

## Telemedicine in the Treatment of Viral Infections in Children

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**Abstract. Background:** The COVID-19 pandemic has accelerated the adoption of telemedicine, including in paediatrics, offering a safe and effective solution for diagnosis and monitoring, particularly in the management of common viral infections in children. Telemedicine has become essential for families in remote areas, reducing the burden on traditional healthcare facilities. **Aim:** The study investigates the impact of telemedicine on accessibility, efficiency, and quality of treatment for paediatric viral infections, compared to traditional care. **Methodology:** Following the PRISMA guidelines, a systematic review was conducted on 51,900 articles published between 2020 and 2024, using databases such as PubMed, Springer, and Elsevier. Of these, 23 studies were included in the analysis, focusing on telemedicine use in diagnosis, treatment, and prevention. **Results:** Telemedicine improves accessibility for children in rural areas, facilitates rapid diagnosis through video consultations and connected devices, reduces costs, and enhances user satisfaction. Limitations include technological barriers, data confidentiality concerns, and legislative challenges. The integration of mobile applications and remote monitoring has significantly contributed to reducing complications and recovery time. **Conclusions:** Telemedicine is an effective tool in paediatrics, providing modern solutions for managing viral infections, with the potential to transform healthcare by increasing accessibility, reducing costs, and optimising clinical outcomes. Investments in infrastructure and clear regulations are crucial for maximising long-term benefits.

**Keywords.** telemedicine, paediatric viral infections, healthcare accessibility, remote monitoring, treatment efficiency

### 1. Introduction

The COVID-19 pandemic significantly accelerated the adoption of telemedicine, including in paediatrics. The need to maintain social distancing and limit exposure in hospitals led to a rapid transition towards online consultations, providing parents and doctors with a safe and effective alternative for diagnosis and monitoring. During this period, many healthcare institutions developed or expanded digital platforms to ensure continuity of care, and users became more familiar with new technologies. In this context, telemedicine emerged as an essential tool for managing non-urgent cases, reducing pressure on emergency services and preventing overcrowding [1].

The role of telemedicine in paediatrics is best understood through the unique needs of this medical field, combined with technological advancements that have redefined healthcare delivery. Paediatrics focuses on the care and health monitoring of children—a vulnerable group requiring special attention

from medical professionals. Telemedicine has therefore become a modern and effective solution to ensure accessibility and continuity of care, especially when in-person visits are challenging [2].

Children are frequently affected by a variety of infections, particularly viral ones, which can progress rapidly and require prompt evaluation. Access to telemedicine facilitates swift contact between parents and healthcare professionals, enabling initial assessments without the need to visit a clinic. This is particularly critical for families in rural or remote areas, where access to specialised medical care is limited. Through video consultations, secure chats, and dedicated platforms, telemedicine allows doctors to evaluate symptoms, provide treatment guidance, and recommend additional tests or physical visits if necessary [3].

Another important aspect of telemedicine in paediatrics is its role in reducing the anxiety often associated with medical visits for children. Conducting consultations in the familiar environment of the home creates a less stressful experience for both the child and the family. Additionally, parents benefit from convenience and time savings, as they can access the care they need without significant disruptions to their daily routines. This is especially valuable for working parents or those caring for multiple children [4, 5].

Moreover, telemedicine has contributed to increasing parental education about children's health. Telemedicine platforms not only facilitate consultations but also provide access to educational resources, symptom-monitoring guides, and home care recommendations [6]. This is particularly important in managing viral infections, where timely interventions and symptom management can prevent complications.

### *1.1. The Concept and Development of Telemedicine*

Telemedicine leverages communication and information technologies to provide remote medical services, facilitating interactions between patients and doctors without requiring physical presence. It encompasses consultations, diagnosis, treatment, medical education, and monitoring, all conducted via digital platforms. The key components of telemedicine include video consultations, enabling real-time interaction between patients and healthcare providers, and asynchronous services such as the exchange of messages and medical files for case analysis. Additionally, telemedicine involves the use of remote monitoring devices, such as connected thermometers and pulse oximeters, which deliver essential patient health data. The integration of these components contributes to a more flexible and accessible approach to healthcare, transforming how various conditions are managed [7].

