effect of telemedicine should be examined through its impact on access to care, continuity of treatment for chronic diseases, reduction of indirect losses, support for population working capacity, rationalization of workforce resources, and strengthening of health system resilience.

The war has intensified the demographic challenges that existed in Ukraine before 2022. After the beginning of the full-scale invasion, these processes were compounded by large-scale external and internal population displacement, changes in the age and sex structure of the population, human capital losses, and uncertainty regarding the return of refugees. The literature emphasizes that war and migration may substantially alter Ukraine's long-term demographic trajectory, while adverse demographic changes are directly associated with the prospects for economic recovery and the condition of the labour market (Kulu et al., 2023; Tverdostup, 2023). On the one hand, population decline and ageing increase the burden on the health care system, expanding the need for long-term monitoring, treatment of chronic diseases, rehabilitation, and support for patients' functional autonomy. On the other hand, migration and the territorial redistribution of the population change the geography of demand for medical services and require more flexible models of care delivery. In this context, telemedicine may be regarded as a mechanism for adapting the health care system to spatial and age-structure asymmetries in demand for health services.

The role of digital solutions is increasing under conditions of workforce transformation in the health care system. The war has led to a growing workload for medical workers, their internal and external migration, professional burnout, changes in working conditions, and the need for rapid redistribution of competencies. Studies indicate a high adaptive burden on medical workers and the need to maintain the resilience of the health workforce under wartime conditions (Deac et al., 2024; Diakunchak et al., 2024). At the same time, issues related to the training of medical personnel and the transformation of medical education have acquired strategic importance for post-war recovery (Mayer et al., 2023). Under these conditions, telemedicine may perform not only a service function but also an organizational and health workforce management function, enabling the redistribution of expert resources, supporting remote consultations, strengthening primary health care, and ensuring access to specialists in regions with workforce shortages.

Ukraine's post-war recovery will require not only the physical reconstruction of destroyed infrastructure but also a reconsideration of the model of health care delivery. Recovery needs assessments emphasize the scale of damage and the necessity of long-term reconstruction planning, including social infrastructure and the health care system (World Bank et al., 2025). Digital health may become one of the instruments for improving system resilience, economic efficiency, and governance capacity. However, the potential of telemedicine is not automatic: it depends on regulatory integration, financing, the digital literacy of medical workers and patients, data quality, cybersecurity, trust in remote services, and the capacity of the health care system to use digital tools as part of clinical pathways rather than as an isolated technological solution (Mudge et al., 2025; World Health Organization, 2024).

Despite the growing number of studies devoted to digital health, telemedicine, and the impact of the war on Ukraine's health care system, the relationship between the economics of telemedicine, demographic change, and the workforce transformation of the medical system remains insufficiently studied. Most existing works examine digital infrastructure and eHealth, migration and demographic losses, the resilience of medical care, workforce challenges, or the economic evaluation of digital interventions as separate aspects. The scientific problem lies in the need for an integrated analysis of telemedicine as an economic mechanism for adapting the health care system to demographic and workforce changes during war and recovery.

The aim of the study is to provide a theoretical and analytical substantiation of the role of telemedicine as an economic instrument for maintaining the accessibility, resilience, and efficiency of medical care in Ukraine under conditions of wartime, post-war recovery, demographic change, and transformation of the health care workforce. To achieve this aim, the study seeks to systematize scientific approaches to the economic evaluation of telemedicine, identify demographic and workforce-related factors affecting the demand for and supply of medical services, and substantiate directions for the use of telemedicine solutions in the model of recovery and modernization of Ukraine's health care system.

Literature review.

