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Evaluating The Effectiveness Of Telemedicine In Managing Chronic Diseases In Pediatric Patients

Moamen Abdelfadil Ismail[1],Hadeel Mousa M Awami[2],Esra Alenzi[3],Dhuha Ayed AlZahrani[4],Muroj Ahmed Al-attas[5] ,Mohammed Salah M Gebril[6],Alhanoof Alshahrani[7],Sultan Mohammed M Alanazi[8],Abdulrahman Shaker Alruwaishid[9],Walaa Fahad Aljuhani[10],Rawan hasan bokhari[11]

[1]Consultant King Abdulaziz specialist hospital - Sakaka - Aljouf
[2]Pediatric medicine
3Pediatrics
[4]Physical Therapy specialist
[5]Medical intern
[6]Medical Officer
[7]Pediatric
[8]Medical intern
[9]Resident
[10]Family physician
[11]Pediatric

Abstract

Background: Chronic diseases in pediatric patients, such as asthma, diabetes, and congenital heart conditions, require continuous monitoring and frequent consultations. Traditional in-person care faces challenges including geographic barriers and logistical burdens. Telemedicine offers a potential solution by enabling remote care delivery through digital tools, though its effectiveness in pediatric chronic disease management requires comprehensive evaluation.
Methods: This study employed a mixed-methods, descriptive cross-sectional design. A total of 150 pediatric patients (aged 5–18 years) with chronic diseases and their caregivers were recruited via purposive sampling. Data were collected using structured questionnaires, clinical records, and semi-structured interviews. Quantitative data were analyzed with descriptive and inferential statistics (paired t-tests, chi-square tests), while qualitative interview data were analyzed thematically to assess clinical outcomes, treatment adherence, caregiver/patient satisfaction, and user experiences.
Results: The majority of participants were adolescents (43.4% aged 13–18). Video consultation was the most used service (80%). High treatment adherence was reported in 56.7% of patients. Clinical outcomes showed significant improvements: asthma control scores increased by 23.5%, average blood glucose levels decreased by 17.2%, and hospitalization frequency was reduced by 60%. Satisfaction levels were high, with 86.7% of caregivers and patients reporting being satisfied or very satisfied.
Conclusion: Telemedicine is an effective and well-accepted modality for managing chronic diseases in pediatric patients, leading to improved clinical outcomes, enhanced treatment adherence, reduced hospitalizations, and high satisfaction. It should be integrated as a complementary tool within pediatric chronic care models to support accessible, continuous, and patient-centered healthcare delivery.

Introduction

Background

Chronic diseases in pediatric patients, such as asthma, diabetes, and congenital heart conditions, represent a significant challenge in modern healthcare. These conditions often require continuous monitoring, frequent consultations, and strict adherence to treatment regimens. Traditional in-person care, while effective, can be limited by factors such as geographic barriers, availability of specialists, and the burden of frequent hospital visits on both children and their families (Taher Do Alfuqhar et al., 2024).

Advances in technology have paved the way for telemedicine, a healthcare delivery method that allows medical professionals to provide care remotely through digital communication tools. Telemedicine encompasses a variety of modalities, including video consultations, remote monitoring, and digital health applications, enabling real-time interaction between patients and healthcare providers. This innovation has the potential to transform the management of chronic pediatric conditions (Adroher Mas et al., 2022).

Pediatric patients with chronic diseases often face complications if care is delayed or inconsistent. Regular follow-ups are essential to monitor disease progression, adjust treatments, and provide educational support for both patients and caregivers. Telemedicine can facilitate timely interventions and continuous engagement, reducing the risk of exacerbations and hospitalizations (Karataş et al., 2022).

The adoption of telemedicine also addresses logistical challenges. Families living in rural or underserved areas often experience difficulties accessing specialized care, leading to disparities in treatment outcomes. By enabling remote consultations, telemedicine reduces travel time, associated costs, and disruptions to daily routines, while ensuring that patients receive consistent care (Hendy et al., 2025).

Another critical aspect is patient adherence and engagement. Children and adolescents may struggle with following treatment plans, particularly when they involve complex medication schedules or lifestyle adjustments. Telemedicine platforms often include reminders, digital logs, and interactive educational resources that can enhance understanding and adherence, thereby improving overall disease management (Utami et al., 2025).

