SYSTEMATIC REVIEW   **Open Access**

The use of telemedicine in family medicine: a scoping review

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Abstract

Background Telemedicine is becoming increasingly important in primary health care globally. It is recognized as safe, convenient, and cost-effective. The aim of this study is to explore the use of telemedicine in family medicine services, focusing on identifying its areas of application, advantages, disadvantages, and the infrastructure required for effective implementation of this technology.

Methods This scoping review was conducted in 2024 using the 5-step framework of Arksey and O'Malley. Comprehensive searches were carried out in the Web of Science, PubMed, and Scopus databases, using keywords such as telemedicine, telehealth, virtual care, teleconsultation, family physician, and family medicine. The search was limited to publications from 2015 to 2024. A total of 37 relevant articles were included in the analysis.

Results Telemedicine is utilized in four primary areas of family medicine: prevention, treatment, monitoring and control, and consultation/administration. According to the frequency of mention in the studies reviewed, the key advantages of telemedicine include improved patient access, enhanced convenience for both patients and healthcare providers, increased patient safety, and greater flexibility in service delivery. However, several challenges were also noted, including the lack of physical examinations, communication and cognitive barriers, low digital literacy among patients and family physicians, and concerns about patient privacy. Essential infrastructure for effective telemedicine implementation comprises reliable information and communication technology, appropriate devices for patients and family physicians, robust technical support, well-defined guidelines and initiatives to enhance digital literacy.

Conclusion Recognizing the advantages of telemedicine in family medicine, it is essential for national health systems to prioritize its integration and development. Telemedicine has the potential to transform the delivery of family medicine services by enhancing access for remote and underserved communities while substantially reducing costs for both patients and providers. However, achieving this potential necessitates the establishment of appropriate legal, technical, and cultural infrastructure.

Keywords Family physician, Family medicine, Telemedicine, Virtual care, Teleconsultation

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Introduction

As advancements in information technology continue to accelerate, the demand for innovation in healthcare delivery has grown, leading to the emergence of telemedicine [1].Telemedicine involves electronically transmitting medical data in either audio or visual formats between locations, enabling communication either in real-time or asynchronously [2]. Although telemedicine dates back to the 1950s, initially used in radiology, recent advancements in information technology have significantly expanded its adoption and popularity [3]. The COVID-19 pandemic further accelerated this shift, transforming virtual care from an option to a necessity for both patients and healthcare providers [4, 5].

Today, telemedicine is widely integrated into various medical specialties, including radiology, emergency medicine, pathology, psychiatry, dermatology, oncology, and post-surgical care [3, 6]. Family medicine, in particular, has embraced telemedicine extensively during and after the pandemic. FPs provide comprehensive healthcare services to individuals of all ages within the community, from newborns to the elderly [7]. FPs play a crucial role in delivering preventive care, encouraging health-promoting behaviors, managing ongoing patient care, coordinating treatment plans for various health conditions, and supporting public health initiatives [2, 8]. Telemedicine allows family physicians to conduct consultations, monitor chronic conditions, and provide follow-up care through virtual platforms, thereby reducing the need for in-person visits. Numerous studies highlight the effectiveness of virtual care offered by FPs, including patient monitoring, managing chronic conditions, and psychological support as part of behavioral health programs [9]. Overall, telemedicine has facilitated the exchange of information between patients and FPs, monitoring, delivery and management of health services [10].

Integrating telemedicine into the family medicine has numerous advantages, for both patients and FPs. Telemedicine has proven its ability to significantly enhance the availability and accessibility of care [4], particularly in rural areas where patients often face long travel distances to receive care [11, 12]. It also facilitates access for underserved populations, such as those in remote areas or those with mobility issues [13]. By eliminating the need for travel, telemedicine enables patients to consult with FPs from their homes [14]. This is particularly advantageous for the elderly and those with complex health conditions, as it enhances their ability to complete essential visits [15]. Patients report reduced travel time and cost, as well as shorter wait times for appointments, which makes health services more accessible [9]. Moreover, telemedicine allows flexible scheduling and the possibility of appointments outside of regular office hours. It has proven effective in managing acute care needs and has minimized the need for in-person follow-up visits [16]. Despite the increased number of visits, telemedicine has not compromised the quality of care nor driven up healthcare costs [17]. By reducing the need for in-person visits, telemedicine saves time and money, cutting costs related with travel and time off work for patients [3]. Over time, it helps lowers primary care expenses, improves the management of chronic conditions, and enhances the overall efficiency of healthcare delivery [18, 19].

Despite the numerous advantages, several challenges have hindered the widespread adoption of telemedicine in family medicine. One key limitation is that telemedicine does not allow for a complete physical examination. Additionally, virtual visits are less likely to foster the same social and emotional connections between patients and healthcare providers that in-person visits do [3]. The inability to conduct physical assessments and the reduced personal interaction can negatively affect treatment adherence and health outcomes [20, 21]. Moreover, the lack of physical exams increases the risk of diagnostic errors and the inappropriate medications prescription [22].

Cultural resistance and a lack of trust in technology among both FPs and patients can also impede the adoption of telemedicine [23]. Furthermore, a significant digital literacy gap, particularly in rural areas, can hinder the effective use of telemedicine platforms [24]. The inadequate training of FPs and insufficient resource allocation are additional barriers to successful implementation [25]. FPs and support staff must undergo proper training before engaging in telemedicine, and new equipment may need to be purchased, installed, and maintained. Telemedicine programs also require full-time staff to manage and troubleshoot equipment and systems, adding to the overall expense [3]. For telemedicine to function effectively, both patients and FPs need access to suitable devices and high-speed internet connections. Moreover, connectivity issues, such as poor network quality or equipment failure, can frequently disrupt virtual visits [26, 27]. Privacy concerns also present significant risks, as sensitive information is vulnerable to interception and theft, with proper security measures often proving costly [3]. Finally, reimbursement regulations vary by country, and in some regions, telemedicine visits are not yet reimbursed, further complicating its widespread adoption [28].