Early systematic reviews indicated that the economic performance of telemedicine depends substantially on the specific service model, disease type, frequency of contacts, equipment costs, organization of the patient pathway, and degree of integration of remote consultation into the existing health care system (Wade et al., 2010). This is of fundamental importance for the analysis of Ukraine, since under wartime conditions telemedicine is not an isolated technological innovation but part of a broader system of adaptation of medical care to constraints on physical accessibility, workforce shortages, and the territorial redistribution of the population. In subsequent studies, the focus shifted from a simple assessment of the cost of a telemedicine consultation to the analysis of the systemic effects of digital health interventions. It has been shown that, under certain conditions, telemedicine can reduce health system costs if it substitutes for some face-to-face visits, decreases unnecessary hospitalizations, reduces transport and time costs, improves monitoring of patients with chronic diseases, and does not lead to excessive use of medical services (Snoswell et al., 2020). Therefore, the economic effect of telemedicine should be assessed not only through direct medical costs but also through patients' indirect costs, working time losses, the workload of medical personnel, and the resilience of care delivery. Methodological studies on the economic evaluation of digital health interventions emphasize that such interventions require a specific research design, as their effectiveness depends on the implementation context, user behaviour, digital literacy, scale of use, and interaction with existing organizational processes (McNamee et al., 2016). In this respect, telemedicine differs from traditional medical technologies, since its economic value is formed not only by clinical outcomes but also by changes in the process of care delivery, the accessibility of medical resources, workload distribution, and the governance capacity of the health care system. Reviews of cost-effectiveness and cost-utility studies show that digital and telemedicine interventions may be economically justified in various clinical areas; however, the level of evidence is heterogeneous and depends on data quality, the time horizon of evaluation, the choice of comparator, and the inclusion of indirect costs (de la Torre-Díez et al., 2015). For countries with limited resources and unstable infrastructure, not only the cost of the technology but also its capacity to maintain continuity of medical care when usual access channels are disrupted is of particular importance. Contemporary approaches to the evaluation of digital health propose considering the economic value of digital interventions as a multilevel category that includes clinical effectiveness, resource savings, expanded access, improved data management, decision-making support, and increased health system resilience (Wilkinson et al., 2024). Studies devoted to digital health in Ukraine indicate the existence of an institutional foundation for the further scaling of telemedicine solutions. The Ukrainian eHealth system is regarded as a set of digital tools that includes electronic medical records, electronic prescriptions, electronic referrals, and legally established mechanisms for the exchange of medical information (Malakhov, 2023). This creates the preconditions for a transition from the fragmented use of telemedicine to its integration into clinical pathways, health care financing, and the health system governance framework. Experience with the use of telemedicine in Ukraine during the war shows that remote medical services have acquired the significance of a crisis response instrument. A questionnaire-based study of Ukrainian physicians documented changes in telemedicine practices under the influence of the war, reflecting the

