OPEN ACCESS ORIGNAL ARTICLE

EFFECTIVENESS OF TELEMEDICINE INTERVENTIONS IN ASTHMA MANAGEMENT IN SCHOOL GOING CHILDREN: A COMMUNITY BASED APPROACH.

Muhammad Amir[1], Muhammad Siddique Rajput[2], Ghulam Shabir Laghari[3], SalahuddinSheikh[4], Maria Ahsan[5], Kashif Ali Mastoi[6], Madiha Naz[7]

ABSTRACT

BACKGROUND: Telemedicine has evolved as a potential method of distant healthcare delivery, especially the management of chronic illnesses such as asthma. The purpose of this study was to compare the effectiveness of telemedicine treatments in asthma. **METHOD:** A quasi-experimental study was conducted with n=114 asthma children from the different private schools of district Hyderabad for the period of 01 year from August 2023 to July 2024, using the convenience sampling technique. Patients received remote asthma management services, such as virtual consultations, remote symptom monitoring, and education via digital platforms. The primary outcomes were asthma-related symptoms. Data was analyzed using SPSS (Version 26.0) Descriptive statistics and Chi square tests were applied for association. **RESULTS:** 114 students from 13 different private schools were enrolled with a participation percentage of 79.1%. Sixty-eight (59.46%) of the 114 children enrolled were male, with a mean age of 7.7 (1.5). Children had more symptom-free days (SFDs) after the intervention compared to baseline (11.6 vs 7.0; difference, 4.6; 95% CI, 0.15-1.22; P =.01). Furthermore, compared to baseline, children reported fewer symptom days, symptom nights, and days with limited activity post treatment. Furthermore, more children were prescribed preventive asthma medication, while fewer children required emergency department visits or hospitalizations for asthma (7% vs 15%; odds ratio, 0.52; 95% CI, 0.32-0.84). **CONCLUSION:** Our research showed that school-based programs have a favorable influence on improving care and outcomes for children with chronic asthma. We have successfully increased access to guideline-based therapies and facilitated appropriate primary care follow-up assessments by integrating telemedicine with school-based care.

KEYWORDS: Asthma, Telemedicine

1. Associate Professor, ISRA University, Hyderabad, Pakistan.
2. Associate Professor, Peoples University of Medical and Health Sciences, Nawabshah.
3. Associate Professor, Liaquat University of Medical and Health Sciences, Jamshoro.
4. Assistant Professor, ISRA University, Hyderabad, Pakistan.
5. Lecturer, College of Pharmacy, Liaquat University of Medical and Health Sciences, Jamshoro, Pakistan.
6. Lecturer /PG Peoples University of Medical and Health Sciences, Nawabshah, Pakistan.
7. Faculty of Pharmacy, Shaheed Benazir Bhutto Dewan University, Karachi, Pakistan.

Corresponding author: Muhammad Siddique Rajput, Associate Professor, Dept. Of Community Medicine, PUMHS, Nawabshah. dr_rana82@yahoo.com

How to cite this article: Amir M[1], Rajput MS[2], Laghari GS[3], Sheikh S[4], Ahsan M[5], Mastoi KA[6], Naz M[7] **EFFECTIVENESS OF TELEMEDICINE INTERVENTIONS IN ASTHMA MANAGEMENT IN SCHOOL GOING CHILDREN: A COMMUNITY BASED APPROACH..** J Peop Univ Med Health Sci. 2025:15(2), 261-268. http://doi.org/10.46536/jpumhs/2025/15.02.649

Received On 15 MAY 2025, Accepted On 15 JUNE 2025, Published On 30 JUNE 2025.

