DOI:10.17951/h.2025.59.1.113-130

ANNALES
UNIVERSITATIS MARIAE CURIE-SKŁODOWSKA
LUBLIN – POLONIA

VOL. LIX, 1 SECTIO H 2025

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Implementation and Progress of Telemedicine in Poland: Comparative Analysis with EU Member States

Keywords: European Union (EU); healthcare system; quality of healthcare; Poland; telemedicine

JEL: H51; H52; H53; H75

How to quote this paper: Latif, F. (2025). Implementation and Progress of Telemedicine in Poland: A Comparative Analysis with EU Member States. *Annales Universitatis Mariae Curie-Skłodowska, sectio H – Oeconomia*, *59*(1), 113–130.

Abstract

Theoretical background: Telemedicine has become a critical component of modern healthcare, offering the potential to improve patient outcomes, streamline clinical workflow, and facilitate more informed decision-making. Its implementation in healthcare systems offers the opportunity to leverage technology to improve access, efficiency, and quality of care.

Purpose of the article: This study aims to investigate the implementation of telemedicine in the Polish healthcare system and assess its adoption in comparison with other EU countries. It also aims to assess the impact of the rate of adoption of teleconsultations as a percentage of all consultations in Poland on the quality and accessibility of healthcare in comparison with other EU member states.

Research methods: This research used a literature-based approach, analyzing existing scientific articles, government reports and OECD data to understand the current state of telemedicine in Poland and EU countries. Data on the implementation rate of medical teleconsultations as a percentage of all consultations were collected from national healthcare databases and Eurostat.

Main findings: The study highlights the urgent need to prioritize telemedicine in Poland to enhance healthcare efficiency. Poland's teleconsultation rate (25%) and digitized health records (41%) lag behind leading EU nations such as Denmark, Germany, and the Netherlands, which have higher telemedicine adoption

and fully digitized records. The low adoption rate in Poland contributes to inefficiencies, administrative burdens, and healthcare disparities, especially in rural areas. Countries with advanced telemedicine systems demonstrate improved patient outcomes, reduced hospital congestion, and optimized resource allocation. Strategic measures, including infrastructure development, policy reforms, and digital education, are essential for Poland's healthcare modernization.

Introduction

In recent years, the integration of telemedicine into healthcare systems has emerged as a transformative force, contributing to the advancement of healthcare service delivery (Fouad et al., 2023; Smółka & Smółka, 2024). The rapid development of telemedicine, driven by technological advances, has facilitated the work of medical professionals and enabled faster, more efficient access to healthcare services (Beattie et al., 2013; Czerw et al., 2016; Doniec et al., 2022). It has been particularly important in addressing the challenges posed by geographical barriers, resource constraints, and increasing demand for healthcare services (Romanick-Schmiedl & Raghu, 2020; Ricci et al., 2023; Tan et al., 2024). Telemedicine has become an essential tool in healthcare, enabling efficient and effective consultations, diagnoses, and treatments remotely (Adepoju et al., 2022; Mesmari, 2023; Wróbel et al., 2021). It improves the quality of healthcare as it aligns with the broader goals of improving patient outcomes, reducing costs, and ensuring equitable access to care.

The World Health Organization (WHO) defines telemedicine as the use of information and communication technologies to provide health care services remotely, enabling health care professionals to exchange important information for the diagnosis, treatment, and prevention of disease and injury, as well as for continuing education and research (Blackstone & Fuhr, 2007; Giansanti, 2023; Ricci et al., 2023). This definition emphasizes the versatility of telemedicine as an approach to health care rather than just a tool. It can be delivered through a variety of communication channels, such as live video consultations, mobile health apps, and remote monitoring devices (Mitrano et al., 2022). The convenience of telemedicine is a key advantage, as it allows individuals to consult with health care providers from the comfort of their homes, reducing the need to travel and minimizing disruption to daily life (Vovk & Kister, 2021). Although the terms "telemedicine" and "telehealth" are often used interchangeably, they have distinct technical and regulatory definitions (Heinzelmann et al., 2005; Mehrotra et al., 2021). Telemedicine typically refers to the delivery of clinical services, whereas telehealth encompasses a broader range of health-related services, including educational and administrative functions (Mehrotra et al., 2021). Other terms, such as "digital health" and "mobile health", are used to provide a more comprehensive view of healthcare in the digital age, reflecting the increasing integration of technology into all aspects of healthcare delivery (OECD, 2023).