adaptation of medical workers' professional behaviour to new conditions of care delivery (Poberezhets et al., 2022). The international TeleHelp Ukraine model also demonstrates the possibility of a distributed telemedicine response to a humanitarian crisis, in which remote consultations are used to support patients who lack stable access to conventional medical infrastructure (Narayan et al., 2024). The wartime situation has substantially changed not only the demand for medical services but also the conditions under which they are delivered. Studies on the resilience of primary health care in Ukraine show that the health care system simultaneously experienced the consequences of the COVID-19 pandemic and the full-scale war, which intensified the burden on primary care, organizational resources, and the capacity to ensure continuity of care (Dale et al., 2024). In this context, telemedicine may be considered one of the instruments for maintaining the resilience of primary health care, particularly when remote support is required for patients with chronic diseases and for populations displaced as a result of the war. A comparative analysis of Ukrainian hospital services before and during the war shows that hostilities affected the accessibility and functional capacity of medical institutions, thereby increasing the importance of alternative channels for delivering medical care (Haque et al., 2024). Systematic reviews and analytical studies on the crisis of Ukrainian health care indicate the need to combine short-term humanitarian response with long-term reconstruction that includes sustainable digital solutions (Goniewicz et al., 2023). The study by Kulu et al. emphasizes that the scale of external migration and the possible non-return of part of the population may affect the future size and structure of Ukraine's population (Kulu et al., 2023). Analytical assessments of demographic challenges indicate a relationship between demographic contraction, labour potential, and the prospects for economic recovery (Tverdostup, 2023). Ukrainian studies of wartime migration emphasize that population displacement has not only humanitarian but also long-term socio-economic significance. Wartime migration affects household structure, the regional distribution of the population, and access to employment, medical care, and social services (Libanova, 2024). Methodological difficulties in assessing demographic losses under wartime conditions further complicate the planning of medical infrastructure and the forecasting of demand for medical services (Puhachova, 2024). Studies document an increase in professional workload, changes in working conditions, risks of emotional exhaustion, and the need for medical workers to adapt to care delivery under conditions of uncertainty (Deac et al., 2024). Publications on the leadership and resilience of Ukrainian physicians emphasize the importance of professional self-organization, adaptive management, and the capacity of medical teams to maintain care delivery under conditions of damaged infrastructure and increased demand (Diakunchak et al., 2024). Workforce changes have direct economic significance, since shortages of specialists, migration of medical workers, and the uneven distribution of personnel increase the cost of access to medical care and limit the productive capacity of the health care system. The health labour market analysis in Ukraine prepared by the World Health Organization indicates the need for a systemic understanding of workforce capacity, imbalances, and the conditions for its recovery (World Health Organization, 2024). Under conditions of workforce shortages, telemedicine may potentially enable the redistribution of expert resources, expand access to specialist consultations, and reduce the burden on individual institutions; however, this potential requires organizational and financial integration. The needs analysis of Ukrainian medical schools shows that the war has changed the conditions of education, communication, practical training, and professional development of future physicians (Mayer et al., 2023). Therefore, digital technologies in health care should be considered not only as a tool for service delivery but also as part of a new model of professional training, distance learning, clinical mentoring, and support for workforce reproduction. The literature on the future of Ukrainian health care emphasizes that post-war recovery should take into account not only the need to reconstruct damaged facilities but also the possibility of institutional renewal of the system based on digital solutions. Digital transformation is regarded as a potential mechanism for improving the transparency, efficiency, governance capacity, and resilience of medical care (Mudge et al., 2025). At the same time, assessments of Ukraine's recovery needs indicate the scale of reconstruction tasks and the need for long-term investment in social infrastructure, including health care (World Bank et al., 2025).

The literature analysis indicates the existence of several interrelated research areas: the economic evaluation of telemedicine and digital health interventions; the development of eHealth and telemedicine in Ukraine; the impact of the war on the accessibility and resilience of medical care; the demographic consequences of the war; workforce transformation in the health care system; and the post-war reconstruction of medical infrastructure. Existing studies predominantly examine these areas separately. An

integrated approach, in which telemedicine is analysed as an economic mechanism for adapting Ukraine's health care system to the simultaneous effects of demographic change, workforce constraints, wartime risks, and the objectives of post-war recovery, remains insufficiently developed.

Materials and Methods.

The study was designed as a conceptual narrative review of peer-reviewed literature and institutional analytical materials on the economics of telemedicine, digital health, demographic change, and workforce transformation in Ukraine. The information base comprised peer-reviewed publications, systematic reviews, institutional reports, and analytical materials of international organizations devoted to the economic evaluation of telemedicine, the development of eHealth, the impact of the war on Ukraine's healthcare system, wartime migration, demographic losses, workforce provision, and post-war recovery. The study employed methods of analysis and synthesis, comparative analysis, logical-structural generalization, and conceptual modelling. No primary empirical dataset was generated; therefore, the study does not estimate causal or monetary effects. Analysis was used to identify the key economic, demographic, and workforce-related factors influencing the development of telemedicine. Synthesis was used to integrate the identified factors into a unified analytical framework. Comparative analysis made it possible to compare international approaches to the economic evaluation of telemedicine with the operating conditions of Ukraine's health care system during the period of war and recovery.

Results.