The growing integration of telemedicine into global primary care systems is underpinned by evidence emphasizing its safety, convenience, and cost-effectiveness [2]. Even in the post-COVID-19 era, telemedicine is expected to remain an essential component of healthcare delivery, addressing diverse patient needs such as chronic disease management, mental health follow-ups, and counseling

services [29]. Virtual care is anticipated to expand further and become a routine practice [28]. As healthcare systems increasingly invest in telemedicine infrastructure, it is imperative to explore its application areas, benefits, challenges, and potential for addressing future patient needs [29]. Although previous research outlines the benefits and drawbacks of telemedicine in family medicine, a comprehensive understanding of its impact on both physicians and patients as a care delivery model is still lacking. Most studies on this topic primarily explore the use of telemedicine in healthcare [3, 25, 26, 30] but do not specifically focus on family medicine, leaving a knowledge gap in this area. This calls for the generation of robust evidence and the establishment of best practices to guide virtual care implementation [19]. Review studies play a pivotal role in providing actionable insights for policymakers and healthcare managers. So, this review aims to shed light on the application areas, advantages, disadvantages, and essential infrastructure required for integrating telemedicine into family medicine.

Methods

This scoping review was conducted following the five-steps framework outlined by Arksey & O'Malley [31].

Identifying the research question

The primary objective of this study is to explore the applications, advantages, disadvantages, and infrastructural requirements associated with telemedicine in family medicine.

Identifying relevant studies

Systematic searches were conducted across three databases: PubMed, Scopus, and Web of Science, covering the period from January 1, 2015, to October 31, 2024. The following keywords were used: telemedicine, telehealth, virtual care, teleconsultation, family physician, family medicine, and family doctor (Appendix 1: Search Strategy).

Study selection

Inclusion criteria:

- Studies focusing on telemedicine in family medicine.
- Original research articles.
- Articles written in English.
- Full-text access available.

Exclusion criteria:

- Studies focused on general practice or hospital services.
- Conference proceedings and book chapters.
- Non-English language articles.

- Articles without full-text access.

The PRISMA framework was applied to screen and select articles. All records were imported into Endnote for reference management. After removing duplicates, two team members (MM and SM) independently reviewed the titles and abstracts of the remaining articles. Articles deemed relevant were retrieved in full for a comprehensive evaluation and data extraction.

Charting the data

Two researchers independently reviewed each article. A data extraction form was created in Excel, which included bibliographic details for each study. This form collected the following information: first author's name, publication year, study location, study design, data collection methods, target population, advantages, disadvantages, infrastructure requirements, and the telemedicine application area.

Collating, summarizing, and reporting the results

Content analysis was applied to interpret the data. The framework by Bostan et al. [2], which includes areas of application, advantages, and disadvantages, was used to organize financings. Data extraction and synthesis were conducted in two stages. Initially, studies were categorized based on geographic distribution, study design, populations involved, and other characteristics. In the second stage, the core findings were organized into four main categories: applications of telemedicine in family medicine, advantages, disadvantages, and infrastructural needs. The figures were designed with Excel 2019 and Artificial intelligence (AI) was used to edit the text.

Results

The initial search identified 3,585 articles, of which 1,269 were duplicates and were removed. The titles and abstracts of the remaining 2,316 articles were then reviewed, resulting in the exclusion of 2,712 articles that did not meet the inclusion criteria. Among the 144 remaining articles, full-text access for 2 was unavailable, and 5 were not in English. A thorough review of the full texts of the remaining 137 articles led to the exclusion of an additional 100 studies, either due to failure to meet inclusion criteria or lack of relevance. Ultimately, 37 original articles were included in the study (see Fig. 1 and Table S1).

Regarding study design, 17 studies employed quantitative methods, 16 used qualitative approaches, and 4 utilized mixed methods. Data collection methods included interviews in 19 studies, questionnaires in 15, focus groups in 2 studies, and patient record reviews in 5 studies. The target population consisted of 25 studies involving physicians and healthcare providers, 7 focused
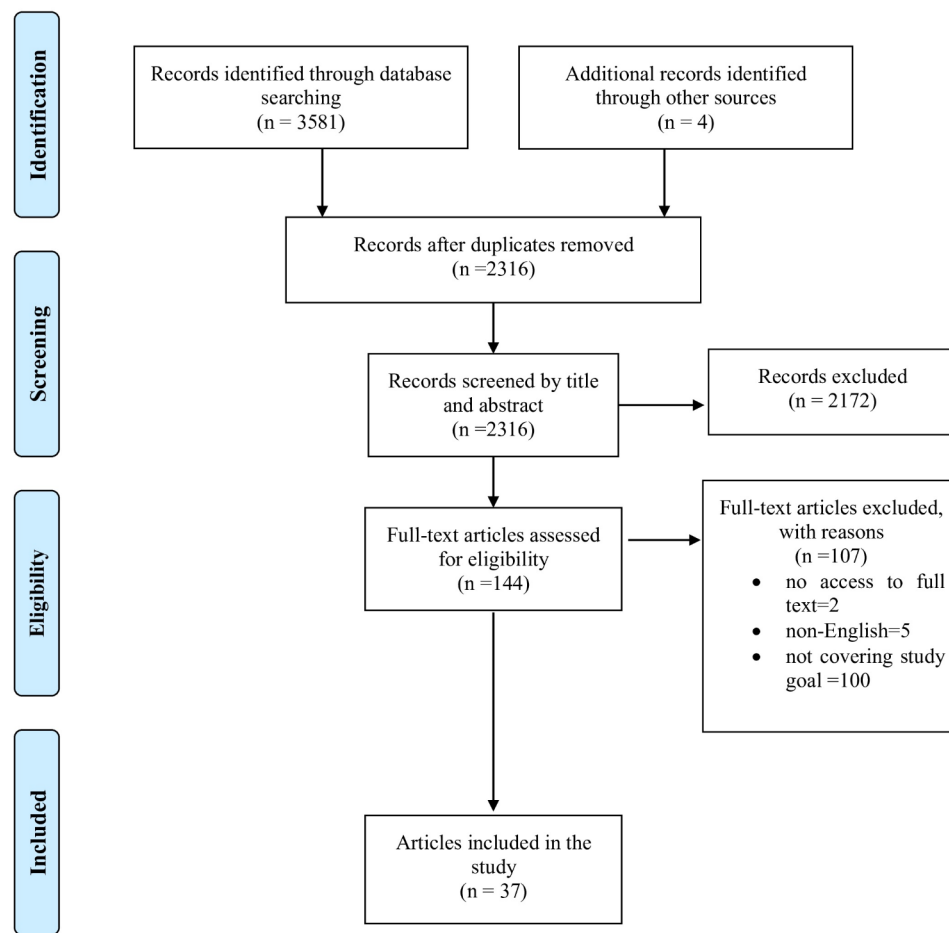
Fig. 1 PRISMA flowchart

