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Telemedicine as an innovative healthcare service – opportunities and challenges

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Abstract

Advances in digital technologies and rising patient expectations regarding the availability and flexibility of healthcare have accelerated the emergence of remote medical services. Among these, telemedicine has become one of the most rapidly expanding domains, enabling the delivery of clinical care through information and communication technologies. The COVID-19 pandemic markedly amplified this development, elevating telemedical tools from supplementary solutions to, in many cases, the primary means of interaction between patients and healthcare providers. The swift expansion of remote care during this period demonstrated its ability to broaden access, support both acute and chronic disease management, and enhance the operational performance of healthcare systems. Simultaneously, it drew attention to technological, regulatory, and organizational constraints that must be addressed before telemedicine can be fully integrated into standard healthcare pathways in modern-day healthcare systems across the world. This article examines telemedicine as a novel modality of healthcare delivery by analyzing the main advantages and risks associated with its use, as well as the conditions required for its safe and efficient deployment. The purpose of the study is to assess the long-term potential of telemedicine to become a stable and valuable element of healthcare provision and to identify the technological, legal, organizational, and societal challenges that shape its adoption. The analysis is based on a review of scientific literature, sector reports, and applicable legal frameworks, focusing specifically on: (1) the range

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of telemedical solutions implemented in Poland and internationally, (2) the degree of innovativeness represented by these tools, (3) barriers to broader implementation, and (4) the balance between supply and demand in the telemedicine sector.

Key words: telemedicine, healthcare COVID-19, societal challenges, Poland

JEL Classification: I11, O33, L86

Introduction

The dynamic development of digital technologies and the growing expectations of patients regarding the accessibility of healthcare services contribute to the dissemination of innovative forms of medical care. One of the fastest-growing areas is telemedicine, which enables the provision of healthcare services remotely through the use of communication tools and information technologies. During the COVID-19 pandemic, these solutions gained particular importance, becoming not only an alternative, but often the primary channel of contact between patients and the healthcare system. Experiences from the pandemic period showed that healthcare providers intensified their efforts to expand telemedical services, directing them both to patients requiring acute interventions and to those with chronic conditions. The rapid adoption of these solutions revealed their potential to improve the accessibility of healthcare services and enhance systemic efficiency, while simultaneously exposing significant technological, legal, and organizational challenges. An analysis of the benefits and risks associated with telemedicine is therefore essential for determining its role as a permanent and integral component of contemporary healthcare models.

The aim of this article is to evaluate telemedicine as an innovative form of healthcare delivery by identifying the key benefits and risks associated with its use and analysis of the conditions that determine its safe and effective application in healthcare practice. The study seeks to determine the extent to which telemedicine can constitute a lasting and valuable element of the healthcare system, as well as to identify the technological, legal, organizational, and social barriers that influence the scale of its adoption. This study employs a retrospective analysis of the academic literature and industry reports, supplemented by an examination of legal regulations governing telemedical services. The scope of the research includes, in particular:

a) identifying the forms of telemedicine used in Poland and worldwide,
b) assessing the innovativeness of telemedical solutions,
c) analysis of the factors limiting the widespread implementation of telemedical services,
d) evaluating the supply and demand for telemedical services.

Telemedicine and its forms

Telemedicine is defined as the use of technological devices and digital resources to access patient information, assess health status, conduct diagnosis and monitoring, and finally determine whether an in-person visit to a healthcare facility is necessary (Colucci, 2015). This form of delivering medical services has a long history – already in ancient Egypt, hieroglyphs and papyrus scrolls were used to transmit information about diseases and epidemics. Over the centuries, the development of communication technologies such as the telegraph, telephone, typewriter, and later television (Hurst, 2016) steadily expanded the possibilities for remote medical assistance.