Recent technological advancements have made telemedicine a viable and increasingly utilised solution. Progress in video communication, widespread access to high-speed internet, and the advent of portable smart devices have enabled remote healthcare services to achieve a quality level comparable to traditional consultations. The COVID-19 pandemic accelerated the adoption of these technologies, highlighting the need for flexible solutions to reduce risks associated with in-person visits. The impact on healthcare systems has been significant: telemedicine has eased the burden on emergency departments, allowed for more efficient patient triage, and reduced disparities in access to specialists for populations in remote areas. Furthermore, emerging technologies, such as artificial intelligence and medical data analytics, have begun to be integrated into telemedicine platforms, enhancing diagnostic capabilities and enabling more personalised treatments [8].

The adoption of telemedicine in paediatrics has seen substantial growth, driven by the specific needs of children and their families. Paediatric consultations often involve assessing acute symptoms, such as fever or respiratory difficulties, for which telemedicine provides a rapid and effective solution. Parents can access paediatricians via online platforms to discuss their child's symptoms, receive treatment recommendations, or determine whether a physical visit is necessary. Moreover, portable monitoring devices allow doctors to collect objective data about the child's condition, such as oxygen saturation levels or heart rate, without requiring the young patient to leave their home [9].

Telemedicine also benefits paediatrics in the management of chronic conditions, such as asthma or diabetes, where regular contact with healthcare providers is crucial for treatment adjustments and

complication prevention. In this context, telemedicine has improved treatment adherence, reduced school absenteeism, and alleviated the stress associated with frequent clinic visits. Additionally, telemedicine plays an essential role in educating parents by providing access to tailored information and advice, enabling them to care for their children more effectively [10].

While technical and legislative challenges remain barriers in certain regions, the adoption of telemedicine in paediatrics continues to grow, demonstrating its utility and long-term potential.

### *1.2. Common Viral Infections in Children*

Viral infections are frequent among children due to exposure in community settings and their developing immune systems. These include influenza, caused by seasonal influenza viruses, presenting with fever, cough, and fatigue. Bronchiolitis, triggered by the respiratory syncytial virus (RSV), affects the lower respiratory tract in infants and young children, leading to breathing difficulties and persistent cough. Chickenpox, caused by the varicella-zoster virus, is characterised by skin rashes, fever, and itching. Other infections include viral gastroenteritis, caused by rotavirus or norovirus, which results in diarrhoea and vomiting, as well as respiratory infections caused by adenoviruses or rhinoviruses [11].

Although many viral infections in children are self-limiting, some can progress to severe complications if not properly managed. For instance, influenza in children under five years old or those with chronic conditions can lead to pneumonia, bacterial sinusitis, or heart inflammation. RSV infections are a common cause of hospitalisation in infants due to severe respiratory difficulties. Chickenpox may result in bacterial superinfection of skin lesions, encephalitis, or pneumonia, particularly in children with weakened immune systems [12].

Timely monitoring is essential to recognise signs of worsening conditions and to intervene promptly. Prolonged fever, respiratory distress, refusal to eat, and low energy levels are warning signs requiring immediate medical evaluation [13]. In viral gastroenteritis, monitoring for signs of dehydration, such as dry mouth and reduced urination, is crucial to prevent serious complications [14]. Telemedicine can play a key role, providing parents with rapid access to medical advice and guidance for home care or decisions about seeking emergency interventions.

Complications from viral infections can be prevented through prompt intervention, parental education, and access to appropriate medical resources. Early identification of risk factors and initiation of symptomatic treatment can reduce the severity of the disease and improve long-term outcomes. Thus, rapid monitoring and medical intervention are essential to safeguard children's health and prevent complications associated with common viral infections.