on patients, and 4 examined both groups. One study included quality managers from the family physician program. The smallest sample size was 5 participants, while the largest included 1,557 physicians and 903 patients. For the patient records review, sample sizes ranged from 130 to 35,503.

In terms of geographical distribution, the studies covered 13 countries, with the largest number conducted in the United States (13 studies, 35%), followed by Canada (9 studies, 24%) and Saudi Arabia (4 studies, 11%). North America contributed 22 studies, the Middle East 8, Europe 6, and there was one study from East Asia. Most studies were published after the COVID-19 pandemic, with the highest number of publications in 2024 and 2023, each featuring 9 articles.

The applications of telemedicine in family medicine
According to the model by Bostan et al. [2], the applications of telemedicine in family medicine encompasses four main categories: prevention, treatment, monitoring/control, and consultation/administration (Table 1). Overall, 81 instances of telemedicine use in family medicine

were identified across the studies. Of these, 44% were for treatment, 32% for monitoring/control, 15% for consultation/administration, and 9% for prevention. In preventive care, telemedicine is employed for health education, cancer screenings, promoting physical activity, and supporting tobacco cessation programs. Within the treatment domain, telemedicine services are diverse, covering both acute and chronic conditions. These services include managing acute care situations, such as COVID-19, and the management of chronic diseases. Frequent applications in treatment include addressing acute conditions, medication prescriptions, and renewals ($N=8$). Additionally, mental health care and chronic disease management are prominent areas of focus. Monitoring and control applications are particularly significant, with the monitoring of diabetic patients ($N=7$) being the most frequently reported use of telemedicine in the studies. Other applications in this area include tracking treatment adherence, interpreting laboratory test results, and overseeing prenatal care. In the area of consultation and administration, telemedicine provides valuable support

Table 1 Applications of telemedicine in family medicine services

Area of application		Frequency	References
Prevention	Health education	3	[2, 32, 33]
	Cancer screenings	2	[2, 11]
	Promoting physical activity	1	[2]
	Tobacco cessation	1	[2]
Treatment	Medication management (prescription/ renewal of prescription)	8	[2, 9, 11, 20, 32–35]
	Acute conditions (including COVID-19)	8	[11, 12, 32, 34, 36–39]
	Mental health	6	[2, 9, 12, 19, 20, 36]
	Chronic diseases	5	[9, 11, 32, 34, 39]
	Consultation with other physicians	3	[2, 39, 40]
	Initial examination and consultation	2	[5, 32]
	Chronic pains management	2	[35, 40]
	Skin care	2	[41, 42]
Monitoring/Control	Diabetes	7	[12, 20, 32, 36, 43–45]
	Regular follow-ups	6	[5, 9, 11, 32, 35, 39]
	Interpretation the results of laboratory tests	5	[2, 9, 20, 32, 33]
	Pregnancy care	3	[2, 32, 46]
	Blood pressure	3	[20, 32, 36]
	Monitoring of patients with limited mobility	1	[2]
	Asthma	1	[36]
Consultation/ Administration	Family planning and parenting counseling	4	[2, 32, 47, 48]
	Sick Leave	4	[32, 34, 35, 39]
	Drug information	2	[2, 35]
	Nutrition &diet	1	[2]
	Health measures	1	[2]

for family planning guidance, parenting advice, and the issuance of sick leave certificates ($N = 4$).

Advantages of using telemedicine in family medicine

Figure 2 shows the advantages of telemedicine in family medicine and the frequency of their repetition in studies. Overall, 17 distinct benefits of telemedicine in family medicine were identified. Among these, increased patient access was reported in 38% of studies, while provider convenience and patient safety were each cited in 32% of studies. Additionally, patient preference fulfillment was noted in 30%, and patient convenience in 27% of the studies.