Similarly, electronic medical records (EMR) and teleconsultations are two integral components of telemedicine that work together to improve the delivery of healthcare remotely (Heinzelmann et al., 2005; Smółka & Smółka, 2024). EMRs serve as digital repositories of comprehensive patient health data, including medical history, diagnoses, prescriptions, and laboratory test results (Giansanti, 2023). It allows healthcare providers to access, update, and share this information remotely during virtual consultations or monitoring patient progress. This digitization ensures timely, efficient, and accurate decision-making, as well as effective coordination between healthcare providers, even remotely (Blackstone & Fuhr, 2007).

On the other hand, teleconsultations involve real-time virtual interactions between a patient and a healthcare professional via video calls, phone calls, or messaging platforms (Fouad et al., 2023). These consultations make healthcare more accessible by eliminating the need for in-person visits, which is especially beneficial for patients living in remote areas (Adepoju et al., 2022; Mesmari, 2023; Ricci et al., 2023; Tan et al., 2024). Teleconsultations enable healthcare professionals to assess symptoms, make diagnoses, recommend treatment plans, and provide follow-up care remotely, ensuring that patients receive high-quality care despite geographical barriers (Vovk & Kister, 2021). The integration of secure communication technologies ensures the confidentiality and security of patient information during these interactions.

Together, this offers an efficient and safe way to provide medical care remotely, while maintaining high standards of patient care and regulatory compliance (Mitrano et al., 2022). To find the implementation of telemedicine in healthcare in Poland, a study was conducted to review the existing scientific literature on the concept, importance, and use of telemedicine, as well as to assess the progress in this field (Qi et al., 2022). The results of this study provide a basis for future research and practical applications in healthcare management. The study highlights the importance of telemedicine in Poland, which helps to improve access to care in remote areas.

In summary, our study aims to critically examine the implementation of telemedicine in the Polish healthcare system, providing a comparative analysis of its adoption compared to other EU countries. By assessing the adoption rate of teleconsultations as a percentage of the total number of consultations in Poland, the study aims to assess the impact of telemedicine on the quality and accessibility of healthcare compared to other EU member states. The results of this study will contribute to a deeper understanding of the factors influencing the successful integration of telemedicine into healthcare systems, as well as its potential to overcome geographic, logistical, and resource challenges. As healthcare systems around the world strive to meet increasing demands, telemedicine is emerging as a critical tool to provide timely, equitable, and patient-centered care, ultimately improving health outcomes and transforming healthcare delivery. Furthermore, this study will provide valuable insights to policymakers, healthcare providers, and stakeholders by offering evidence-based recommendations to increase the adoption and effectiveness of telemedicine.

Literature review

As previously discussed, telemedicine and telehealth are often used interchangeably, but they have different meanings in scientific and regulatory contexts. Telemedicine specifically refers to the use of digital communication technologies to provide healthcare services remotely, such as virtual consultations, remote diagnostics, and digital prescriptions (Heinzelmann et al., 2005; Tan et al., 2024). It primarily focuses on face-to-face interactions between healthcare providers and patients, with a focus on diagnosis, treatment, and medical decision-making (Tan et al., 2024).

In contrast, telehealth is a broader concept that encompasses telemedicine but also includes nonclinical services such as health education, administrative meetings, provider training, and remote public health initiatives (Beattie et al., 2013; Botma & Labuschagne, 2019; Doniec et al., 2022). Telehealth extends beyond patient-provider interactions to include preventive care, wellness programs, and healthcare system management via digital platforms.

Thus, while telemedicine is a subset of telehealth that deals explicitly with medical consultation and treatment, telehealth is a comprehensive approach to integrating digital solutions into various aspects of healthcare delivery (Elliott, 2024; Graham & Woodhead, 2021; Kumsa et al., 2023). This distinction is crucial in policymaking, healthcare infrastructure development, and regulatory frameworks, ensuring that digital health services are effectively categorized and implemented (Adepoju et al., 2022).

Telemedicine platforms have found application in a wide range of healthcare settings, including remote consultations, chronic disease management, and patient monitoring (Locke et al., 2021; Mitchell et al., 1998; Nates et al., 2020). These platforms provide clinicians with the tools to deliver care more efficiently and effectively, reducing the burden on traditional healthcare systems (Giansanti, 2023; Romaszko-Wojtowicz et al., 2023; Tan et al., 2024). Research indicates that integrating telemedicine into the healthcare setting can lead to significant improvements in clinical efficiency and patient satisfaction (Fouad et al., 2023). For example, telemedicine enables timely access to care, particularly for underserved or remote populations, thereby increasing access to health care and reducing delays in diagnosis and treatment (Mitchell et al., 1998; Qi et al., 2022; Smółka & Smółka, 2024). These advances underscore the potential of telemedicine to transform health care delivery, making it more patient-centered and responsive to contemporary health care challenges.