INTRODUCTION

Asthma is a significant public health concern that places a substantial burden on children, as it is the most common chronic illness during childhood and a primary source of morbidity among them[1]. Asthma is significant public health problem affecting 339 million people worldwide.[2] Inhaled corticosteroids are effective in providing long-term treatment for people with asthma. According to guidelines, all patients with persistent asthma symptoms should take preventive drugs regularly. Unfortunately, a significant number of children with persistent asthma do not obtain the appropriate preventive drugs, especially those from minority origins who live in poverty and are at the most significant risk of receiving inadequate therapy[3]. Furthermore, even when children are prescribed preventive drugs, maintaining reasonable asthma control remain challenging due to poor adherence and insufficient follow-up treatment[4]. Despite major advances in asthma care, the burden of this chronic disease remains high, significantly compromising the general well-being and academic performance of asthmatic children.[5] Conventional asthma management depends primarily on regular clinic visits and interaction between healthcare practitioners and families[6]. Nonetheless, this method usually falls short of meeting the complex and ever-changing needs of children with asthma, particularly in terms of prompt evaluations, medication changes, and post-care follow-ups. Furthermore, children from underprivileged communities, including minority backgrounds and low-income households, face additional challenges in accessing adequate asthma care due to a variety of socioeconomic circumstances. The SB-TEAM (School-Based Telemedicine Enhanced Asthma Management) program focused on a field of healthcare that allows remote diagnosis, monitoring, and treatment via telecommunication technology by utilizing the advantages of telemedicine[7, 8]. It focuses on gaps in asthma management by engaging the multidisciplinary team within the school, including school nurses, primary care physicians, and families. The SB-TEAM program's fundamental idea is to give a complete and proactive asthma care plan that goes beyond typical clinic visits. Telemedicine provides constant monitoring of asthma symptoms, objective evaluation of lung function, and personalized treatment plans for each child. This continuous monitoring enables early detection of symptom deterioration and prompt care, such as altering drug regimens, adjusting therapy dosages, and establishing personalized asthma action plans[9, 10].

The use of telemedicine technology in the school setting has the potential to deliver various benefits for asthma management. For starters, because a child spends a substantial portion of their day at school, it enhances convenience and accessibility. The school nurse can use telemedicine to establish remote connections with healthcare providers, allowing for prompt consultations and guidance in reducing asthma exacerbations. As a result, children no longer need to be physically present at healthcare facilities, which reduces the number of missed school days and disrupts their education[11, 12].

The SB-TEAM program has the potential to alleviate asthma management healthcare inequities[13]. Minority children and low-income families frequently encounter difficulties to receiving specialized asthma care due to factors such as transportation constraints, financial constraints, and cultural disparities. By using telemedicine, the project boosts the availability of asthma experts in underserved areas, supporting equal access to high-quality care and lowering asthma outcomes inequities. The SB-TEAM project takes an innovative and motivating approach to asthma control in school-aged children. Using telemedicine technology, the plan

intends to enhance access to specialized care, allow real-time monitoring and treatment changes, and foster collaboration among healthcare practitioners, families, and school officials. Hence, the current study is aimed to determine the effect of the School-Based Telemedicine Enhanced Asthma Management Program on Asthma Morbidity.[14,15]

MATERIALS AND METHODS

A quasi-experimental study was conducted with n=114 asthma children from the thirteen different private schools of district Hyderabad for the period of 01 year from August 2023 to July 2024, using the convenience sampling technique, after approval from the institution (Reference: IRB/MCH/OPD/24/121 Date: 01/08/2024). Considering the prevalence of asthma 9.23%[16] as estimated, taking 95% confidence interval and 80% power, a sample of 114 was estimated using Epi info sample size calculator. For eligibility in the study, the children had to have a physician-confirmed diagnosis of asthma. The age range for participation was 3 to 10 years. The school must have a healthcare provider for children. Exclusion criteria for children and their families included the absence of a phone for follow-up communication and the presence of other serious medical issues that could potentially impair the assessments. The screening process was carried out at the start of each academic year to determine eligibility. Health care providers at school and research team members identified asthmatic children by checking school health information. Afterwards, a telephonic communication with each child's caregiver was done to determine their enrollment for the study.