The studies highlight that the primary advantage of telemedicine is its ability to enhance patient access to care. This benefit is evident in various ways: it improves access for individuals with limited mobility [5, 29, 49, 50], for those living in remote areas [9, 47, 50, 51], and through improved physical and economic access for patients [2, 12, 20, 32, 33, 52, 53]. Telemedicine significantly enhances the continuity of care, especially during health emergencies, adverse weather conditions that disrupt attendance at healthcare facilities, or for certain groups like students, the elderly, and individuals who struggle to take time off work [2, 5, 9, 18, 49, 52]. Telemedicine enables patients to receive consultations and care at various times and from different locations, including their workplaces, thus improving comfort and saving time [2, 5, 9, 18, 29, 32, 45, 47, 50, 53, 54]. Virtual consultations reduce travel time and provide greater convenience for individuals balancing work and family responsibilities [2, 5, 9, 12, 29, 32, 36, 42, 49, 50].

Some studies emphasize improvements in the doctor-patient relationship, citing better communication, enhanced consultation quality, and increased opportunities for patient education [2, 5, 19]. Additionally, financial benefits arise from the elimination of travel costs [2, 32, 42, 50, 53], reduced waiting times [9, 12], more effective follow-up care [5, 20, 32, 47], and improved overall care quality [9, 47], all of which contribute to a positive patient experience with telemedicine [2, 12, 18, 37, 42, 46, 55].

Telemedicine also enhances family-centered care by actively involving caregivers in the patient's care process. Family members can participate in consultations, provide additional information the patient may not share, and engage in decision-making [2, 12, 19, 20, 29, 36, 51]. Video consultations allow healthcare providers to gain insights into a patient's home and lifestyle, facilitating more comprehensive assessments [19, 20, 29, 50, 53]. Moreover, delivering care remotely helps ensure patient safety by minimizing exposure to infectious hazards, a key advantage emphasized during the COVID-19 pandemic [2, 5, 12, 29, 32, 35, 37, 45, 49, 53, 56, 57].
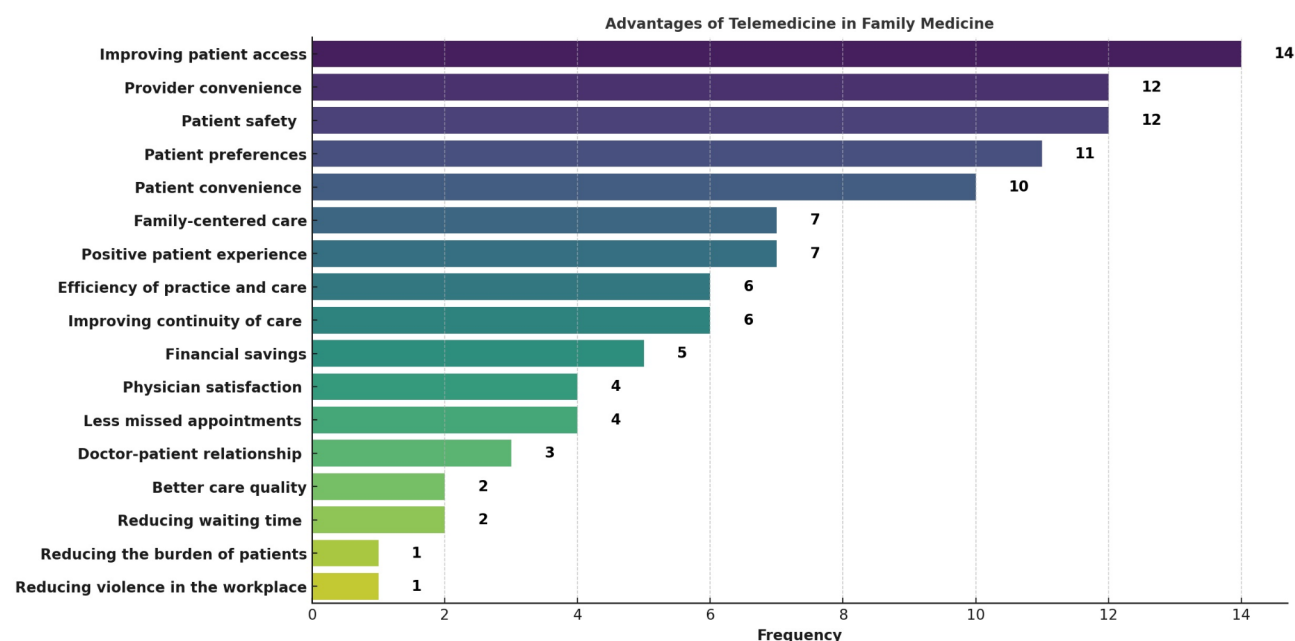
Fig. 2 Advantages of telemedicine in family medicine

Telemedicine also offers several benefits to service providers. Physicians find it more convenient, as telemedicine allows for consultations from home and provides flexibility in scheduling. Numerous studies have highlighted these advantages [9, 18–20, 29, 32, 36, 50, 51, 53, 54, 56]. Additionally, some research points to greater physician satisfaction [11, 29, 32, 35], often linked to better work-life balance, which allows for more family time [29] and an overall improved quality of life [50]. Furthermore, reducing the crowding and patient load in healthcare facilities can alleviate workplace stress and potentially lower incidents of workplace violence [2]. Lastly, telemedicine contributes to improvements in practice efficiency and added value [5, 12, 50, 53, 54, 56]. Time typically lost on tasks such as admissions and room preparation is saved, and no-show appointments are reduced [50], resulting in additional operational benefits.