The Institute of Medicine (IOM), now known as the National Academy of Medicine, has refined the concept of health care quality into six core domains: safety, effectiveness, patient-centeredness, timeliness, efficiency, and equity (Adepoju et al., 2022). These domains provide a comprehensive framework for assessing and improving the quality of health care services, facilitating continuous improvement in practice and policy (Beattie et al., 2013; Fouad et al., 2023). Safety ensures that patients are protected from harm during the delivery of health services, whereas effectiveness focuses on delivering evidence-based interventions that produce positive

outcomes (Bashshur et al., 2009). Patient-centeredness emphasizes the importance of care tailored to individual needs and preferences, increasing collaboration between patients and providers (Adepoju et al., 2022; Wróbel et al., 2021). Timeliness ensures that care is delivered promptly, reducing delays that can exacerbate health conditions (OECD, 2023). Efficiency involves optimizing resource use to minimize waste and maximize value, and equity aims to ensure that all patients have access to high-quality care, regardless of their socioeconomic status or geographic location (Porter & Teisberg, 2007). Together, these domains provide a structured guide for assessing the impact of telemedicine on the quality of health care and identifying areas for improvement.

The concept of healthcare quality, particularly in the context of telemedicine, aims to improve patient care and outcomes (Endeshaw, 2020). Donabedian views healthcare quality as consisting of three integral components: structure, process, and outcomes (Elliott, 2024; Mitchell et al., 1998). Structure refers to the physical and organizational settings in which care is delivered, including the availability of resources, technology, and infrastructure (Endeshaw, 2020). Process includes the methodologies and practices associated with the delivery of care, such as clinical workflows, communication, and adherence to evidence-based guidelines (Botma & Labuschagne, 2019). Outcomes refer to the impact of healthcare interventions on patient health outcomes, including clinical outcomes, patient satisfaction, and overall well-being (McCullough et al., 2023). The Donabedian model has had a profound influence on the assessment and improvement of healthcare quality standards, providing a framework for assessing the effectiveness of implementing telemedicine to deliver healthcare services remotely.

Donabedian redefined health care quality as a function of maximizing patient value by improving health outcomes while effectively managing costs (Donabedian et al., 2022; Endeshaw, 2020; Tiribelli et al., 2023). This value-based approach shifts the emphasis from traditional metrics such as volume of services to a comprehensive assessment of the value generated for patients per dollar invested (Botma & Labuschagne, 2019). The importance of aligning healthcare delivery with patient needs and preferences, ensuring that resources are allocated efficiently to achieve the best possible outcomes (Porter & Teisberg, 2007). This approach is particularly relevant in the context of telemedicine, which has the potential to deliver high-value services by reducing unnecessary costs, improving access, and enhancing the patient experience.

Telemedicine is often described as an "open and constantly evolving" field, adapting to changing healthcare needs through the integration of advanced technologies (Nates et al., 2020). Its main goals include increasing patient access to healthcare services, facilitating effective communication between healthcare professionals, and optimizing the time and cost of healthcare delivery (Romanick-Schmiedl & Raghu, 2020). The global aging population creates both opportunities and challenges for telemedicine. In 2022, approximately 21% of the Polish population was 70 years and older, underscoring the urgent need for eHealth solutions to address these challenges

(OECD, 2023). Telemedicine offers a feasible solution by providing accessible and efficient healthcare services to elderly patients, reducing the need for frequent in-person visits, and reducing the burden on healthcare systems (Bashshur et al., 2009).

Technological advances continue to drive the evolution of telemedicine, increasing its capabilities and expanding its applications in healthcare (OECD & World Health Organization, 2024). Teleconsultations provide real-time data that alert healthcare providers, improving early detection of conditions such as diabetes and heart disease (Dieleman et al., 2020; Nixon & Ulmann, 2006; Özkaya et al., 2024). Similarly, telemedicine platforms are increasingly used for immersive therapy sessions, pain management, and remote surgery planning, offering patients a more interactive and engaging healthcare experience (Gavurova & Megyesiova, 2022; Jiang et al., 2024; Toritsemogba et al., 2024). This innovation is transforming healthcare services into a more efficient and patient-centric approach. For example, virtual therapy sessions using telemedicine allow patients to participate in exercise and rehabilitation programs from the comfort of their homes, while remote surgery planning tools enable specialists to collaborate on complex cases without geographic limitations (Nabbe & Brand, 2021). By integrating these advanced functionalities, telemedicine not only improves clinical outcomes but also increases patient satisfaction and access to specialized care (Aaltonen & Vaalavuo, 2024; Rokicki et al., 2020). These developments underscore the potential of telemedicine to revolutionize healthcare delivery, making it more responsive to the diverse needs of patients and healthcare providers (Shaheen & Salim, 2024).