The analysis indicates that, during war and recovery, telemedicine in Ukraine has not only clinical but also significant economic importance. Its role is determined by the combined effects of disrupted physical access to medical care, demographic contraction and population displacement, workforce shortages in the health care system, and the need to reconstruct medical infrastructure.

Table 1 systematizes the key constraints affecting the functioning of Ukraine's health care system and the role of telemedicine in mitigating them.

Table 1

Key Determinants of the Role of Telemedicine in Ukraine's Health Care System during War and Recovery

Factor	Change in the Health Care System	Significance of Telemedicine
Damage to and overload of medical infrastructure	Restricted physical access to health care facilities; changes in patient pathways	Support for continuity of care; reduction of transport and time costs
Internal and external population displacement	Territorial redistribution of demand for medical services	Expansion of access to consultations regardless of the patient's location
Demographic contraction and population ageing	Increased relative need for chronic disease monitoring and rehabilitation	Support for long-term monitoring and reduction in the frequency of unnecessary face-to-face visits
Workforce changes in health care	Shortage of specialists, professional overload, uneven distribution of personnel	Rationalization of expert resource use; remote consultations
Post-war recovery	Need for infrastructure reconstruction and increased system resilience	Integration of digital solutions into a new model of medical care organization

Source: Authors' compilation based on Dale et al. (2024), Malakhov (2023), and World Health Organization Regional Office for Europe (2024).

The obtained results indicate that the economic effect of telemedicine in Ukraine should not be assessed solely through the cost of a remote consultation. More significant is its systemic impact on reducing patients' indirect costs, supporting access to care in regions with limited infrastructure, rationalizing the use of medical personnel, and reducing the risk of interruptions in the treatment of chronic diseases. Table 2 presents the main economic channels through which telemedicine affects the health care system.

Table 2

Economic Channels of the Impact of Telemedicine on Ukraine's Health Care System

Impact Channel	Economic Content	Expected Systemic Result
Reduction of transaction costs	Reduction of time and financial costs associated with physically seeking medical care	Improved accessibility of services and reduction of patients' indirect losses
Substitution of some face-to-face contacts	Transfer of some consultations and monitoring to a remote format	Reduced burden on outpatient care and medical infrastructure
Support for patients with chronic diseases	Remote monitoring and follow-up consultations	Reduced risk of treatment interruptions and complications
Redistribution of workforce resources	Use of remote specialist consultations for regions with workforce shortages	More rational use of limited medical personnel
Data management	Use of eHealth infrastructure to coordinate medical pathways	Improved governance capacity of the health care system

Source: Authors' compilation based on Snoswell et al. (2020), Wade et al. (2010), Wilkinson et al. (2024).

The war has changed both the size and spatial distribution of the population and, consequently, the geography of demand for medical services. Forced migration, uncertainty regarding the return of refugees, internal displacement, and population ageing create geographically and demographically asymmetric demand for medical care. This increases the importance of remote models of medical service delivery, particularly for patients with chronic diseases, older people, internally displaced persons, and residents of regions with limited access to medical infrastructure. Table 3 summarizes demographic changes and their relationship with the need for telemedicine.

Table 3

Demographic Changes in Ukraine and the Significance of Telemedicine

Demographic Change	Impact on Medical Services	Significance of Telemedicine
International population migration	Disruption of stable links between the patient, physician, and health care institution	Possibility of maintaining remote contact with the health care system
Internal population migration	Increased burden on health care institutions in receiving regions	Redistribution of some consultations to a remote format
Population ageing	Increased need for chronic disease monitoring	Remote monitoring and follow-up consultations
Regional population heterogeneity	Mismatch between the location of patients and medical resources	Expanded access to specialists regardless of territory
Uncertainty regarding the return of refugees	Difficulty of long-term planning of medical infrastructure	Flexible model of medical service delivery

Source: Authors' compilation based on Kulu et al. (2023), Libanova (2024), Tverdostup (2023).