### *1.3. The Importance of Prompt Treatment of Viral Infections in Children*

Prompt treatment of viral infections in children is essential due to their heightened vulnerability and the risks associated with the rapid progression of illness [15]. The immune systems of children, particularly those under five years old, are not fully developed, making them more susceptible to infections and their complications [16]. Early intervention is crucial to limit symptom severity, prevent complications, and ensure rapid recovery, thereby minimising the overall impact on the child's health.

Viral infections such as influenza, bronchiolitis caused by the respiratory syncytial virus (RSV), viral gastroenteritis, and chickenpox can progress quickly if not managed appropriately [17]. For instance, viral bronchiolitis, a common condition in infants, can lead to severe respiratory distress requiring emergency medical intervention [18]. Prompt treatment, even at the level of home care, can reduce the need for hospitalisation and prevent serious respiratory complications. Similarly, untreated influenza can develop into severe complications such as pneumonia or secondary bacterial infections, particularly in children with pre-existing conditions or weakened immunity.

Acting quickly to treat viral infections also plays a vital role in reducing the spread of disease within the community, especially in environments like schools, nurseries, or other crowded settings frequented by children [19]. Early intervention, whether through initiating symptomatic treatment or

isolating the sick child, helps limit the transmission of viruses to other children or family members [20]. In this way, prompt treatment not only supports the health of the affected child but also has a broader positive impact on public health.

Another critical aspect of prompt treatment is the psychological support it provides to parents. Symptoms of viral infections, such as high fever, breathing difficulties, or dehydration, can cause significant anxiety among parents [21]. Early intervention by a healthcare professional, whether in person or via telemedicine, can alleviate concerns and provide clear guidance on managing the illness [22]. This is particularly important in preventing the unwarranted and excessive use of antibiotics, a practice that contributes to the growing problem of antimicrobial resistance.

In children with chronic conditions such as asthma, diabetes, or cardiovascular diseases, viral infections can quickly exacerbate underlying health issues. Prompt treatment not only addresses the viral episode but also prevents the decompensation of these chronic conditions, which could otherwise necessitate hospitalisation or more complex interventions [23]. Rapid identification of warning signs and the initiation of appropriate treatment help maintain a stable health status in these children.

Lastly, timely treatment of viral infections contributes to reducing healthcare costs. Addressing mild symptoms in the early stages of illness is significantly more cost-effective than managing severe complications or hospitalisation [24]. This is an important consideration for both families and healthcare systems, particularly in the context of increasing pressure on medical services.

#### *1.4. The Role of Telemedicine in Accessibility and Treatment Efficiency*

The role of telemedicine in enhancing accessibility and efficiency of treatment is increasingly significant, particularly in the face of challenges confronting modern healthcare systems. Telemedicine enables patients to access high-quality medical services without the need to travel to a healthcare facility, thereby reducing geographical, economic, and logistical barriers to care. This is especially beneficial for vulnerable populations, such as children [25]. As a practical solution for improving public health, telemedicine brings the expertise of medical professionals closer to patients, regardless of their location.

In rural or remote areas, where access to specialists is often limited, telemedicine can replace or complement traditional in-person visits. Through digital platforms, parents can consult paediatricians to assess their child's symptoms, avoiding delays in diagnosis and treatment [26]. This is particularly impactful in paediatrics, as children, with their more fragile immune systems, require timely interventions to prevent complications. Furthermore, for families with limited financial resources, telemedicine eliminates transportation costs and reduces parents' absenteeism from work, making it a more economically accessible option [27].

The efficiency of telemedicine in treatment is evident in the speed with which cases are managed. Using video consultations, online questionnaires, or home monitoring devices, doctors can gather relevant information about a child's health and provide personalised recommendations [28]. This approach reduces the time required to reach a diagnosis and initiate treatment, a critical factor in managing viral infections that can progress rapidly. Additionally, telemedicine allows for continuous monitoring of patients, ensuring closer follow-up of the illness's progression and enabling real-time adjustments to the treatment plan when necessary.