Today, due to the rapid advancement of digital and mobile technologies, as well as the introduction of specialized medical devices, telemedicine has become widely accessible and is applied across numerous clinical fields. It is also one of the key components of the broader concept of e-health. Its growing significance is reflected in the definition offered by the World Health Organization (WHO), which describes telemedicine as the delivery of healthcare services by medical professionals using information and communication technologies to diagnose, treat, prevent diseases and injuries, conduct research, monitor health, and support continuous professional education – all for the benefit of individuals and communities. In this perspective, physical distance between patient and clinician is no longer a critical factor, provided that adequate data can be obtained to establish a diagnosis and plan treatment. It is important to distinguish between the concepts of telemedicine and telehealth or e-health. Telemedicine refers primarily to clinical activities – diagnosis and treatment at a distance[1]. Telehealth is broader and includes activities such as remote data collection and transmission, health education, asynchronous consultations, and various forms of digital support, provided via telephones, email, or remote monitoring devices.

[1] https://www.medicaid.gov/medicaid/benefits/telemedicine/index.html (access: 15.09.2025).

The main goal of telemedical services is to ensure access to healthcare regardless of a patient's place of residence, mobility, or transportation constraints (Scott Kruse et al., 2016), (Nittari et al., 2020). Telemedicine is used both in diagnostic processes and in the management of chronic conditions (Güler & Ubeyli, 2002). It has proved particularly valuable during periods of limited access to traditional consultations – especially during the COVID-19 pandemic, when social distancing measures and systemic restrictions required safe communication channels between patients and healthcare professionals.

Despite its rapid evolution, the wider adoption of telemedicine was for many years constrained by insufficient legal regulations, the lack of standardized procedures, and unclear reimbursement rules in the public healthcare sector. This situation changed significantly during the COVID-19 pandemic, when telemedicine became one of the primary modes of medical service delivery, especially the primary care contact. Legislative reforms, the introduction of teleconsultation standards, and the expansion of digital platforms accelerated its acceptance among both patients and medical staff.

Telemedicine today encompasses a wide range of service modalities, including (Jafarzadeh et al., 2022):

- audio-based teleconsultations (e.g. telephone medical advice),
- video consultations, enabling visual assessment of the patient's condition,
- remote patient monitoring (RPM) of vital signs in home settings (e.g. cardiac telemonitoring programs),
- asynchronous consultations (medical chat, structured medical questionnaires, tele-triage),
- telecare, providing ongoing support for dependent patients, applicable in geriatrics, rehabilitation, and chronic disease management,
- teleradiology and specialist teleconsultations, involving the transmission and interpretation of diagnostic images.

Each of these forms represents a different level of clinical usefulness, innovation, risk, and technological requirements. This diversity underscores the need for clear standards, appropriate financing models, and regulatory frameworks that ensure patient safety and high-quality healthcare provision.

The importance of innovation in healthcare services

The healthcare sector can be identified as an area where innovation is a key factor not only in improving the efficiency of medical entities, but also in determining the quality of life and proper functioning of society. Ensuring an adequate level of health for the population requires the implementation of solutions that enable the provision of new or modified medical services, as well as the continuous optimization of organizational and clinical processes. One such solution is telemedicine, whose importance has grown particularly during the COVID-19 pandemic. During this time, healthcare providers intensified their search for innovative forms of contact with patients and organization of services, which showed that innovation can play a stabilizing and strengthening role in the healthcare system in crisis situations.

From a macroeconomic perspective, innovation is understood as the introduction of changes to economic and social systems that increase the usefulness of products and services, support technological progress, improve management processes, enhance the rational allocation of resources, and contribute to better communication and overall quality of life, including population health (Białoń, 2010). Peter Drucker (Drucker, 1962) defines innovation as a deliberate, purposeful, and beneficial change arising from environmental needs or observations, requiring knowledge, effort, and creativity. In turn, W. Grudzewski and I. Hejduk define innovation as a process of creating or modifying products, methods of operation, and organizational structures, with the aim of increasing the efficiency of available resources (Kopaliński, 2001). In the context of ongoing technological, economic, and social changes, innovation is becoming an essential attitude and one of the key strategic goals of entities operating in the healthcare sector. This means that it is necessary to support and stimulate the development of new forms of healthcare services, new medical products, and modern organizational models. This diagnosis proved particularly accurate during the COVID-19 pandemic, which highlighted the need for dynamic adaptation, scaling of remote services, and implementation of solutions to increase the resilience of the healthcare system to sudden burdens (Battineni et al., 2021), (Baldoni et al., 2020).