Remote monitoring devices have also made significant progress, enabling continuous tracking of vital signs, glucose levels, and other health indicators (Koijen et al., 2016). These devices integrate seamlessly with telemedicine platforms, providing real-time data to healthcare providers and facilitating timely interventions (Alumran et al., 2021; Warchoł et al., 2019). For example, advanced remote monitoring devices have been shown to reduce hospital readmissions for heart failure patients by 25%, demonstrating their potential to improve chronic disease management (OECD, 2023).

However, despite its numerous benefits, telemedicine faces many challenges that must be addressed to ensure its sustainable development (Mitchell et al., 1998; Nates et al., 2020). Data security and patient privacy remain major concerns, as the digital transmission of sensitive health information creates security vulnerabilities (Giansanti, 2023). Robust encryption protocols and advanced cybersecurity measures are essential to mitigate these risks and maintain patient trust (Mehrotra et al., 2021). In addition, the digital divide poses a significant obstacle, as many communities lack reliable access to the Internet and the necessary devices to fully benefit from telemedicine (Hoffman et al., 2006; Meterko et al., 2004). Initiatives to provide affordable or subsidized devices and improve digital literacy are critical to closing this gap and ensuring equitable access to telemedicine services (Batbaatar et al., 2017; Moya-Salazar et al., 2023). Regulatory frameworks vary by region, and healthcare organizations must ensure compliance with local regulations and guidelines (Beattie

et al., 2013; Vovk & Kister, 2021). Ensuring reimbursement for telemedicine services from insurance providers and government programs is essential for the viability of telemedicine initiatives.

The COVID-19 pandemic has catalyzed the widespread use of telemedicine, particularly in primary care (OECD, 2023). Before the pandemic, telemedicine services were neglected in many countries, including Poland, where only 23% of the population aged 16 to 74 sought health information online (OECD, 2023). However, the pandemic forced a rapid transition to telehealth visits, demonstrating the potential of telemedicine to provide continuity of care during crises (Mitchell et al., 1998; Ricci et al., 2023; Tan et al., 2024). This shift has not only improved access to healthcare but also underscored the importance of integrating telemedicine into standard healthcare practices.

However, after the pandemic in 2022, the percentage of the population seeking online medical consultations increased to 52% (OECD, 2023). It is worth noting that this number, although showing a significant increase, remains below the average of 60% in EU member states for people seeking help via online medical consultations (OECD, 2023). Most people in Poland used telemedicine as an alternative option, but it is not often used after the COVID-19 pandemic (Wróbel et al., 2021). According to OECD data from 2023, 90% of the Polish population would consider using telemedicine services for e-prescriptions, 77% for telephone consultations, 74% for e-sick leave certificates, 60% for online pharmacies, 38% for video chats, 40% for emailing doctors, and 27% for text chats. See Figure 1, which shows the percentage of respondents using e-health services as an alternative option:

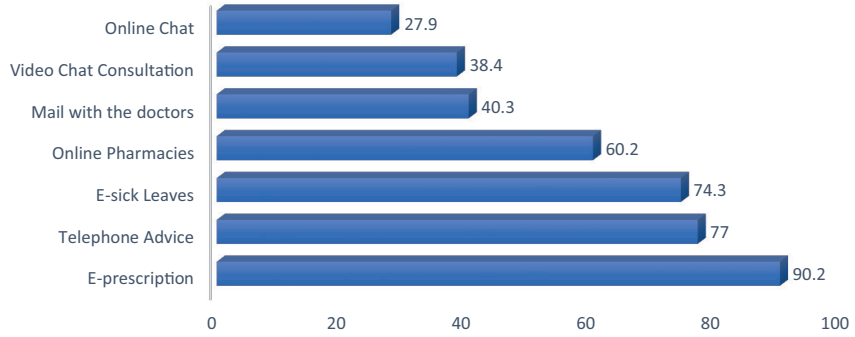

Figure 1. Percentage of respondents using e-health services

Source: Author's own study based on (OECD, 2023).