After the eligibility screening was completed, a home visit was scheduled to gain informed consent from caregivers. Asthma symptoms, secondhand smoke exposure, and information about family and health history were assessed as part of the baseline evaluation. Each caregiver was given an asthma symptom journal to keep track of their child's symptoms during the school year. Furthermore, saliva samples were taken from each kid to assess smoking exposure using the cotinine biomarker. Every family in the study got an educational booklet providing basic information about asthma, smoking cessation resources, and local asthma-related support services. The intervention was initiated and maintained throughout the course of one academic year.

A telemedicine appointment was scheduled at the school within two weeks of the initial examination to do an initial asthma assessment and select the appropriate beginning medication for direct observation therapy (DOT) during school hours. Caregivers were also urged to attend this session. The clinical assistant at school was briefed on the intervention. The assistant interacted with the students, taking notes on their symptoms, triggers, and pertinent physical examination data, such as photos, height and weight measurements, and breath sounds.

Following the telemedicine visit, the telemedicine clinician called/video conference with the child's care givers to discuss the child's asthma, develop a personalized treatment plan, and provided any needed education and referrals. A standardized asthma template was utilized during the telemedicine consultations to assess the level of impairment and risk. Clinicians received brief training sessions on the asthma burden, the most recent guideline, and approaches for delivering guideline-based care at the start of intervention.[4]

Because all of the children in the study had persistent asthma or poor control that need daily preventative medication, follow-up telemedicine assessments were performed four to six weeks after the start of DOT and again four to six weeks later. Following the implementation of the DOT regimen, these follow-up visits were designed to assess the child's asthma control and address any potential triggers

or concomitant conditions that would compromise treatment response. Clinicians were encouraged to educate children about asthma and make medication adjustments based on guidelines, or to refer children to professionals if poor control persisted.

After collecting data, was processed by hand sorting techniques, calculator and using statistical program for social sciences (SPSS Version 26.0). The data collection form was prepared to study each variable separately and data was analyzed using Chi Square test for statistical significance and findings recorded and presented in the form of charts and tables. Level of significance will be set at $P \leq 0.05$.

RESULTS

Out of the 425 children who were initially examined based on the diagnosis and history, 132 were found to be qualified for the study. 114 students were enrolled from 13 different schools, for a participation percentage of 79.1%. Table 1 shows the demographic features of the enrolled children. 68 (59.46%) of the 114 children enrolled were male, with a mean age of 7.7 (1.5). Approximately half of the children (54 [47.36%]) lived in homes with at least one smoker, and 41 care givers (35.96%) reported depressed symptoms. For asthma severity at baseline over 14 days, 7.0 (5.2) days were reported to be symptoms free where-as day time symptoms reported for 4.2 (4.5). The detailed description is provided in table 1.

Table 2 summarizes the study's findings. In terms of the primary outcome, children had more symptom-free days (SFDs) after the intervention compared to baseline (11.6 vs 7.0; difference, 4.6; 95% CI, 0.15-1.22; P =.01). Significant treatment effects were also observed in the secondary analysis, which used weighted generalized estimating equations (GEE) to adjust for missing data (difference, 0.73; 95% CI, 0.20-1.27). Furthermore, compared to baseline, children reported fewer symptom days, symptom nights, and days with limited activity post treatment. Furthermore, more children were prescribed preventive asthma medication, while fewer children required emergency department visits or hospitalizations for asthma (7% vs 15%; odds ratio, 0.52; 95% CI, 0.32-0.84).

Table 1 showing Participants characteristics and asthma related symptoms at baseline	
Total children enrolled	114
Child Age, mean (S.D)	7.7 (1.5)
Gender, frequency	68 males, 46 female
≥1 Smoker in home	54
Asthma severity over 14 days, mean (SD)	
Symptom-free days	7.0 (5.2)
Days with daytime symptoms	4.2 (4.5)
Days with nighttime symptoms	2.9 (3.1)
Days with rescue medication use	4.8 (4.9)
≥1 ED visit or hospitalization	37

Table 2 depicting participants primary outcomes		
Variables	Post tele-rehabilitation	P value (<0.05)
Symptom-free days	11.6 (2.7)	**<0.05**
Days with daytime symptoms	1.7 (2.0)	
Days with nighttime symptoms	0.9 (1.5)	
Days with rescue medication use	1.9 (2.5)	
≥1 d Absent from school due to asthma, No. (%)	29	
≥1 ED visit or hospitalization	11 (7.0)	

Table 3 shows the changes in fractional exhaled nitric oxide (FeNO) levels and quality of life. Children improved their FeNO levels more as compared to their baseline findings (mean difference, -5.54; 95% CI, -9.8 to -1.3). Quality of life was improved for caregivers.