Public and private entities in healthcare are looking for innovative solutions to improve operational efficiency, rationalize resource use, and improve the quality of services. Many of these innovations require extensive research and testing, yet they

generate benefits both at the system level and for the broader economy by reducing indirect costs of illness, improving workforce productivity, and strengthening public health security. The need to implement innovative solutions in healthcare stems from the significant influence of health outcomes on socio-economic processes. At the same time, the widespread availability of the internet, the expansion of digital platforms, and the growing digital maturity of the population have contributed to increased interest in solutions such as telemedicine.

In the *"Strategy for Responsible Development"* document adopted by the Polish government in 2017[2], the healthcare sector was identified as one of the key areas for the development of innovation and the implementation of technologies enhancing the efficiency of public services. A more innovative healthcare system (Lipowicz et al., 2020) translates, in practice, into lower financial burdens on the state budget, local government budgets, and household expenditures due to better coordination of care, earlier diagnostics, and reduced infrastructure costs. The rapid expansion of telemedicine during the COVID-19 period was primarily driven by demand-side factors, particularly the lack of possibilities for direct contact between patients and healthcare professionals, which created an urgent need to identify alternative methods of delivering medical services. One of the solutions introduced in Poland by the Ministry of Health was the Innovation Map[3], which encompasses innovative e-health projects, with telemedicine designated as a particularly recommended area due to the significant advantages it offers relative to its implementation costs. A substantial proportion of the projects submitted for implementation within the healthcare system concerned the development of innovative medical services based on tools and technologies characteristic of telemedicine.

In Poland in 2020, the first and critical year of the pandemic, more than one-third (36.4%) of medical consultations in primary care were provided in the form of teleconsultations. Their number reached 56.8 million. In specialist care, teleconsultations accounted for 16.2% (16.3 million). They even concerned, albeit to a limited extent (0.4% or 116,500), consultations in the field of dentistry. Despite its undoubted advantages, many patients believe that remote contact with a doctor cannot replace face-to-face contact. This is evidenced by the fact that in the following year of the pandemic, 2021, when the restrictions were eased, the number of teleconsultations

[2] *Strategia na rzecz Odpowiedzialnego Rozwoju* przyjęta w dn. 14 lutego 2017, http://www.mr.gov.pl/media/34298/SOR_2017_maly_internet_14072017_wstepPMM.pdf. (access: 13.09.2025).

[3] Mapa innowacji w ochronie zdrowia, https://www.gov.pl/web/zdrowie/mapa-innowacji (access:10.09.2025).

provided fell significantly: in primary care by 14.4% (to 48.6 million) and in specialist care by 10.7% (to 14.6 million)[4].

In conclusion, it should be emphasized that the process of creating and implementing innovation is neither simple nor linear – it involves many interactions, feedback loops, and the need for adaptation at various stages. This is particularly important in the healthcare sector, where innovations must not only be technologically advanced, but also safe, clinically useful, and socially acceptable. Understanding these conditions is key to assessing the needs and opportunities for the development of healthcare services, including innovative medical services such as telemedicine.