Disadvantages of using telemedicine in family medicine
Figure 3 shows the disadvantages of telemedicine in family medicine and the frequency of their repetition in studies. Overall, 22 disadvantages of telemedicine in family medicine were identified. Lack of physical examination and communication/perceptual barriers were highlighted in 30% of the studies, while patient privacy concerns were cited in 24%, and inadequate access to communication technology was mentioned in 20% of the studies. A major challenge of telemedicine in family medicine services is its inability to physical examinations [9, 19, 20, 32, 35, 45, 47, 50, 51, 54, 55]. Telemedicine proves impractical for initial consultations, complex medical conditions, or emergencies [5]. Additionally, some diagnoses and clinical decisions cannot be made without conducting a physical examination [51]. For example, diagnosing the causes of dizziness or skin rashes is difficult through self-reported symptoms during a telephone call [51], as are critical conditions such as chest or abdominal pain, respiratory issues, headaches, and musculoskeletal or neurological disorders [20]. Without a comprehensive patient assessment [2, 42, 47], telemedicine carries the risk of inaccurate diagnoses [2, 32, 42, 46, 56], which can lead to incorrect prescriptions, inappropriate tests, or treatments that are either inadequate or excessive [32, 58]. Moreover, a study suggest that telemedicine consultations are associated with higher rates of antibiotic prescriptions compared to in-person visits [58].

Communication barriers—such as challenges related to language, hearing, and non-verbal cues [2, 5, 9, 12, 19, 20, 32, 47, 51, 53, 55] —are significant drawbacks of telemedicine. These issues are particularly pronounced in older adults [5]. The absence of non-verbal cues [51], limited health literacy [51], and difficulties patients may have in articulating their medical issues, which complicates obtaining an accurate medical history [20], further exacerbate these challenges. Additionally, the use of telecommunication tools can be hindered by low technological literacy among both patients and FPs [2, 5, 9, 12, 20, 37, 50, 51, 57, 59], along with insufficient access to up-to-date communication technology or a lack of technical support [32, 38, 50, 51, 53, 54, 57]. Furthermore, the absence of visual contact during certain consultations or recurrent call disconnections [5, 12, 50, 51, 54]) reduces the effectiveness and quality of the consultation [4, 45].
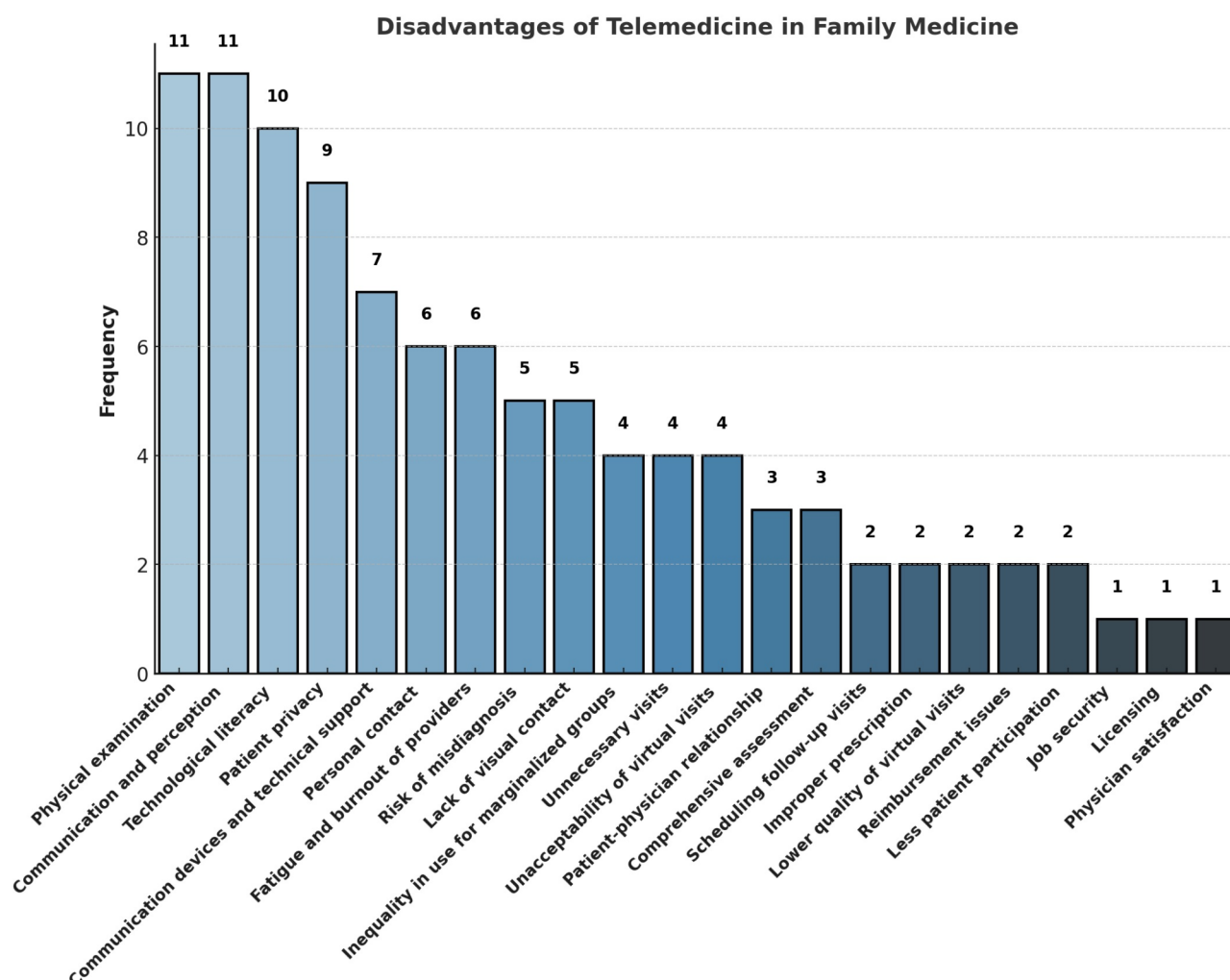
Fig. 3 Disadvantages of telemedicine in family medicine

The limited personal interaction between patients and healthcare providers [12, 20, 35, 45, 50, 54] can undermine trust and the doctor-patient relationship [2, 32, 57]. It has been noted that reduced patient participation in the care process is a significant concern [12, 50]. Acceptability also poses a challenge, as patients may not view telephone or video consultations as legitimate visits, potentially undermining the practice of medicine [2, 5, 9, 47] and leading to unnecessary or redundant appointments [2, 18, 32, 50]. While telemedicine improves access to healthcare, it remains less accessible for certain populations, including marginalized groups, low-income households, and refugees, who have limited access to communication devices [20, 47, 49, 60], thus exacerbating healthcare inequities.