## **2. Materials and Methods**

To conduct this study, the methodology was developed in accordance with the principles outlined in the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. This approach was chosen to ensure a systematic, transparent, and rigorous process in the selection and analysis of relevant literature. The PRISMA framework provided a structured methodology for the data search and analysis process, maximising the relevance and applicability of the results.

The central research question was formulated as follows: What is the impact of telemedicine on the accessibility, efficiency, and quality of treatment for viral infections in children compared to

traditional care? This question guided the entire process of searching for and selecting relevant literature.

### *2.1. Systematic Literature Search*

The research was carried out through a systematic search across seven renowned academic databases, including Springer, PubMed, MDPI, JAMA Network, Sage Journals, Frontiers, and Elsevier.

To identify relevant studies, search phrases were constructed using keywords such as: “telemedicine viral infections in children” (17,600 results), “telemedicine paediatric viral diseases” (17,100 results), and “remote care for paediatric viral infections” (17,200 results).

A total of 51,900 initial articles were identified. Boolean operators AND and OR were applied to combine search terms, enhancing the specificity and relevance of the results.

The search focused on articles published between 2020 and 2024, fully accessible, and written in English, ensuring that the data included in the study reflected the most current advancements in the field.

### *2.2. Inclusion and Exclusion Criteria*

#### **Inclusion Criteria:**

The following criteria were used to include studies in this review: articles published between 2020 and 2024; original research studies, systematic reviews, clinical guidelines, and meta-analyses focused on paediatric viral infections; studies exploring the use of telemedicine for the diagnosis, treatment, prevention, or monitoring of these infections; articles demonstrating relevance to paediatrics and the clinical applicability of telemedicine.