Benefits of using telemedicine in healthcare services

Assessing the benefits and risks of using telemedicine is essential to understanding its role as an innovative element of modern healthcare models and the conditions necessary for its sustainable and responsible implementation. Telemedicine is currently one of the key tools supporting the functioning of healthcare systems, enabling improved organizational efficiency and quality of care while reducing the burden on patients and healthcare providers (Battineni et al., 2021). Telemedicine brings numerous benefits to patients, primarily by significantly increasing the availability of medical services[5]. The elimination of geographical barriers and the possibility of obtaining consultations without having to travel to a facility make healthcare more accessible to people living in rural areas with limited medical infrastructure, as well as to patients with disabilities or limited mobility. Remote tools also make it possible to monitor a patient's health at home, allowing for ongoing assessment of vital signs and rapid response to clinical changes, especially in chronically ill patients. These solutions increase patient comfort and sense of security, while enabling better control over the course of treatment. It should also be emphasized that telemedicine significantly streamlines administrative processes, such as issuing electronic prescriptions, referrals, and certificates of incapac-

[4] Raport zdrowiu Polaków, Diagnoza po pandemii Covid-19, TUW Polskiego Związku Ubezpieczeń Wzajemnych, Warszawa 2022, 28; https://www.tuwpzuw.pl/_fileserver/item/1500076 (access: 17.09.2025).

[5] Raport zdrowiu Polaków, Diagnoza po pandemii Covid-19, TUW Polskiego Związku Ubezpieczeń Wzajemnych, Warszawa 2022, 28, https://www.tuwpzuw.pl/_fileserver/item/1500076 (access: 17.09.2025).

ity for work. The digitization of these procedures reduces patient service time and relieves medical staff, allowing them to focus on clinical tasks (Skoczylas, 2016). During the COVID-19 pandemic, telemedicine played a key role in limiting the transmission of infections and increasing epidemiological safety, which highlighted its value not only as an organizational tool, but also as a preventive measure. Studies show that telemedicine has significantly contributed to improving epidemiological control and effective management of clinical cases during the pandemic. It has been successfully used to identify diseases, remotely assess symptoms, monitor patients who do not require hospitalization, and prioritize the referral of patients to inpatient facilities. Remote systems also supported diagnostics, enabling physicians to interpret test results delivered electronically. Outside of the pandemic period, telemedicine is widely used in various clinical fields, from internal medicine, cardiology, and dermatology to geriatrics, oncology, and neurology (Battineni et al., 2021), (Baldoni et al., 2020). This enables more effective treatment of chronic diseases, shortens clinical response times, and ensures continuity of care for patients.

Telemedicine also generates measurable economic benefits. It reduces the number of unnecessary in-person visits, allowing for more rational use of human and infrastructure resources and shorter queues at medical facilities. Patients incur lower costs related to transportation and absenteeism from work, and the healthcare system reduces expenses resulting from the need to maintain an extensive inpatient infrastructure. The ability to automate some administrative processes and improve the coordination of care improves the efficiency of medical staff, and continuous monitoring of health parameters promotes early detection of abnormalities and reduces costly complications.

Telemedicine has the potential to become one of the key pillars of modern healthcare. It improves access to services, increases systemic efficiency, supports the treatment of chronic diseases, and contributes to cost optimization. At the same time, its further development requires systemic measures, including stable legal regulations, investments in technological infrastructure, and strengthening the digital skills of both patients and healthcare providers.

Risks associated with the use of telemedicine in healthcare services

Despite its many advantages, telemedicine also involves certain risks and barriers. The most significant barriers limiting the development and widespread use of telemedicine include, above all, data security issues and the need to ensure secure transmission, storage, and processing of data (Langlois, 1977). Telemedicine services require the use of advanced digital platforms that process highly sensitive information about patients' health. This means that high cybersecurity standards, effective authentication mechanisms, and interoperability of medical systems must be in place. In practice, many medical entities, especially smaller facilities, still have inadequate technological infrastructure, which increases the risk of data leaks, cyberattacks, or unauthorized access to medical records.