Table 3. Depicting FeNO Levels and Quality of Life			
Variable	Treatment Group, Mean (SD) Pre	Post	Difference (95% CI)
Change in FeNO level	0.10 (21.9)	−5.44 (19.5)	-5.54 (-9.98 to -1.3)
Change in quality of life measure	0.65 (1.1)	0.79 (1.1)	0.14 (−0.08 to 0.37)

DISCUSSION

School health systems are increasingly investing in telemedicine platforms to address acute and chronic illnesses. Given the rising incidence of asthma and the effects it has on both individuals and society as a whole, careful monitoring and efficient treatment are crucial.[16] Telemedicine in a school-based setting is linkage between child with asthma and health care provider that can provide patients and caregivers with chances to well manage chronic conditions, communicate among partners, and collaborate for solutions in convenient locations.[17]

The aim of the study was evaluate the effectiveness of telemedicine interventions in asthma management among school-going children. Our findings provide valuable insights into the potential benefits and limitations of telemedicine in improving asthma management in this specific population. The study findings show that children with chronic asthma who received the intervention had significantly better outcomes. These children had more symptom-free days, fewer limits in daily activities, lower airway inflammation as indicated by FeNO levels, and a lower incidence of asthma-related emergency department visits or hospitalizations.[18] This study's telemedicine model is a type of connected care that effectively improves access to medical treatments, particularly for traditionally under- served children. It was proven to be a successful method of connecting children to primary care and facilitating asthma screening and treatment. Notably, almost all of the SB-TEAM children were able to engage in telemedicine sessions, and the vast majority of them began directly observed therapy (DOT) for preventive asthma drugs at school. The importance of school nurses or health aides in administering this programme cannot be emphasized. Their participation is critical to the successful delivery of care and support to the children during the intervention[19]

School health systems are increasingly investing in telemedicine platforms to address acute and chronic illnesses. Given its significant impact on school absence, asthma the most prevalent chronic illness in children is of special importance. By utilizing telemedicine, children can receive timely and convenient care, leading to better asthma control and improved quality of life.[20] Results of real-time tele medically delivered asthma education to improve QOL, enhance symptom management ability, and reduce symptom burden were positive or nonsignificant. No study found that telemedicine had any negative consequences.[21] The remote monitoring capabilities of telemedicine platforms allowed healthcare providers to remotely assess symptoms, review medication usage, and provide personalized feedback to children and their families. As a result, telemedicine interventions contributed to enhanced self-care skills and asthma management knowledge among the children, empowering them to take an active role in their own health. A review published in 2022 on effects of videoconferencing on disease prevention and management revealed that replacing or enhancing

components of usual care with videoconferencing results in similar clinical effectiveness, health care usage, patient satisfaction, and quality of life as usual care. However, included trials were restricted to a few disease categories, with individuals seeking care for a certain set of reasons.[22]

It necessary to determine best practices for implementing telemedicine programs to support the care of children in school settings, although telemedicine is a viable strategy for expanding access to main and specialty asthma care.[23] In many studies, the telemedicine techniques produced results that were either equal to or better than those of the control groups. These findings were linked to outcomes such as medication adherence, appointment completion rates, life satisfaction, symptom management, and disease progression. Both traditional in-person healthcare services and telemedicine services may be advantageous to patients, medical professionals, and cares. This is in accordance with our study as well.[24]

However, it is important to acknowledge some limitations and challenges associated with telemedicine interventions in asthma management. Firstly, technological barriers such as limited internet access or technical difficulties hinder the implementation and effectiveness of telemedicine. Another aspect worth considering is the potential limitations of telemedicine in terms of the personal connection between healthcare providers and patients.[25] In-person visits allow for non-verbal communication, empathetic interactions, and the establishment of a therapeutic relationship, which may be challenging to replicate through telemedicine alone. Efforts should be made to ensure that telemedicine interventions are designed to prioritize patient-provider communication and foster a sense of trust and connection.