Under conditions of specialist shortages, professional overload, and the territorial imbalance of medical personnel, telemedicine consultations may be used to provide primary health care, expert support for complex cases, and improved access to specialized care. Figure 1 illustrates the conceptual relationship between demographic change, workforce constraints, and the economic function of telemedicine.

The quantitative context of recovery confirms the scale of the economic burden. Ukraine's total recovery and reconstruction needs are estimated at USD 524 billion over the next decade, while the recovery and reconstruction needs of the healthcare sector are estimated at USD 19.4 billion over the next ten years (Ministry of Health of Ukraine, 2025; World Bank et al., 2025). This demonstrates that digital solutions in health care delivery should be treated as part of recovery planning and as an economically justified component of healthcare system reconstruction.

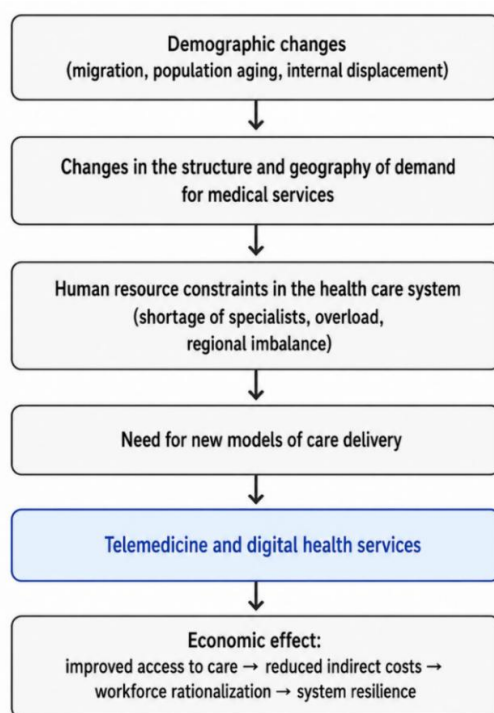


Fig 1. Relationship Between Demographic Factors, Workforce Factors, and the Economic Role of Telemedicine in Ukraine

Source: Authors' compilation based on Deac et al. (2024), Kulu et al. (2023), World Health Organization Regional Office for Europe (2024).

The synthesis of the results makes it possible to identify five economic functions of telemedicine in Ukraine's health care system during the wartime and post-war periods (Figure 2).

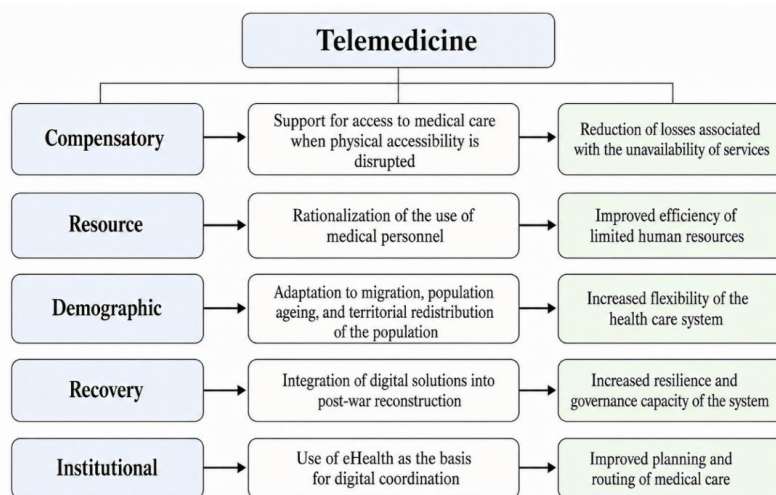


Fig 2. Functions of Telemedicine in the Health Care Economy of Ukraine during the Wartime and Post-War Periods

Source: Authors' compilation based on Malakhov (2023), Mudge et al. (2025), Wilkinson et al. (2024).