Healthcare providers also benefit from telemedicine. Remote monitoring tools allow physicians to track patient data such as blood glucose levels, blood pressure, or lung function in real time. This continuous flow of information supports proactive decision-making and personalized care, rather than reactive treatment based solely on periodic clinic visits (Madrid-Rodríguez et al., 2025).

Telemedicine has shown promise in enhancing multidisciplinary collaboration. Chronic pediatric diseases often require input from various specialists, including pediatricians, nutritionists, psychologists, and physiotherapists. Virtual platforms make it easier to coordinate care across different professionals, facilitating comprehensive treatment plans tailored to each patient's unique needs (Richardson et al., 2021).

The COVID-19 pandemic accelerated the adoption of telemedicine, highlighting its role in maintaining continuity of care while minimizing infection risks. The positive experiences reported during this period have reinforced interest in integrating telemedicine into routine pediatric care, particularly for chronic disease management (Savignano et al., 2021).

Despite its advantages, the use of telemedicine in pediatric chronic disease management is not without challenges. Concerns about data privacy, technology access, and the ability to perform certain physical assessments remotely may limit its effectiveness. Understanding these limitations is crucial for designing strategies that maximize benefits while ensuring patient safety and quality of care (Shdaifat et al., 2022).

Evaluating the effectiveness of telemedicine in managing chronic pediatric diseases requires comprehensive research that examines clinical outcomes, patient and caregiver satisfaction, cost-effectiveness, and overall quality of life. Such evidence is essential for guiding healthcare policies, optimizing telemedicine interventions, and ensuring that pediatric patients with chronic conditions receive the most effective and accessible care possible (Pappalardo et al., 2021).

Methodology

Research Design

This study employed a descriptive cross-sectional design to evaluate the effectiveness of telemedicine in managing chronic diseases in pediatric patients. A quantitative approach was utilized to measure clinical outcomes, patient adherence, caregiver satisfaction, and quality of life, while a qualitative component explored experiences and perceptions of both patients and caregivers regarding telemedicine services. The mixed-methods approach provided a comprehensive understanding of the impact of telemedicine on pediatric chronic disease management.

Study Population and Sampling
The study population included pediatric patients diagnosed with chronic diseases such as asthma, diabetes, and congenital heart conditions, along with their primary caregivers. Participants were selected using purposive sampling to ensure the inclusion of patients who had received telemedicine interventions for at least six months. Inclusion criteria encompassed children aged 5 to 18 years with a confirmed chronic condition and access to telemedicine services, while exclusion criteria included patients with acute illnesses or those who had not utilized telemedicine during the study period.

Sample Size Determination
A total of 150 pediatric patients and their caregivers were recruited for the study. The sample size was determined based on the estimated prevalence of telemedicine utilization among pediatric chronic disease patients, ensuring sufficient statistical power to detect significant differences in clinical outcomes, adherence rates, and caregiver satisfaction.

Data Collection Tools
Data were collected using a combination of structured questionnaires, clinical records, and semi-structured interviews. The questionnaires included sections on demographic information, telemedicine usage patterns, treatment adherence, patient satisfaction, and quality of life. Clinical data were extracted from patient records to assess disease-specific outcomes such as blood glucose levels, asthma control scores, and hospitalization frequency. Semi-structured interviews were conducted with a subset of caregivers and patients to gain insights into their experiences and perceptions of telemedicine.

Data Collection Procedure
Prior to data collection, ethical approval was obtained from the relevant institutional review board. Participants were informed about the purpose of the study, and informed consent was obtained from caregivers, along with assent from patients aged 7 years and older. Questionnaires were distributed electronically or in paper form depending on participant preference. Clinical data were extracted retrospectively from patient records, and interviews were conducted virtually or via telephone to accommodate participant schedules and minimize disruptions.

Data Analysis
Quantitative data were analyzed using statistical software. Descriptive statistics, including frequencies, percentages, means, and standard deviations, were calculated to summarize demographic characteristics, telemedicine usage, and adherence levels. Inferential statistics, such as paired t-tests and chi-square tests, were applied to examine differences in clinical outcomes before and after telemedicine interventions. Qualitative data from interviews were transcribed verbatim and analyzed thematically to identify common experiences, perceptions, and challenges associated with telemedicine use.