CONCLUSION

This study data showed that school-based programs have a favorable influence on improving care and outcomes for children with chronic asthma. We have successfully increased access to guideline-based therapies and facilitated appropriate primary care follow-up assessments by integrating telemedicine with school-based care. This technique has proven to be a successful method for ensuring that children receive the care and support they require to effectively manage their asthma.

ACKNOWLEDGEMENT: I am very grateful to my Friends and colleagues Dr. Muhammad Siddique Rajput, Dr. Ghulam Shabir Laghari, Dr. Salahuddin Sheikh, Dr. Ahsan Ali Memon, Dr. Kashif Ali Mastoi and Dr. Madiha Naz for their participation and contribution for completion of this research work.

FINANCIAL STATEMENT*:*
No funding sources had role in the study design, analysis or interpretation of data, writing of the manuscript, or decision to submit for publication. The content is solely the responsibility of the authors and does not necessarily represent the official views.

CONFLICT OF INTEREST:
There is no conflict of interest in this study.

ETHICS APPROVAL: The ERC Gave Ethical Review Approval.
CONSENT TO PARTICIPATE: Written And Verbal Consent Was Taken From Subjects And Next Of Kin.
FUNDING: The Work Was Not Financially Supported By Any Organization. The Entire Expense Was Taken By The Authors.
ACKNOWLEDGEMENTS: We Are Thankful To All Who Were Involved In Our Study.
AUTHORS' CONTRIBUTIONS: All Persons Who Meet Authorship Criteria Are Listed As Authors, And All Authors Certify That They Have Participated In The Work To Take Public Responsibility Of This

Manuscript. All Authors Read And Approved The Final Manuscript.

CONFLICT OF INTEREST: No Competing Interest Declared.