The compensatory function is manifested in the partial mitigation of constraints on the physical accessibility of medical care. The resource-related function is associated with the more rational use of medical personnel through remote technologies. The demographic function reflects the capacity of telemedicine to adapt the healthcare system to changes in the size, structure, and territorial distribution of

the population. The recovery function consists in the possibility of integrating digital health services into a new model of post-war reconstruction of the healthcare system. The institutional function reflects the use of eHealth infrastructure as a basis for digital coordination, patient routing, and data-driven governance of care.

Discussion.

The economic role of telemedicine in Ukraine should be considered in the context of the simultaneous influence of wartime, demographic, and workforce-related factors. Compared with stable health care systems, where telemedicine is often analysed as an additional channel of care delivery, in Ukraine it functions as an adaptive mechanism. This is because the war has changed not only the accessibility of medical infrastructure but also the spatial distribution of patients, the structure of population needs, and the capacity to allocate health workforce resources. The economic effectiveness of telemedicine is not a universal characteristic of the technology itself. It depends on whether the remote format substitutes for some face-to-face visits, reduces patients' indirect costs, decreases the burden on institutions, and is integrated into existing clinical pathways (Snoswell et al., 2020; Wade et al., 2010). For Ukraine, this means that telemedicine should not be assessed only by the cost of a consultation or the number of remote contacts. More significant is its impact on the organization of access to care under conditions of disrupted infrastructure and changes in the geography and structure of demand for medical services. Demographic changes increase the economic significance of telemedicine because they alter the basic parameters of medical care planning. International migration, internal displacement, population ageing, and uncertainty regarding the return of refugees create a situation in which the traditional model of territorial attachment of the patient to medical infrastructure becomes less stable. This is particularly important for chronic diseases, preventive monitoring, follow-up consultations, and rehabilitation. Under such conditions, digital channels of interaction may reduce the patient's dependence on a specific place of residence while maintaining continuity of contact with the physician and the healthcare system.

The extent to which telemedicine can compensate for demographic contraction and population redistribution remains a subject of debate. It cannot replace physical infrastructure, inpatient care, emergency medicine, or face-to-face clinical examination. However, its significance increases in those segments where medical services are based primarily on consultation, monitoring, data interpretation, therapy adjustment, or patient routing. Therefore, the economic potential of telemedicine is not in the complete substitution of traditional care, but in the rational redistribution of forms of contact between the patient and the healthcare system.

Under conditions of specialist shortages and the territorial unevenness of the distribution of medical personnel, remote consultations can expand access to expert resources without the physical relocation of the physician or patient. This is particularly important for regions with limited access to specialized care. At the same time, telemedicine does not eliminate the workforce shortage itself. If poorly organized, it may increase the workload of physicians by generating additional consultations, duplicating face-to-face and remote consultations, or lacking clear criteria for the clinical appropriateness of the remote format. Therefore, the organizational model of implementation is of fundamental importance. Telemedicine generates an economic effect only when it is embedded in patient pathways, has clear grounds for use, is linked to electronic medical records, and does not lead to the parallel duplication of processes. In this respect, Ukraine's eHealth infrastructure is an important precondition, as it creates a digital basis for coordinating medical data, referrals, prescriptions, and interaction among participants in the healthcare system (Malakhov, 2023).

In the context of post-war recovery, telemedicine should be regarded not as a temporary crisis measure but as one of the elements of modernization of the health care delivery model. Wartime destruction of infrastructure creates a need not only to restore facilities but also to reconsider the very principles of access to medical care. Digital tools should be embedded in the recovery of primary health care, specialist consultations, rehabilitation, mental health care, and support for patients with chronic diseases. Such use requires institutional consolidation, the development of financial models, data protection, personnel training, and assessment of the clinical safety and appropriateness of remote forms of care.