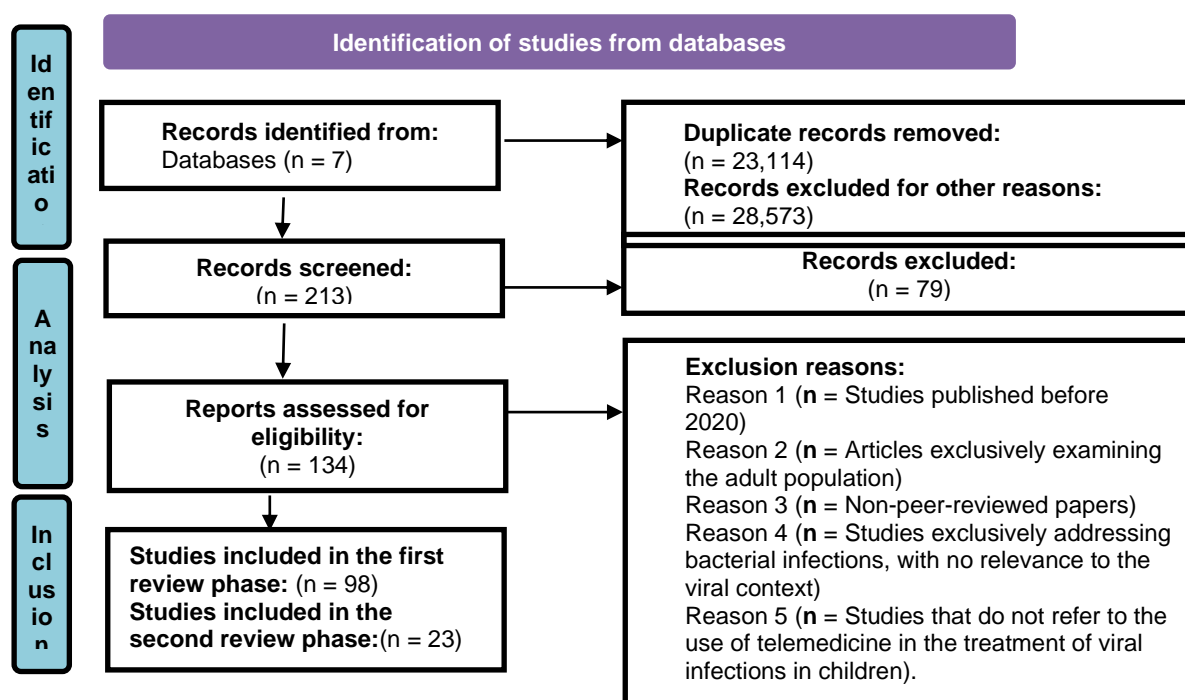
#### **Exclusion Criteria:**

The following articles were excluded: studies published prior to 2020; articles focusing exclusively on adult populations, non-peer-reviewed studies; papers dealing exclusively with bacterial infections or diseases unrelated to viral infections.

### *2.3 Data Extraction and Analysis*

Data extracted from the selected articles were analysed qualitatively, with a particular focus on the practical aspects of implementing telemedicine in paediatrics and its impact on managing viral infections. The findings were synthesised to highlight key trends, challenges, and opportunities associated with the use of telemedicine in this field.

The results provide an in-depth overview of telemedicine's role in improving accessibility and efficiency in treating paediatric viral infections, offering insights for both clinical practice and future research.



**Figure 1.**PRISMA Flow Diagram of Articles Related to the Use of Telemedicine in the Treatment of Viral Infections in Children

Figure 1 illustrates the step-by-step process of selecting and analysing studies using the PRISMA flow diagram. The process began with the identification of 10 relevant databases, from which an initial 51,900 records were retrieved. After removing 23,114 duplicate entries and a further 28,573 records that did not meet preliminary criteria, 213 records remained for detailed screening.

Following this screening, 79 records were excluded for not meeting the selection criteria, based on specific reasons such as the absence of peer review, a different target population, or a lack of relevant data on the topic. Consequently, 134 scientific articles were further assessed for eligibility. Of these, 98 studies were included in the first stage of detailed analysis, with 23 studies subsequently selected for the second stage of review.

This diagram provides a clear and systematic representation of the process of identifying, selecting, and evaluating relevant studies, forming the methodological foundation of the literature review on the use of telemedicine in managing viral infections in children.

### 3. Results

Telemedicine represents a modern and innovative solution for managing viral infections in children, providing significant benefits in diagnosis, treatment, and monitoring. By utilising digital technologies, it enables the delivery of remote medical services, reducing the time required to access care and enhancing the efficiency of clinical interventions.

Table 1 summarises the key aspects of telemedicine's effectiveness in diagnosis and treatment, the advantages it offers to both parents and healthcare providers, as well as the limitations and challenges encountered in implementing this model of care. The information presented is supported by specialised literature, offering a balanced perspective on the potential and challenges of telemedicine in paediatrics.

**Table 1.** Telemedicine in the Management of Viral Infections in Children

Efficiency in Diagnosis and Treatment via Telemedicine	Advantages of Telemedicine for Parents and Doctors	Limitations and Challenges	References
Enables rapid diagnosis of viral infections based on parent-reported symptoms and video consultations.	Saves time for parents by reducing the need for travel and waiting times.	Lack of access to reliable internet or necessary devices in rural areas.	Rosenberg Danziger et al., 2021 [29]; Do Alfuqhar et al., 2024 [30]; Abdel-Wahab et al., 2020 [31].
Ensures the prescription of appropriate treatments and continuous monitoring of symptom progression.	Reduces the child's exposure to pathogens in crowded hospitals or clinics.	Difficulty in performing direct physical examinations or complex diagnostic procedures.	Kvedariene et al., 2022 [32]; Nageswaran et al., 2024 [33]; Demaerschalk et al., 2022 [34].
Supports efficient triage of cases, prioritising emergencies that require physical intervention.	Increases access to specialist doctors for families in isolated areas or those without local medical services.	Resistance from parents or doctors to using technology.	Ezeamii et al., 2024 [35]; Filip et al., 2022 [36]; Snapiri et al., 2020 [37].
Use of home-monitoring devices aids in assessing relevant vital parameters.	Reduces costs associated with transportation and parental absenteeism from work.	Issues related to data confidentiality and information security.	Villafuerte et al., 2023 [38]; Tully et al., 2021 [39]; Bouabida et al., 2022 [40].
Facilitates the collection and analysis of data on symptoms and patient history for informed decision-making.	Improves communication between doctors and parents through educational resources and personalised consultations.	Legislative limitations in the implementation of telemedicine in certain countries or regions.	Wittman et al., 2024 [41]; Ferro et al., 2021; Eisenstein et al., 2020 [42].