REFERENCES

1. Serebrisky D, Wiznia A. Pediatric asthma: a global epidemic. Annals of global Health. 2019;85(1):1-8.
2. Chen M, Burns C, Owens L, Woolfenden S, Lingam R, Jaffe A, et al. Community-based interventions for childhood asthma using comprehensive approaches: a systematic review and meta-analysis, Allergy, Asthma & Clinical Immunology, 2021;17(19):1-16
3. Barnes PJ, Inhaled Corticosteroids, Pharmaceuticals (Basel), 2010;8(3):514–40. doi: 10.3390/ph3030514
4. Capo-Ramos DE, Duran C, Simon AE, Akinbami LJ, Schoendorf KC. Preventive asthma medication discontinuation among children enrolled in fee-for-service Medicaid. Journal of Asthma. 2014 Aug 1;51(6):618-26.
5. Stubbs MA, Clark VL, McDonald VM. Living well with severe asthma. Breathe, 2019;15(2):e40-9.
6. Andrenacci B, Ferrante G, Roberto G, Piacentini G, La Grutta S, Marseglia GL, Licari A. Challenges in uncontrolled asthma in pediatrics: important considerations for the clinician. Expert Review of Clinical Immunology. 2022;18(8):807-21.
7. Wenderlich AM, Herendeen N. Telehealth in pediatric primary care. Current problems in pediatric and adolescent health care. 2021;51(1):100951.
8. Davies B, Kenia P, Nagakumar P, Gupta A. Paediatric and adolescent asthma: a narrative review of telemedicine and emerging technologies for the post-COVID-19 era. Clinical & Experimental Allergy. 2021;51(3):393-401.
9. Persaud YK. Using telemedicine to care for the asthma patient. Current Allergy and Asthma Reports. 2022;22(4):43-52.
10. Portnoy JM, Wu AC, Is telemedicine as effective as usual care?. The Journal of Allergy and Clinical Immunology: In Practice. 2019;7(1):217-18.
11. The Use of Telemedicine Access to Schools to Facilitate Expert Assessment of Children with Asthma, International Journal of Telemedicine and Applications 2008;12(2008):1-7. DOI: 10.1155/2008/159276
12. Portnoy JM, Waller M, De Lurgio S, Dinakar C. Telemedicine is as effective as in-person visits for patients with asthma. Annals of Allergy, Asthma & Immunology. 2016;117(3):241-45.
13. Perry TT, Turner JH. School-based telemedicine for asthma management. The Journal of Allergy and Clinical Immunology: In Practice. 2019;7(8):2524-32.
14. Pacheco CM, Ciaccio CE, Nazir N, Daley CM, DiDonna A, Choi WS, et al, Homes of low-income minority families with asthmatic children have increased condition issues, Allergy Asthma Proc, 2014;35(6):467–474. doi: 10.2500/aap.2014.35.3792)
15. Kemble H, Foster M, Blamires J, Mowat R, Children and young people's self-reported experiences of asthma and self-management nursing strategies: An integrative review, Journal of Pediatric Nursing, 2024;77(2024):212-35)
16. Almasi S, bodaghi AS, Asadi F, Efficacy of Telemedicine for the Management of Asthma: A Systematic Review, Tanaffos 2022; 21(2):132-45
17. Culmer N, Smith T, Stager C, Wright A, Burgess K, Johns S, et al. Telemedical Asthma Education and Health Care Outcomes for School-Age Children: A Systematic Review, The Journal of Allergy and Clinical Immunology:2020;8(6):1908-18
18. Amir M, Laghari GS, Sheikh S, Zeba N, Hussain A, Rajput MS. Estimating Prevalence of Asthma Among Children Associated With Raised IgE Immunoglobulin: A Cross-Sectional Study. Annals of PIMS-Shaheed Zulfiqar Ali Bhutto Medical University. 2024;20(SUPPL-1):464-8.
19. Halterman JS, Fagnano M, Tajon RS, Tremblay P, Wang H, Butz A, Perry TT, McConnochie KM. Effect of the school-based telemedicine enhanced asthma management (SB-TEAM) program on asthma morbidity: a randomized clinical

trial. JAMA pediatrics. 2018;172(3):e174938-.
20. Kim SH, Lieng MK, Rylee TL. Gee KA, Marcin JP, Melnikow JA, School-Based Telemedicine Interventions for Asthma: A Systematic Review, Acad Pediatr, 2020;20(7):893–901. doi: 10.1016/j.acap.2020.05.008
21. Culmer N, Stager C, Wright A, Burgess K, Johns S, Wall M, Desch M, Telemedical Asthma Education and Health Care Outcomes for School-Age Children: A Systematic Review, The Journal of Allergy and Clinical Immunology, 2020;8(6):1908-18
22. Wainwright P, Thomas J, Jones M. Health promotion and the role of the school nurse: a systematic review. Journal of Advanced Nursing. 2000;32(5):1083-91.
23. Perry TT, Turner JH, School-Based Telemedicine for Asthma Management, J Allergy Clin Immunol Pract, 2019 Nov-Dec;7(8):2524-32. DOI: 10.1016/j.jaip.2019.08.009
24. Do Alfuqhar IMT, Khalafalla AEA, Ali SHM, Adam EIA, Osman HM, Alrabie RS, Effectiveness of Telemedicine in Managing Health-Related Issues in the Pediatric Population: A Systematic Review, Cureus 2024;16(10):e72144. doi:10.7759/cureus.72144
25. Albritton J, Ortiz A, Wines R, Booth G, DiBello M, Brown S, Gartlehner G, Crotty K. Video teleconferencing for disease prevention, diagnosis, and treatment: a rapid review. Annals of Internal Medicine. 2022;175(2):256-66.