Particular importance should be attached to distinguishing between digitalization as infrastructure and telemedicine as a complex of medical services. The presence of electronic records, prescriptions, or referrals does not automatically imply the development of telemedicine. An economic effect arises only when there is a functional link between digital infrastructure and the actual process of care delivery. For Ukraine, it is

critically important not only to expand digital services but also to incorporate them into the systems of financing, patient routing, quality control, and evaluation of medical care outcomes. In international approaches to the evaluation of digital health interventions, increasing importance is attached to the conditions under which a given technology is used. Wartime conditions, infrastructure destruction, migration, workforce changes, and limited financial resources distinguish the Ukrainian context from standard models of telemedicine evaluation developed for stable healthcare systems. The economic evaluation of telemedicine in Ukraine should take into account not only direct costs and clinical outcomes, but also the resilience of access, indirect costs, territorial disparities, workforce burden, and the capacity of the system to maintain continuity of care under crisis conditions (Wilkinson et al., 2024).

It should be noted that telemedicine can not only expand access to care but may also intensify barriers for population groups with low digital literacy, limited internet access, older patients, persons with disabilities, or residents of areas with unstable connectivity. Therefore, the economic effectiveness of telemedicine depends not only on potential resource savings but also on the costs of ensuring equitable access, user training, technical support, and adaptation of services to the needs of socially vulnerable groups. Sustainable use of remote medical services requires patients' trust in the quality of consultations, the protection of medical data, and the physician's capacity to make clinically justified decisions without face-to-face contact. Medical protocols for the provision of telemedicine services, clear patient routing, legal certainty, technical support, and safeguards against unjustified workload growth are necessary. Without these conditions, telemedicine may remain a fragmented practice, and its economic potential will be limited.

Workforce transformation in healthcare makes telemedicine part of a broader discussion on the productivity of the health workforce. Under conditions of a limited number of specialists, models that enable more rational use of expert resources are of particular importance. Formats such as remote consultative interaction between physicians, support for primary care, remote mentoring, telemedicine triage, and patient follow-up after face-to-face examination may have economic significance by reducing ineffective referrals, shortening delays in decision-making, and improving access to specialized medical care. Telemedicine should not be regarded as a substitute for workforce policy. It can increase the flexibility of health workforce allocation, but it does not resolve issues of remuneration, professional burnout, specialist migration, the quality of medical education, or the regional attractiveness of workplaces. Its economic role should be analysed in connection with workforce recovery policy, the development of primary health care, medical education, and workload management for personnel (World Health Organization, 2024).

Thus, the focus of discussion shifts from the question of whether telemedicine reduces costs to the question of under which institutional, demographic, and workforce-related conditions it creates economic value for the healthcare system and the national economy as a whole. For Ukraine, the key issue is not the isolated expansion of remote consultations, but the formation of a governance-oriented model of digital health care capable of supporting accessibility, continuity, and the rational use of resources during the wartime and post-war periods.

Further research should be directed toward the quantitative assessment of the impact of telemedicine on healthcare system expenditures, patients' indirect costs, the workload of medical personnel, and access to care in the regions of Ukraine. The economic effectiveness of telemedicine for chronic diseases, rehabilitation, mental health, primary health care, and support for internally displaced persons requires separate analysis. A promising direction is the development of regional models that take into account demographic changes, workforce provision, infrastructure conditions, and the level of digital accessibility.

Conclusions.

In Ukraine, during war and post-war recovery, telemedicine functions as an economic instrument for adapting the healthcare system to infrastructural, demographic, and workforce-related changes. Its economic role is manifested in maintaining access to medical care, reducing patients' indirect costs, rationalizing the use of limited workforce resources, and ensuring continuity of monitoring for patients with chronic diseases. Demographic changes, including migration, internal displacement, population ageing, and the regional redistribution of demand, increase the need for flexible digital models of medical service delivery. Workforce constraints in the health care system increase the significance of telemedicine as an instrument for remote consultation, support for primary care, and interregional use of expert resources. The development of eHealth infrastructure creates an institutional foundation for integrating telemedicine into the model of post-war recovery of Ukraine's healthcare system. The economic effect of telemedicine

depends on its incorporation into clinical pathways, financing mechanisms, data management, and workforce policy.

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