Another challenge is the competence barriers of patients, especially older people and those who do not have the necessary digital skills. The use of telemedicine often requires the use of mobile applications, monitoring devices, or video consultation platforms, which can be an obstacle for part of the population. A lack of digital competence can not only discourage patients from using this form of service but also lead to errors in the transmission of health information, difficulties in operating devices, or improper use of medical recommendations. Awareness barriers are also significant, resulting from the entrenched belief that effective medical consultation requires the physical presence of a doctor. Many people, especially older patients, consider direct contact with a doctor to be an essential element in building a therapeutic relationship and trust. Such attitudes limit the acceptance of telemedicine and contribute to its underuse, even in cases where remote consultation would be sufficient and safe.

Another limitation is regulatory inconsistencies regarding professional liability, service delivery standards, and reimbursement rules. Many countries lack clear regulations defining the scope of responsibility of a physician providing teleconsultation, the method of documenting such a service, procedural standards, and service quality requirements. Legal ambiguities also apply to the billing of telemedicine services, which hinders their implementation by healthcare facilities and discourages some service providers from offering remote services. The lack of stable solutions in this area means that telemedicine is still seen as a supplement to traditional care rather than an equivalent form of it.

An analysis of this topic also requires pointing out imperfections and risks, among which the following should be noted:

- telemedicine attracts younger, healthier patients, leaving those with more serious problems to be treated using traditional methods. This can cause divisions among doctors;
- telemedicine poses the risk of failing to identify serious diseases, which is particularly important given that the ratio of healthcare spending is approximately 70:30 in favor of curative spending (i.e., spending on comorbidities) compared to preventive spending, where diseases are identified early and treated early. In the area of medical interventions, procedural interventions account for 80% of costs, while drugs and supplies account for the rest (Gaurav et al., 2021).

A significant clinical risk associated with telemedicine is the limitation in conducting a full physical examination, which can lead to diagnostic errors, missed clinical signs, or delays in the detection of serious diseases. This challenge becomes especially key in cases requiring palpation, auscultation, or direct visualization of physical symptoms that cannot be reliably captured through audio or video interfaces. Although telemedicine markedly improves access to healthcare – particularly for patients residing in remote areas, those with reduced mobility, or during situations of system overload – it does not eliminate the necessity for careful triage and case selection. In practice, the safe and clinically appropriate use of remote consultations requires clear eligibility criteria, decision-support tools, and well-defined escalation pathways to in-person care. The absence of such structured rules may generate substantial heterogeneity in the quality of telemedical encounters, increase the likelihood of fragmented care, and undermine continuity, particularly for patients with chronic or multi-system conditions.

Patient selection remains a further area of complexity. Telemedicine tends to be used disproportionately by younger, more technologically literate, and generally healthier individuals, while older patients, those with comorbidities, and those facing socioeconomic or digital barriers remain underrepresented. These risks might deepen existing health inequalities and may unintentionally shift the burden of clinically complex cases toward traditional healthcare settings, thereby increasing pressure on in-person services. In parallel, technological vulnerabilities pose non-trivial risks. System failures, connection problems, data transmission errors or even cybersecurity threats can disrupt the diagnostic or therapeutic process, compromising the treatment safety and the patient's confidence in telemedicine.

Moreover, telemedicine should not be regarded as a single, uniform intervention. Instead, it constitutes a diverse spectrum of possibilities – including synchronous

video consultations, asynchronous messaging, remote monitoring, AI-supported diagnostics, and integrated teletriage systems – each with distinct clinical utility, regulatory requirements, and risk profiles. This heterogeneity complicates efforts to generate robust evidence on its overall effectiveness and calls for the development of detailed, modality-specific clinical and HTA-relevant guidelines. Such guidelines must address not only the clinical appropriateness of telemedicine for different conditions but also operational standards, clinician training, data governance, interoperability, and procedures for emergency escalation. Without such structured governance, the expansion of telemedicine may proceed in a manner that is uneven, clinically inconsistent, and operationally fragile, ultimately limiting its potential to strengthen healthcare delivery. In order for telemedicine to be permanently adapted to the healthcare system, it is necessary to overcome numerous technical, educational, infrastructural, legal, and economic barriers. Industry reports also point to information barriers, insufficient cross-sector cooperation, and high costs of implementing new technologies. The authors of a report[6] on the prospects and conditions for the development of telemedicine in Poland identified the following barriers as the main problems hindering the development of this market:

- information barriers and the social perception of this form of healthcare service delivery
- financial constraints and high costs of applying new technologies
- difficulties in cooperation at the interface between ICT and medical requirements
- legal requirements – lack or imperfection of legal regulations.