The nature of telemedicine presents a risk to data confidentiality and patient privacy [18, 32, 33, 45, 47, 48, 50, 51, 57]. While involving a third party in the care process can be beneficial, it may also raise privacy concerns [51]. Furthermore, some studies highlight that telemedicine

providers may face fatigue, burnout, and an increased administrative burden [18, 20, 33, 34, 51, 54]. These challenges arise from long and exhausting consultations [51], fatigue from prolonged sitting [54], and the increased administrative workload of recording patient data and coordinating virtual communications or calls. Additionally, issues such as the lack of reimbursement or the complexities involved in obtaining licenses can decrease physicians' motivation to adopt telemedicine [12, 39]. Some studies also discuss potential threats to job security for healthcare workers [2].

Infrastructure requirements for the use of telemedicine in family medicine

The successful implementation of telemedicine in family medicine requires robust technical, legal, and cultural infrastructures (Fig. 4). A total of 11 key infrastructures for the development of telemedicine in family medicine were identified. All three themes were frequently mentioned regarding the technical and communication
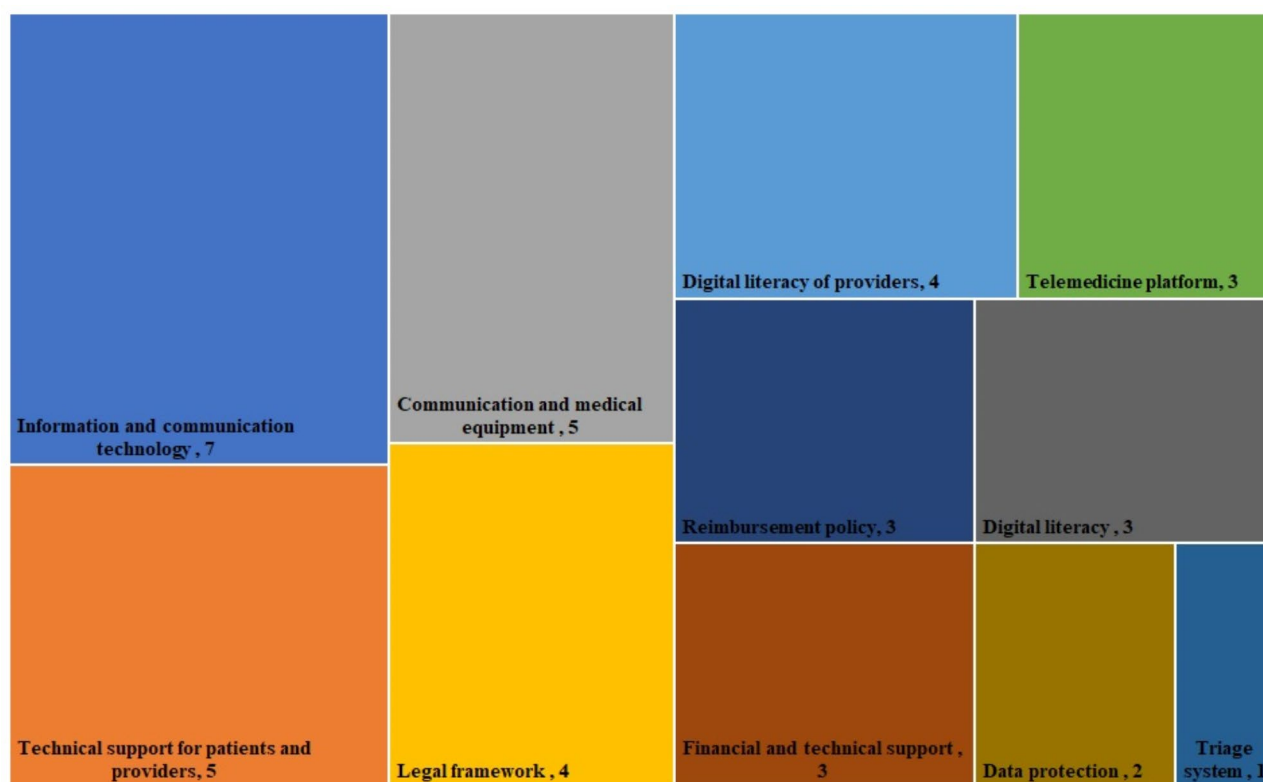
Fig. 4 Infrastructure requirements for the use of telemedicine in family medicine

infrastructures needed for telemedicine: information and communication technology in 19% of the studies, and communication devices and technical support for users in 14% of the studies. Communication technologies and reliable internet access are particularly critical in rural and remote areas [11, 12, 18, 38, 49, 51, 57]. Legal frameworks, including clear guidelines and instructions, are necessary to define the scope of services provided and identify the types of consultations that are appropriate for telemedicine [33, 34, 44, 57]. Three studies highlighted the need for a standardized platform for doctor-patient interactions [5, 9, 42]. Additionally, a triage system is essential to assess which patients are suitable for virtual consultations [36]. It is also important to document patient information before virtual visits and to arrange follow-up appointments [32].