In Poland, the introduction of teleconsultation in healthcare facilities was a new experience during the COVID-19 pandemic, and basic telemedicine services were provided in the form of telephone consultations (OECD, 2023; Wróbel et al., 2021). Reports indicate that 60% of Polish patients are ready for the integration of tele-

medicine solutions. IT solutions such as Medicover and Polmed are used for remote consultations and patient monitoring (Romanick-Schmiedl & Raghu, 2020). They enable patients to receive medical assistance through virtual outpatient clinics when a personal visit to a doctor is not possible for various reasons (OECD, 2023). For example, telemedicine includes tele diagnosis, in which the results of medical tests obtained in one place are sent to a doctor in another place for diagnosis and interpretation. One of the main challenges of implementing telemedicine in Poland is the digital divide, which disproportionately affects residents of rural areas and the elderly (Giansanti, 2023; OECD, 2023; Vovk & Kister, 2021).

In summary, the potential of telemedicine to address healthcare challenges in Poland is significant, particularly in the context of an ageing population and workforce shortages (Giansanti, 2023; OECD, 2023; Ricci et al., 2023). The percentage of the Polish population aged 70 and over is expected to increase significantly by 2050, which will further burden the healthcare system (OECD, 2023). It offers a viable solution to these challenges by improving access to care, reducing the burden on healthcare facilities, and enabling more efficient resource allocation, all of which contribute to positively impacting healthcare outcomes. By facilitating timely consultations, remote monitoring, and personalized care, telemedicine has the potential to increase patient satisfaction, improve clinical outcomes, and reduce healthcare costs.

Research method

The first part of this study examines the concept, types and importance of telemedicine, as well as the benefits of integrating telemedicine with remote health services. The second part aims to determine the degree of adoption of remote health services in Poland compared to other European Union countries, in relation to the EU health policy objectives for 2020 and 2030. The hypothesis is that Poland lags behind in the adoption of telemedicine due to the low rate of adoption of telemedicine consultations as a percentage of the total number of consultations, which affects the overall efficiency of healthcare in Poland. However, increased implementation of telemedicine could significantly improve remote health services. This study examined key policy documents and reports from various organizations at national, international, regional and local levels, covering governmental, non-governmental and business entities. To conduct a more thorough analysis, here are some modified research questions:

How does the implementation of telemedicine in the Polish healthcare system compare to other European Union member states?

How does the share of teleconsultations in the total number of medical consultations affect the overall efficiency of healthcare in Poland?

However, like many other studies, this one also has its limitations. One of the main limitations is the limited availability of data on telemedicine services. To overcome this, multiple sources were used, such as reports and online data collected from

the European Executive Agency for Health and Digital Affairs reports, Eurostat data, and OECD data on sustainable digital health. In addition, a comparative study of different EU countries on their digital health policies and adoption of telemedicine practices was conducted to explore perspectives on the implementation and effectiveness of remote healthcare services.

Results

The data we collected show a serious problem in the use of electronic medical records (EMR) in primary care in Poland. Specifically, the percentage of EMR use in Poland is only 41%, which is the lowest among all EU countries after Croatia, Bulgaria, Romania and Cyprus, and significantly lower than the EU average of 72%. This indicates that Poland still relies on traditional methods of providing healthcare services, which are probably more expensive and less accessible to patients. At the same time, most EU countries have achieved 100% percentage of EMR use in primary care, including Denmark, Estonia, Germany, the Netherlands and Sweden. This can be illustrated in Figure 2.

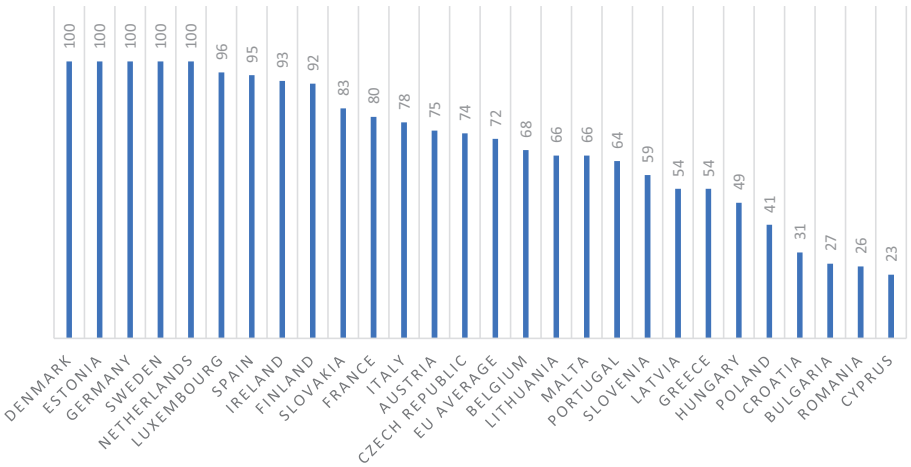

Figure 2. Percentage of primary care practices using EMR

Source: Author's own study based on (OECD, 2023).