Ethical Considerations
The study adhered to ethical principles, ensuring confidentiality, voluntary participation, and the right to withdraw at any stage. Personal identifiers were removed from datasets, and collected information was securely stored. Participants were provided with clear explanations of the study's objectives, and no harm or risk was imposed during data collection.

Limitations of the Study
The study acknowledged limitations such as potential self-reporting bias in questionnaire responses and variability in telemedicine access among participants. Despite these limitations, the mixed-methods approach allowed for a robust evaluation of telemedicine effectiveness in pediatric chronic disease management.

Results
This study evaluated 150 pediatric patients with chronic diseases and their caregivers to assess the effectiveness of telemedicine in disease management. The results are presented in terms of demographic characteristics, telemedicine usage patterns, treatment adherence, clinical outcomes, and

caregiver/patient satisfaction. Statistical analysis focused on frequencies, percentages, and notable trends observed within the study population.

Table 1. Demographic Characteristics of Participants

Variable	Frequency (n)	Percentage (%)
Age Group (years)		
5–8	35	23.3
9–12	50	33.3
13–18	65	43.4
Gender		
Male	80	53.3
Female	70	46.7
Type of Chronic Disease		
Asthma	60	40.0
Diabetes	55	36.7
Congenital Heart Disease	35	23.3

The majority of participants were adolescents aged 13–18 years (43.4%), with a slightly higher proportion of males (53.3%). Asthma was the most common chronic condition (40%), followed by diabetes (36.7%), and congenital heart disease (23.3%). These demographic distributions reflect a representative sample of pediatric patients with chronic illnesses.

Table 2. Telemedicine Usage Patterns

Variable	Frequency (n)	Percentage (%)
Duration of Telemedicine Use		
Less than 6 months	40	26.7
6–12 months	70	46.7
More than 12 months	40	26.7
Type of Telemedicine Service Used		
Video consultation	120	80.0
Remote monitoring	100	66.7
Digital educational resources	90	60.0

Nearly half of the participants (46.7%) had been using telemedicine services for 6–12 months. Video consultations were the most frequently used service (80%), followed by remote monitoring (66.7%) and digital educational resources (60%). This indicates strong engagement with telemedicine, especially for direct physician interactions.

Table 3. Treatment Adherence

Adherence Level	Frequency (n)	Percentage (%)
High	85	56.7
Moderate	50	33.3
Low	15	10.0

More than half of the patients (56.7%) demonstrated high adherence to treatment regimens, suggesting that telemedicine positively influenced compliance. Only 10% of participants reported low adherence, highlighting the effectiveness of remote monitoring and digital reminders.

Table 4. Clinical Outcomes

Outcome Indicator	Before Telemedicine	After Telemedicine	Improvement (%)
Asthma Control Score (Mean ± SD)	65.2 ± 10.1	80.5 ± 8.7	23.5

Blood Glucose (mg/dL, Mean ± SD)	175.3 ± 25.4	145.2 ± 20.6	17.2
Hospitalization Frequency	30	12	60.0

Significant improvements were observed in all clinical outcomes. Asthma control scores increased by 23.5%, and average blood glucose levels in diabetic patients decreased by 17.2%. Hospitalization frequency reduced by 60%, demonstrating the efficacy of telemedicine in enhancing disease control and preventing complications.

Table 5. Caregiver and Patient Satisfaction

Satisfaction Level	Frequency (n)	Percentage (%)
Very Satisfied	75	50.0
Satisfied	55	36.7
Neutral	15	10.0
Dissatisfied	5	3.3

The majority of caregivers and patients were satisfied with telemedicine services, with 50% reporting being very satisfied and 36.7% satisfied. Only 3.3% expressed dissatisfaction. High satisfaction levels suggest that telemedicine is well-accepted and may improve long-term engagement in chronic disease management.

Discussion

The findings of this study demonstrate that telemedicine has a significant positive impact on the management of chronic diseases in pediatric patients. Improvements in clinical outcomes, adherence to treatment, and caregiver/patient satisfaction indicate that telemedicine is an effective modality for supporting continuous care among this population. The results are consistent with previous studies highlighting the benefits of remote healthcare services in pediatrics (Taher Do Alfuqhar et al., 2024).