To facilitate virtual care, a patient registration system must be developed on the platform, with support available for patients during the process. Dedicated personnel to assist with any challenges is crucial [5, 9, 32, 38, 53]. The shift to virtual care introduces the need for new workflows, requiring changes in processes, staff training, and continued patient education [18, 32, 34, 57]. Both healthcare providers and patients must have the necessary communication devices for telemedicine [5, 9, 32, 38, 53]. Certain medical tasks may require specialized devices, even if the patient has the required phone

or video equipment and stable internet connection. For example, routine virtual care for diabetic patients might require instruments like a sphygmomanometer or a blood glucose meter [9]. Furthermore, providing technical support for specific groups, such as the elderly and rural populations [12, 49, 51], along with improvements in digital and health literacy [38, 46, 51], is essential for delivering effective telemedicine services.

Discussion

This study aimed to explore the use of telemedicine in family medicine. The findings indicate that telemedicine presents both advantages and challenges within family physician services. Family physicians play a crucial role in providing primary health care, particularly in promoting preventive health, encouraging healthy lifestyles, ensuring continuity of care, and coordinating the management of medical conditions [61]. The study showed that telemedicine supports a variety of family medicine functions, including prevention, diagnosis, treatment, consultation, patient follow-up and care coordination. Many consultations by FPs can be effectively conducted through telemedicine [20]. Medical conditions that do not require in-person assessment or can be monitored remotely—such as blood glucose or blood pressure levels—are well-suited for virtual care in family medicine area [62]. FPs noted that virtual platforms are especially effective in

managing chronic conditions like hypertension, diabetes, and asthma [36].

Studies show that telemedicine is as effective as in-person care [30, 63] and has become a widely accepted and appropriate method for receiving treatment. It is also cost-effective, offering savings when compared to conventional care [30, 64]. Patients generally report high satisfaction with telemedicine, appreciating the convenience and flexibility it offers to manage their health [30, 64]. In-person consultations sometimes limit the opportunity for FPs to comprehend a patient's situation due to time constraints fully. However, previous research suggests that telemedicine can enhance FP understanding of their patients [29] and foster collaborative decision-making that aligns with patients' and their families' needs, goals, and expectations [29].

The rise of virtual care during the COVID-19 pandemic enabled ongoing primary health care delivery during quarantine or when in-person appointments were deemed too risky for FPs and patients [20]. Telemedicine can potentially enhance access to health care for vulnerable groups [29]. In rural areas, where FPs shortages are ongoing, residents often face difficulties accessing primary health care. Expanding telemedicine in rural areas can significantly enhance healthcare availability for these communities [52].

The provision of telemedicine services has raised concerns about potential changes in clinical roles, the risk of providing too much or too little treatment, procedural gaps, and legal uncertainties. Some studies suggest that patients may not perceive telephone or video consultations as legitimate medical visits, which could undermine the value of these virtual encounters [2, 5, 9, 47]. The lack of physical examinations has emerged as the greatest challenge in utilizing telemedicine by FPs. While not every visit requires a physical exam, patients and FPs regard it as a crucial component of their interactions [20, 50]. FPs point out that diagnosing acute conditions can often be challenging, and attempting to do so without a physical exam may lead to misdiagnoses [36]. However, this limitation is somewhat mitigated when patients contribute their own data, such as taking their temperature, and when video consultations allow physicians to observe symptoms and assess the patient's overall appearance [50].

Non-verbal communication significantly influences physician-patient interactions. The absence of non-verbal cues during teleconsultations can lead to misunderstandings, which may be further exacerbated by low health literacy and more complex medical conditions often seen in rural populations [65]. As a result, patients might find it difficult to provide clear information about their medications or offer vague medical histories, leading to an increased need for referrals to clinics or hospitals [51].

A key factor in the successful implementation of telemedicine in family medicine area is the availability of sufficient information and communication infrastructure. Limited access to technology, inadequate internet connectivity, and the slow expansion of high-speed internet networks are significant obstacles, particularly in developing countries, hindering effective video consultations [26]. Inequities in broadband access also present a major challenge to expanding telemedicine services, even in developed nations. For example, rural internet speeds in Canada are only 10–20% of those in urban areas, often falling below the required speeds for video conferencing [28]. Additionally, patients' limited access to smartphones, computers, and adequate internet bandwidth further exacerbates this issue [27]. The lack of appropriate video call facilities forces many to rely on phone consultations, which FPs report can contribute to burnout [51]. Virtual visits typically involve video or phone consultations, necessitating platforms that offer secure video connections, appointment scheduling, virtual waiting rooms, and data-sharing and storage capabilities [28]. These platforms must be user-friendly, and both patients and FPs should receive straightforward training on how to navigate them. In addition, technical support is often required to assist users [66]. Government assistance, such as expanding internet capacity and updating to newer network technology, is desperately needed given the technological difficulties in developing nations, especially in rural areas [26]. The development of digital infrastructure and high-speed internet, particularly in rural and underserved areas, the provision of technical and logistical support for underprivileged populations, and the creation of safe and user-friendly communication platforms all require intersectoral collaboration between the health and information technology sectors.