EMR is integral to improving the quality of healthcare through improved data management and accuracy of medical records. In countries with high EMR adoption, healthcare providers can access complete and up-to-date medical histories at any time, facilitating accurate diagnoses and effective treatment plans. In Poland, reliance on traditional, paper-based records can lead to data handling errors and impede care

coordination. These manual processes increase the risk of misdiagnosis, medication errors, and treatment delays, undermining patient safety and quality of care.

For an aging population that often has complex, chronic health problems that require ongoing and coordinated care, the lack of digital records is becoming a clear barrier. Moreover, the slow implementation of EMR in Poland may put the country at a disadvantage in terms of quality and access to healthcare, especially in the context of an aging population and increasing healthcare demands. Such a trend could have far-reaching consequences, including rising costs, inefficiencies, and compromised patient care.

As previously discussed, teleconsultations are a core element of telemedicine, allowing patients to connect with healthcare providers remotely via telephone or video consultations. While telemedicine encompasses a broader spectrum of digital healthcare services, including remote patient monitoring and e-prescriptions. Their adoption reflects the extent to which countries have embraced the digital transformation in the healthcare sector. Figure 3 shows teleconsultations as a percentage of the total number of medical consultations in EU member states. The statistics were collected by Eurostat in 2023.

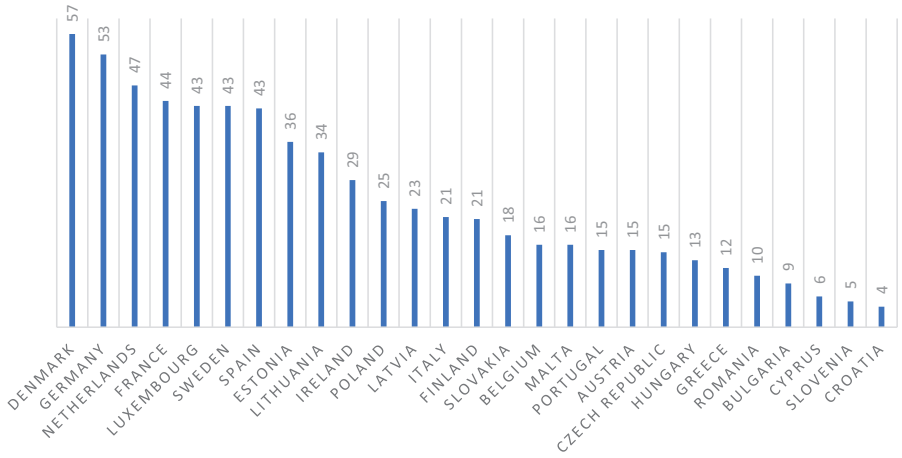

Figure 3. Percentage of medical teleconsultations as a percentage of all consultations

Source: Author's own study based on (OECD, 2023).

Poland is in the lower middle range in terms of teleconsultation adoption, with a share of teleconsultations of around 25% of all medical consultations. This number is noticeably lower than in leading countries such as Denmark (57%), Germany (53%) and the Netherlands (47%). This shows that Poland has been slower in adopting teleconsultations into its healthcare system compared to other EU member states. Countries with high rates of teleconsultation adoption, such as Denmark, Germany, the Netherlands, France, Luxembourg and Sweden, have well-developed telemed-

icine infrastructure, comprehensive digital health policies and strong acceptance among healthcare professionals and patients. These countries have successfully implemented remote healthcare solutions into their healthcare ecosystems.

Healthcare efficiency refers to the optimal use of resources to achieve the best possible health outcomes for individuals and populations (Costongs et al., 2024). It consists of key dimensions such as effectiveness, safety, timeliness, accessibility, equity and patient-centered care. Experts developed healthcare efficiency data using score indices on a scale from 10 to 100, where 100 indicates the best performance, by analyzing key indicators including preventable mortality rates, antimicrobial resistance, hospital infection rates, maternal mortality and self-assessed health status. These indicators are systematically collected from healthcare facilities in EU member states.