Table 1 highlights that telemedicine is a valuable tool in managing paediatric viral infections, enabling rapid diagnosis, continuous monitoring, and improved communication between parents and healthcare professionals. Its benefits include time savings, cost reduction, and increased accessibility to medical services, particularly in remote areas. However, the application of telemedicine is not without challenges, including technological barriers, data privacy concerns, and difficulties in conducting direct physical examinations. Despite these limitations, telemedicine demonstrates its potential to transform paediatric care by integrating modern technologies and adapting to the specific needs of patients and families.

Table 2 analyses the impact of this technology across several key criteria, such as accessibility, quality of care, user satisfaction, cost efficiency, technological integration, and the ethical or technical challenges encountered. Through practical examples and references from specialised literature, the table provides a detailed perspective on how telemedicine influences paediatric care and contributes to improving healthcare systems.

**Table2.**The Impact of Telemedicine in Managing Viral Infections in Children

Criteria	Description	Practical Examples	References
Accessibility	Increasing access to medical care for children in remote or rural areas.	Consultations via platforms such as Teladoc or Doxy.me offered to families in rural areas.	Jadhav and Choure, 2024 [43].
Quality of Care	Enhancing the quality of diagnosis through the use of connected devices and clinical guidelines.	Use of a digital otoscope for at-home evaluation of ear infections.	Cai et al., 2021 [44].
Cost Efficiency	Reducing expenses for transport and in-person medical visits.	Study showing savings of up to 30% with telemedicine for paediatric consultations.	Terrell et al., 2021 [45].
User Satisfaction	Parents and doctors report higher satisfaction due to ease and convenience of access.	Positive feedback from case studies on fast and efficient online consultations.	Raina et al., 2021 [46]; Choo et al., 2021 [47].
Technological Integration	Leveraging modern technologies for monitoring and diagnosis.	Integration of mobile apps with symptom-tracking features, such as TytoCare.	Behar et al., 2020 [48].
Ethical and Legal Challenges	Patient data confidentiality and insufficient regulations for telemedicine.	Need to comply with GDPR and HIPAA standards in online paediatric consultations.	Turgut and Kutlu, 2024 [49].
Technological Barrier	Issues related to the lack of digital infrastructure in some regions.	Areas without stable internet connectivity limiting telemedicine use.	Graves et al., 2021 [50].

Table 2 highlights that telemedicine has a significantly positive impact on managing paediatric viral infections, contributing to increased accessibility, cost reduction, and improved quality of medical services. By utilising advanced technologies and integrating mobile applications, telemedicine facilitates efficient diagnosis and monitoring of patients, particularly for families in rural or remote areas.

The high level of satisfaction reported by users underscores the importance of convenience and ease of access to telemedicine services. However, ethical, legal, and technical challenges, such as data confidentiality and technological barriers, remain significant obstacles to the widespread implementation of this model.

Despite these difficulties, telemedicine continues to be a valuable tool, transforming the delivery of healthcare services for children, especially in the context of viral infections.

**4. Discussion**

Based on the specialised studies analysed, we found that one of the main advantages of telemedicine is its ability to improve access to healthcare services for children in remote or rural areas. This is supported by Camacho-Leon et al. (2024), who noted that during the COVID-19 pandemic, telemedicine was widely implemented to ensure continuity of care, reducing the need for physical

presence in healthcare facilities and, consequently, the risk of virus transmission [51]. This approach enabled access to medical services for patients in isolated or resource-limited areas, thereby enhancing both accessibility and the quality of care.