Developing clear guidelines is essential to determine which medical conditions can be effectively managed by FPs through telemedicine [20, 50]. In a review, Loane and Wootton identified three categories of guidelines for telemedicine: technical, operational, and clinical [67]. Guidelines can reduce litigation risk and standardize work practices. The absence of clear guidelines may discourage healthcare providers from participating in telemedicine services [65]. Without well-defined regulations and protocols, providers may face uncertainty regarding the implementation of virtual care, leading to hesitation in adopting telemedicine practices [59]. Furthermore, the absence of adequate reimbursement mechanisms can potentially impede healthcare providers' willingness to offer telemedicine services, given their concerns regarding financial viability and adequate compensation [65]. The dearth of sufficient or appropriate reimbursement for teleconsultations has been identified as a salient challenge across numerous regions, including Africa, Asia,

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Europe, Latin America, Canada, and the United States [28]. Privacy concerns continue to play a significant role in the adoption of telemedicine. These concerns encompass issues such as data security, insufficient encryption of communications, unauthorized access to video conferences, patient confidentiality, and the potential for unauthorized access to sensitive health information [68]. Healthcare providers must prioritize the protection and security of patient's information on telemedicine platforms [59]. Thus, one of the key components of telemedicine development projects is legal infrastructure. This entails establishing pertinent clinical guidelines and protocols as well as defining the family medical services that can be provided via telemedicine. It is essential to fortify legal and regulatory frameworks in order to protect patient privacy and set national guidelines for patient data access [69]. Additionally, insurance companies must update and revise their reimbursement policies to support the sustainability of telemedicine services.

Low digital literacy has been identified as a significant barrier to the development of telemedicine [65]. Digital literacy involves a range of cognitive and technical skills necessary to effectively use digital tools for finding, evaluating, creating, and sharing information. This encompasses basic computer literacy, proficiency in using the Internet, and the ability to critically assess digital content. For patients, digital literacy is essential for communicating with healthcare providers, facilitating referrals and tests, and accessing online patient portals [70]. Improving patients' digital literacy enhances their ability to accurately communicate symptoms, medications, and other health-related information, which in turn improves diagnostic accuracy [51]. On the other hand, FPs must develop competencies in using technical tools, virtual history-taking, conducting virtual physical exams, and maintaining effective interpersonal communication [26]. Therefore, training and capacity building are key components in the development of telemedicine. Incorporating virtual care education into medical curricula and ensuring ongoing professional development for FPs are essential [28]. Additionally, patients should receive training on how to use home monitoring devices, such as blood pressure monitors, pulse oximeters, thermometers, and scales, to track vital signs and share this data with their physicians remotely [20]. Public awareness of the benefits of telemedicine and its acceptance can be enhanced by implementing national informational campaigns.

Finally, the long-term sustainability of telemedicine depends on funding and regulatory frameworks. Continuous technology updates, cybersecurity requirements, and the ongoing training of healthcare professionals are key cost drivers in maintaining telemedicine services. These expenses can place a significant burden on healthcare systems that are already facing financial pressures. As a result, in addition to government funding and insurance reimbursements, innovative financing solutions—such as public-private partnerships and private investments—are crucial for ensuring the long-term sustainability and viability of telemedicine [69]. It also requires robust regulatory frameworks that encompass up-to-date guidelines, quality standards, and data protection measures. Monitoring and evaluation play a crucial role in ensuring sustainability, including the establishment of systems to track and evaluate family medicine services delivered through telemedicine, conducting studies to assess effectiveness, and identifying challenges and areas for improvement.

Recommendations for researchers

Given the expanding use of telemedicine in family medicine, there is a growing need for further research to address existing gaps in this field. Future studies could focus on the effectiveness of telemedicine in managing common conditions in family medicine, such as diabetes, hypertension, mental health disorders, and chronic diseases. There is a lack of systematic evaluations comparing the effectiveness of telemedicine with in-person care in family medicine, which is crucial for understanding its effects on patient outcomes. The acceptance and satisfaction of telemedicine among both FPs and patients should be explored across different cultural contexts. It is also crucial to conduct robust studies examining the impact of telemedicine on reducing healthcare access inequalities, particularly in disadvantaged and rural areas. Considering the importance of reimbursement mechanisms as an essential infrastructure for telemedicine, research on the design and implementation of reimbursement models would benefit the healthcare system. Finally, evaluating the technologies used in telemedicine for monitoring, controlling, and managing chronic diseases in family medicine is another important area for future research.

Limitations

It is important to recognize the various limitations of this study. First, because it only took into account English-language publications, important results from research done in other languages might have gone unnoticed. This might restrict how thorough the findings are, particularly in areas where telemedicine is widely practiced but published research is mostly available in languages other than English. Furthermore, studies that did not directly address family physicians or family medicine in PHC settings were not included in the review. Relevant research that examined telemedicine in more extensive PHC contexts might have been overlooked as a result of this exclusion. As a result, further research is recommended to explore the use of telemedicine specifically within the context of PHC.

Conclusion

Recognizing the supportive stance of family physicians toward telemedicine, driven by its benefits such as time efficiency, cost reduction, improved access, flexibility, and enhanced patient management, it is essential for the national health systems to prioritize the integration and advancement of this technology within family medicine programs. Overall, telemedicine has the potential to revolutionize delivery of family medicine services, improving access for remote and underserved communities while significantly reducing costs for both patients and providers. However, achieving this potential necessitates the establishment of appropriate legal, technical, and cultural infrastructure.

Abbreviations
FP   Family Physician
PHC   Primary Health Care

Supplementary Information

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Supplementary Material 1.

Supplementary Material 2.

Authors' contributions
E.Z., M.F. and S.M. have made substantial contributions to the conception and design of the work and substantively revised it. S.M. and M.F. selected the articles. M.M. and S.M. extracted articles' data. E.Z. prepared all figures, tables and charts. All authors wrote, reviewed and edited the manuscript.

Data availability
No datasets were generated or analysed during the current study.

Declarations

Ethics approval and consent to participate
Not applicable.

Consent for publication
Not Applicable.

Competing interests
The authors declare no competing interests.

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