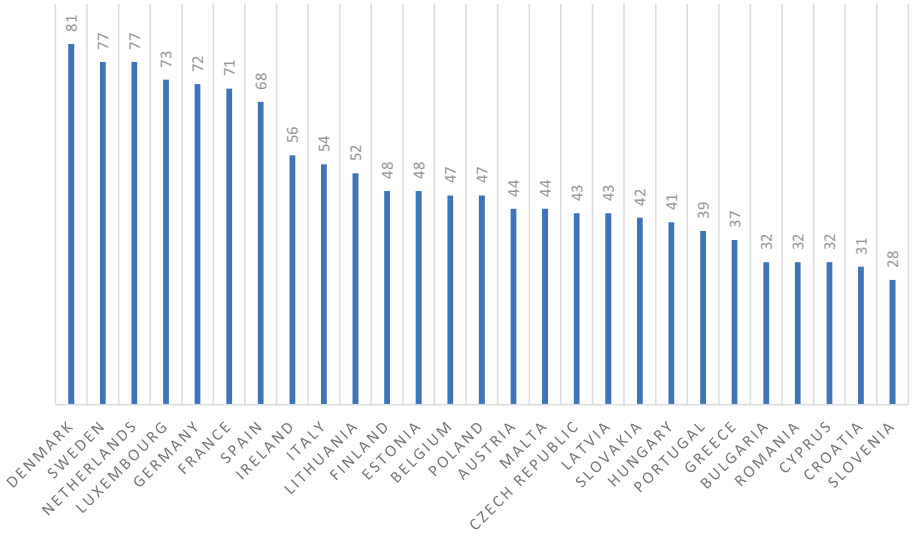

Figure 4. Healthcare efficiency indicators in EU member states

Source: Author's own study based on (Costongs et al., 2024).

Figure 4 above shows healthcare efficiency rankings across EU member states, highlighting how effectively countries use resources to provide high-quality healthcare services. Denmark, Sweden and the Netherlands emerge as top performers, demonstrating highly efficient healthcare systems. In contrast, Slovenia, Croatia and Cyprus rank lower, indicating improvements in resource management and healthcare delivery. Poland ranks in the middle, reflecting moderate levels of efficiency compared to EU member states.

Countries with the highest healthcare efficiency scores, such as Denmark, Sweden, and the Netherlands, have introduced telemedicine practices into their healthcare systems. These countries have invested heavily in digital health platforms, including teleconsultation, e-prescription, and diagnostics, which have reduced patient waiting

times, optimized hospital resources, and improved access to care. The availability of remote healthcare services ensures timely treatment, reducing hospital congestion, and increasing efficiency. In addition, these countries benefit from high internet penetration rates that support widespread adoption of telemedicine.

Poland ranks in the middle range of healthcare efficiency, indicating a system that is functional but not yet optimal. One of the main challenges Poland faces is long waiting times for patients, especially for specialist care, as well as unequal access to healthcare services in rural areas. To address this, Poland should implement telemedicine solutions, such as online medical consultations, digital medical records, and e-prescriptions. Although these steps have improved accessibility and reduced the number of unnecessary hospital visits.

In summary, our research results highlight that the low adoption of EMR and teleconsultations significantly impacts healthcare efficiency. The moderate healthcare efficiency in Poland is due to the low adoption of telemedicine compared to EU member states. While countries such as Denmark, Sweden, and the Netherlands are successfully adopting digital health solutions, they also have highly efficient healthcare systems.

Discussion

The research results show the critical importance of prioritizing telemedicine in Poland to improve the quality, efficiency and accessibility of healthcare. According to our research, 41% of healthcare records in Poland are digitized, representing the percentage share of total healthcare records, while teleconsultations in Poland consists of 25% of total medical consultations, that are below average among other EU member states (OECD & European Commission, 2024; Smółka & Smółka, 2024b). For instance, the percentage share of teleconsultations in total medical consultations is significantly higher in other EU countries, such as Denmark (57%), Germany (53%), and the Netherlands (47%), which rank among the highest in the EU, meanwhile, these countries Denmark, Germany and Netherlands have been keeping 100% of their healthcare records, are digitized that is why, the impact of adoption of telemedicine over healthcare efficiency is notably positive in these countries, with Denmark, Germany, and the Netherlands being top performers (OECD & European Commission, 2024).