We also highlighted that the use of connected devices and clinical guidelines in telemedicine has improved the quality of diagnosis. According to Madhavan and El Saleeby (2020), these technological innovations have facilitated remote monitoring of patients, providing a positive experience for both patients and healthcare professionals [52].

Additionally, we demonstrated that the implementation of telemedicine has contributed to reducing healthcare costs. As noted by Nittari et al. (2022), by decreasing the need for travel and the resources used in traditional clinic visits, telemedicine has offered an economical solution for both patients and healthcare systems [53]. This aspect is particularly relevant in the context of the pandemic, where healthcare resources were under significant pressure.

Regarding the high level of satisfaction reported by users, this underscores the importance of convenience and ease of access to telemedicine services. Both parents and doctors have reported increased satisfaction due to the accessibility and convenience of online consultations, which offer a viable alternative to traditional visits. Positive feedback from case studies on fast and efficient online consultations highlights telemedicine's potential to transform paediatric care [54].

However, the use of telemedicine raises significant ethical and legal challenges. Issues such as patient data confidentiality, informed consent, and professional accountability require adequate regulations to ensure safe and effective practices in telemedicine. For example, compliance with regulations such as GDPR and HIPAA standards in online paediatric consultations is essential to protect sensitive information [55].

The lack of adequate digital infrastructure in certain regions also represents a significant barrier to telemedicine implementation. Areas without stable internet connectivity limit the effective use of telemedicine services, necessitating investments in infrastructure to ensure equitable access to healthcare [56].

Our study also highlighted that integrating modern technologies into telemedicine has shown significant potential in improving efficiency and user satisfaction. The use of mobile applications with symptom-tracking features, such as TytoCare, has facilitated remote patient monitoring, providing a positive experience for both patients and healthcare professionals. According to [reference], these technological innovations have allowed better management of viral infections in children, reducing response times and improving clinical outcomes [57].

The future of telemedicine in paediatrics looks optimistic, given the rapid progress of digital technologies and their growing acceptance by users. The development of artificial intelligence, wearable monitoring devices, and integrated platforms will facilitate more accurate diagnoses, personalised treatments, and remote monitoring of patients. Furthermore, telemedicine could become an integral part of public health programmes, offering equitable access to care for all socio-economic groups. With investments in infrastructure and clear regulations, telemedicine promises to revolutionise the delivery of healthcare services, making them more efficient and accessible.

## 5. Conclusions

Telemedicine has proven to be a valuable tool in managing viral infections in children, significantly improving access to healthcare, reducing costs, and increasing user satisfaction. By utilising modern technologies, it has enabled rapid diagnosis, continuous monitoring, and the delivery of appropriate treatment, particularly for families in remote areas or those with limited access to medical services. Specialised studies have highlighted that telemedicine is an efficient solution, well-suited to current needs, and a viable alternative to traditional in-clinic visits.

A key benefit of telemedicine is its ability to alleviate pressure on healthcare systems while providing parents and doctors with a convenient platform for effective communication. The integration of connected devices and mobile applications has significantly enhanced the quality of care by delivering real-time objective data. Furthermore, this approach has demonstrated its potential to

reduce complications and recovery times, particularly through prompt interventions based on monitoring and efficient triage.

However, the implementation of telemedicine faces challenges related to data confidentiality, legal regulations, and technological barriers. The lack of adequate digital infrastructure and the reluctance of some users remain obstacles that require dedicated solutions. Despite these limitations, the specialised literature confirms the positive impact of telemedicine in paediatrics and emphasises the need for investments in infrastructure and clear regulations to maximise its benefits.

In conclusion, telemedicine represents a promising solution for the care of children with viral infections, with the potential to fundamentally transform healthcare systems, making them more accessible, efficient, and patient-centred.

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