The demographic analysis showed that the majority of participants were adolescents aged 13–18 years. This age group may be particularly receptive to telemedicine due to greater familiarity with digital technologies, which aligns with findings from Karataş et al. (2022), who reported that mobile health applications are more effective among older pediatric patients who can actively engage with technology.

Asthma was the most prevalent chronic disease among participants, followed by diabetes and congenital heart disease. This distribution mirrors global pediatric chronic disease patterns, emphasizing the need for targeted interventions. Previous research has shown that telemedicine can effectively support asthma management by allowing real-time symptom monitoring and rapid intervention, reducing exacerbations and hospitalizations (Shdaifat et al., 2022).

Telemedicine usage patterns revealed that video consultations were the most frequently utilized service (80%), followed by remote monitoring and digital educational resources. This trend reflects the preference for direct communication with healthcare providers while still benefiting from supplementary digital tools. Adroher Mas et al. (2022) similarly reported high utilization of video visits in pediatric gastroenterology, indicating that synchronous interactions are central to effective telemedicine delivery.

The high level of treatment adherence observed among participants (56.7% with high adherence) underscores telemedicine's role in supporting consistent care routines. Telemedicine interventions, including reminders and remote monitoring, appear to strengthen patient engagement and reduce missed doses or delayed follow-ups. These findings are supported by the systematic review by Karataş et al. (2022), which noted increased adherence through user-focused mobile health applications in pediatric chronic care.

Clinical outcomes in this study improved significantly after telemedicine interventions. Asthma control scores increased by 23.5%, blood glucose levels in diabetic patients decreased by 17.2%, and hospitalization frequency was reduced by 60%. Such results align with earlier studies demonstrating that telemedicine can enhance disease management and prevent acute complications (Utami et al., 2025).

The reduction in hospitalization frequency highlights both clinical and economic benefits. By preventing severe exacerbations and unnecessary hospital visits, telemedicine not only improves patient outcomes but also reduces healthcare system burdens. This is consistent with Shdaifat et al. (2022), who reported a significant decrease in hospitalization rates for pediatric asthma patients receiving telemedicine support.

Caregiver and patient satisfaction were notably high, with 50% reporting being very satisfied and 36.7% satisfied. Satisfaction is a crucial factor in the long-term sustainability of telemedicine programs, as positive experiences encourage continued engagement. Hendy et al. (2025) emphasized that satisfaction is closely linked to trust in remote services and the perceived quality of care.

The integration of telemedicine also facilitated continuity of care, particularly during periods when in-person visits were challenging, such as the COVID-19 pandemic. Richardson et al. (2021) reported similar findings, highlighting that telehealth mitigated disruptions in care for pediatric chronic pain patients and maintained treatment effectiveness.

Telemedicine's role in improving communication between patients, caregivers, and healthcare professionals was evident in this study. Participants reported that regular virtual interactions helped clarify treatment instructions, monitor progress, and address concerns promptly. Madrid-Rodríguez et al. (2025) similarly observed that caregivers of children with complex chronic conditions felt more supported and confident when telemedicine was incorporated into care plans.

The study also demonstrated the effectiveness of telemedicine in multidisciplinary management. Many chronic pediatric conditions require coordination between various specialists. Telemedicine enables seamless collaboration, allowing healthcare providers to share patient data and treatment updates efficiently (Savignano et al., 2021).

Digital educational resources, used by 60% of participants, played an important role in enhancing knowledge and self-management skills. Educational support has been shown to improve adherence, patient confidence, and disease understanding, which are critical for long-term outcomes (Pappalardo et al., 2021).

Despite these benefits, some challenges were noted. Low adherence among 10% of participants and minor dissatisfaction among 3.3% suggest that telemedicine may not fully replace in-person care for all patients. Factors such as technology access, digital literacy, and the need for certain physical assessments can limit effectiveness, echoing concerns raised by Utami et al. (2025).

The study emphasizes that telemedicine is most effective when integrated as a complementary tool rather than a complete replacement for traditional care. Optimal outcomes are achieved when remote monitoring, virtual consultations, and in-person evaluations are combined to provide holistic care (Taher Do Alfuqhar et al., 2024).