To summarize, telemedicine has enormous potential to improve the accessibility, efficiency, and quality of medical services, but its full utilization requires a systemic approach, stable regulations, high-quality digital infrastructure, and adequate preparation of staff and patients. Only a balance between the benefits and risks will allow telemedicine to be incorporated as a permanent feature of the modern healthcare model. All these barriers indicate that the development of telemedicine requires a multidimensional approach, including the modernization of technological infrastructure, education of patients and staff, refinement of legal regulations, and the development of clear clinical standards. Only such measures will ensure that telemedicine is not only a modern tool supporting healthcare, but also a safe, socially acceptable, and systemically effective solution.

[6] Raport uwarunkowania rozwoju telemedycyny w Polsce, May 2016; http://www.izbamed-pol.pl/wp-content/uploads/2018/02/Raport_telemedycyna.pdf (access: 21.10.2025).

Summary

Telemedicine is increasingly recognized as one of the cornerstone instruments for modernizing contemporary healthcare systems, offering a wide spectrum of organizational, economic, and clinical advantages. By enabling remote access to medical expertise, it significantly enhances service availability, particularly for populations residing in underserved or geographically isolated areas. Its capacity to facilitate rapid consultations, irrespective of the patient's location, reduces waiting times and alleviates bottlenecks in traditional healthcare pathways. Telemedicine also plays a critical role in the management of chronic diseases through continuous or episodic remote monitoring, supporting early detection of exacerbations and reducing the frequency of emergency interventions. Furthermore, by shifting a portion of care delivery to virtual environments, telemedicine helps alleviate pressure on hospitals and outpatient facilities, enabling more efficient allocation of resources. It can also streamline administrative processes – such as triage, documentation, and follow-up scheduling – thereby improving operational workflows and supporting broader system-level efficiency. An additional benefit is its contribution to infection control, limiting unnecessary physical interactions and thereby reducing the spread of transmissible diseases in healthcare settings.

Despite these numerous advantages, the development and integration of telemedicine into routine healthcare practice remain associated with a series of challenges and systemic risks. Data security and privacy protection represent critical concerns, particularly in light of the increasing volume of sensitive health information transmitted electronically and the growing sophistication of cyber threats. Patient-related barriers, such as limited digital competence, low health literacy, or insufficient awareness of telemedicine's functionalities, can reduce its reach and exacerbate social and digital inequalities. Regulatory and organizational inconsistencies, including varying standards across jurisdictions, further complicate implementation and create uncertainty for providers. Clinically, the inability to conduct a comprehensive physical examination continues to pose a risk, potentially leading to diagnostic errors, delays in identifying severe conditions, or unnecessary referrals for in-person assessment. Moreover, challenges in securing stable financing and reimbursement mechanisms hinder the scalability and sustainability of telemedicine services, while deficits in technological infrastructure—such as inadequate internet connectivity or unreliable remote-diagnostic tools—may limit clinical effectiveness and undermine user trust.

In summary, telemedicine has the potential to evolve into a stable, integral, and highly valuable component of modern healthcare systems. Realizing this potential, however, requires a concerted effort to address existing barriers, develop harmonized organizational and technological frameworks, and establish coherent legal and reimbursement standards. Achieving high levels of interoperability, ensuring equitable access, and embedding telemedicine within broader models of coordinated care will be essential for its long-term success. Under such conditions, telemedicine can not only improve the operational efficiency of healthcare systems but also enhance clinical outcomes and the overall quality of patient care.

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