As discussed earlier, our hypothesis that the adoption of telemedicine positively affects healthcare efficiency, especially in terms of quality and accessibility (OECD, 2023). The results of our analysis positively show that the integration of telemedicine has contributed to the improvement of healthcare delivery (Carrillo De Albornoz et al., 2022). The high adoption rate of telemedicine in Denmark, Germany, and the Netherlands correlates with improved performance across key healthcare indicators, including lower preventable mortality rates, reduced antimicrobial resistance, de-

creased hospital infection rates, lower maternal mortality, and better self-assessed health status (Berros et al., 2023; Lubomski et al., 2023; Smółka & Smółka, 2024). On the other hand, Poland's healthcare efficiency score, as indicated by the available data, is 47, positioning it in the mid-to-lower range among EU member states. This score suggests that Poland should adopt telemedicine practices.

Comparing the percentage of teleconsultations to the total number of medical consultations, the data reveals that it has a significant impact on the overall efficiency of healthcare (OECD & European Commission, 2024). Higher rates of telemedicine adoption correlate with reduced burden on physical healthcare facilities, faster response times, and improved patient access, which contribute to better healthcare outcomes and cost-effectiveness (Lubomski et al., 2023). This is consistent with our hypothesis that telemedicine improves both the quality and accessibility of healthcare in Poland.

In our research, we also found that Poland relies on traditional paper documents, which increases administrative burden, costs, and the risk of data handling errors, leading to misdiagnosis, medication errors, and delays in treatment (Lubomski et al., 2023). The lack of digital documents complicates healthcare coordination, especially for aging populations with chronic conditions that require consistent and integrated health care services. This was also found in their research by Smółka and Smółka (2024a) or Vovk and Kister (2021), and rural areas in Poland often lack the necessary digital infrastructure to support telemedicine (Romanick-Schmiedl & Raghu, 2020).

Limited internet penetration and digital infrastructure in rural areas hinder the implementation of telemedicine platforms. Countries with high levels of telemedicine adoption have reduced hospital congestion, improved access to care, and optimized resource utilization (Adamowicz, 2021; Komorowski & Stanny, 2020). Denmark, Sweden, and the Netherlands benefit from well-developed telemedicine infrastructure, comprehensive digital health policies, and high internet penetration (Berros et al., 2023; OECD & European Commission, 2024). Poland's moderate performance reflects partial adoption of digital health solutions. The pandemic has accelerated global telemedicine adoption (Krawczyk & Marszałek, 2024) but Poland's limited infrastructure and regulatory framework have limited its ability to adopt telemedicine.

Poland has not yet adopted telemedicine, due to some challenges. For example, the technological barriers, particularly in rural areas, are obstacle in widespread adoption of digital health platforms. Second, the regulatory challenges, including inconsistencies in reimbursement policies and telehealth service frameworks, pose obstacles to wide-scale implementation. Third, resistance from traditional healthcare institutions further complicates full integration of telemedicine into the Polish healthcare system. Similar issues were reported in Germany, Denmark and the Netherlands (Becker et al., 2023; Korsgaard et al., 2021; Raes et al., 2022; Tecklenburg, 2021) but they have successfully addressed these challenges through targeted policy reforms, infrastructure investments, and increased acceptance among healthcare providers (Furlepa et al., 2022).

Conclusions

The implementation of telemedicine in Poland is the lowest among all EU countries where adoption rates are significantly higher. While Poland has introduced telemedicine in certain areas, such as teleconsultations, its overall adoption rate stands at 25%. In contrast, Denmark (57%), Germany (53%), and the Netherlands (47%) have made greater progress in integrating telemedicine into their healthcare systems. These countries, known for their high healthcare efficiency, have invested substantially in digital health platforms, enabling advancements in teleconsultation, e-prescription, and remote diagnostics. Their efforts have resulted in reduced patient waiting times, optimized resource allocation, and improved accessibility to medical services.

To enhance the implementation of telemedicine in Poland, several strategic measures should be considered. Expanding internet access and digital platforms, particularly in rural areas, would facilitate the adoption of teleconsultations and telemedicine services. Establishing consistent reimbursement policies and legal frameworks for telehealth would provide financial incentives for healthcare providers and encourage patient participation. Moreover, educating both healthcare professionals and patients on the benefits of digital health solutions would help overcome resistance and build trust in these technologies.

Future advancements should focus on integrating teleconsultation, e-prescription, and remote monitoring into routine healthcare practices to enhance efficiency and accessibility. Additionally, implementing comprehensive metrics to assess the effectiveness of telemedicine – such as safety, patient outcomes, and user experience – would improve data collection and inform policy decisions. By adopting these strategies, Poland can move closer to aligning with the advanced telemedicine systems seen in leading EU healthcare models.

Acknowledgments

The author received no financial support for the research, authorship, and/or publication of this article.

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