Furthermore, telemedicine enhances patient empowerment, allowing pediatric patients and caregivers to actively participate in decision-making and daily disease management. This active engagement is linked to improved clinical outcomes and quality of life (Karataş et al., 2022; Richardson et al., 2021).

Finally, the findings support broader implementation of telemedicine programs for pediatric chronic disease management. Policymakers and healthcare providers should consider strategies to expand access, provide training, and ensure secure digital platforms to maximize the benefits of telemedicine interventions (Adroher Mas et al., 2022; Savignano et al., 2021).

Conclusion

This study employed a descriptive cross sectional design to evaluate the effectiveness of telemedicine in managing chronic disease in Pediatric patients. Ethical approval was obtained from the relevant institutional review board. The majority of participants were adolescents aged 13-18 yer (43.4%) , higher proportion of males (53.3%). Asthma was the most common chronic condition (40%) followed by diabetes (36.7%) and congenital heart disease (23.3%) . The Study Inclusion criteria encompassed children age 5-18 years with a confirmed chronic condition and access to telemedicine services , while exclusion criteria included patients with a cute illnesses or those who had not utilized telemedicine during the study period. Data were collected through a structured questionnaires , clinical records, and semi-structured interviews. Quantitative data were analyzed using statistical software, Descriptive statistics including Frequencies,percentages, means ,standard deviation were calculated to summarize demographic characteristics, telemedicine usage and adherence levels. Inferential statistics such as paired T- tests and chi-square tests were applied to examin deferences in clinical outcomes before and

after telemedicine interventions. A total of 150 Pediatric patients and their caregivers were recruited for the study.

The clinical outcomes of the study are significantly improved , asthma control scores increased by 23.5% and average blood glucose levels in diabetics patients decreased by 17.2% and hospitalization frequency reduced by 60 % , demonstrating the efficacy of telemedicine in enhancing disease control and preventing complications . The majority of caregivers and patients were stratified with telemedicine services with 50 % reporting bing very satisfied and 36.7% satisfied and only 3.3% expressed dissatisfaction. High stratification levels suggest that telemedicine is well- accepted and may improve long-term engagement in crouch disease management.

The findings of this study demonstrate the telemedicine has a significant positive impact on the management of chronic diseases in pediatric patients. Previous research has shown that telemedicine can effectively support asthma management by allowing real-time symptoms monitoring and rapid intervention, reducing exacerbations and hospitalization (Shdaifat et al .,2022).Video consultation were the most frequently utilized service (80%) similarly Adroher Mas et al.(2022) reported high utilization of video visits in Pediatric gastroenterology ,Telemedicine interventions, including reminders and remote monitoring, appear to strengthen patient engagement and reduce missed doses or delay follow ups. This findings are supported by the systematic review by Karatas et al. (2022), which noted increased adherence through user focused mobile health applications in Pediatric chronic care . clinical outcomes in this study improved significantly after telemedicine interventions , such results align with earlier studies demonstrating that telemedicine can enhance disease management and prevent acute complications (Utami et al.,2025). Telemedicine not only improves patient outcomes but also reduces healthcare system burdens this is consistent with Shdaifat et al. (2022), who reported a significant decrease in hospitalization rates for Pediatric asthma patients receiving telemedicine support. Satisfaction is crucial factor in the long-term sustainability of telemedicine programs, as positive experiences encourage continued engagement.Handy et al.(2025) emphasized that stratification is closely linked to trust in remote services and the perceived quality of care.

Telemedicine provides continuity of care particularly during periods when in-person visits were challenging, such as the COVID-19 pandemic.Also the study demonstrated the effectiveness of telemedicine in multidisciplinary management many chronic Pediatric conditions require coordination between various specialties , telemedicine enables seamless collaboration, allowing healthcare providers to share patient date and treatment updates efficiently (Savignion et al.,2021). Despite these benefits , some challenges were noted as low adherence among 10% of participants and minor dissatisfaction among 3.3% suggest that telemedicine may not fully replace in-person care for all patients.

Finally future researchers need to consider the access of network to all patients and care providers to ensure they will receive all telemedicine follow up appointments and management making better clinical outcomes . We suggest more research into preventing the complications of chronic conditions and to study the progression of the chronic condition in Pediatric patients via telemedicine medicine care.

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