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EVALUATING THE EFFECTIVENESS OF CURRENT ASTHMA MANAGEMENT PROTOCOLS IN PEDIATRIC POPULATIONS: A LONGITUDINAL STUDY ON SYMPTOM CONTROL AND QUALITY OF LIFE

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Abstract

Background: *Asthma is a leading chronic respiratory illness among children, significantly affecting their daily functioning and quality of life. Effective management protocols, including pharmacologic treatment, inhaler technique training, and follow-up care, are essential for achieving optimal control and improving outcomes.* ***Objective:*** *To evaluate the effectiveness of current asthma management protocols in pediatric patients by analyzing changes in symptom control and quality of life.* ***Methods:*** *This longitudinal observational study was conducted at Mother and Children complex DHQ Sheikhupura, during May 2024 to December 2024. This study included 107 pediatric asthma patients. Baseline data on demographics, asthma severity, management adherence, and quality of life were collected and compared to follow-up data at 6 months using the Asthma Control Test (ACT) and* ***Results:*** *Among 107 pediatric asthma patients, significant improvements were observed over six months. ACT scores increased from 16.3 ± 4.1 to 21.5 ± 3.2 ($p < 0.001$), while nighttime symptoms and school absences decreased by more than 50% ($p < 0.001$). Quality of life scores across symptoms, activity, and emotional domains also improved significantly ($p < 0.001$). High adherence to medication and follow-up protocols was associated with better outcomes.* ***Conclusion:*** *Current asthma management protocols significantly improve symptom control and quality of life in pediatric patients over six months. Emphasizing adherence, education, and routine follow-ups remains critical for sustained asthma control.*

INTRODUCTION

Asthma is a chronic inflammatory disease of the airways that affects an estimated 262 million people worldwide, and it is among the most common non-communicable diseases in children [1]. In pediatric populations, asthma leads to significant physical, emotional, and social burden, manifesting as recurrent episodes of wheezing, coughing, breathlessness, chest tightness, and sleep disturbances [2]. The global prevalence of pediatric asthma varies by region, but estimates suggest it

affects between 5% to 20% of children, with increasing trends in urban and industrialized settings. In many countries, asthma is a leading cause of school absenteeism, emergency room visits, hospitalizations, and reduced quality of life in children and adolescents [3]. The cornerstone of asthma management is adherence to evidence-based guidelines, which emphasize individualized care plans, pharmacologic therapy using inhaled corticosteroids and bronchodilators, regular monitoring, environmental control, and patient and caregiver education [4]. International standards such as the Global Initiative for Asthma (GINA)recommend a stepwise approach to therapy tailored to asthma severity and control status. In recent years, there has been a shift from the traditional focus on short-term symptom relief to a more holistic model that prioritizes long-term control, prevention of exacerbations, and quality of life enhancement [5][6].

Despite the availability of effective medications and well-established protocols, asthma remains poorly controlled in a large proportion of children, particularly in low- and middle-income countries [7]. This is largely attributed to barriers such as inconsistent medication use, incorrect inhaler technique, lack of caregiver education, limited access to healthcare, and inadequate follow-up care. Studies have shown that more than 50% of pediatric asthma cases are uncontrolled, even among those receiving treatment, primarily due to low adherence and gaps in implementation of management protocols [8]. The pediatric population is particularly vulnerable due to their dependency on caregivers for medication administration, symptom reporting, and healthcare follow-up. Moreover, children may not fully understand or verbalize their symptoms, making objective assessment and consistent monitoring essential. Poorly controlled asthma in childhood is associated with impaired lung development, long-term pulmonary complications, decreased physical activity, poor school performance, and adverse psychological outcomes [9][10]. Therefore, evaluating the real-world implementation and effectiveness of asthma protocols in children is vital for optimizing care and minimizing these risks.

Measuring outcomes in pediatric asthma management involves more than symptom tracking. Tools such as the Asthma Control Test (ACT) and the Pediatric Asthma Quality of Life Questionnaire (PAQLQ) provide validated, standardized ways to assess not only clinical control but also the child's ability to engage in physical activity, sleep soundly, attend school, and maintain emotional well-being. These measures allow for a more comprehensive understanding of how treatment impacts the daily life of the child beyond clinical parameters. Previous studies have demonstrated that adherence to controller medications, proper inhaler technique, and regular follow-up are associated with improved asthma control and reduced exacerbations [11]. However, real-world data on how effectively these management protocols translate into improved outcomes, especially in pediatric populations, remain limited. Variability in healthcare delivery, cultural differences in caregiver understanding, and inconsistent use of asthma action plans are all factors that may affect the effectiveness of current guidelines.

Objective

To evaluate the effectiveness of current asthma management protocols in pediatric patients by analyzing changes in symptom control and quality of life.

Methodology

This was a longitudinal observational study conducted at Mother and Children complex DHQ Sheikhupura, during May 2024 to December 2024, including 107 pediatric patients diagnosed with asthma.

Inclusion Criteria

- Children aged 5 to 14 years
- Clinically diagnosed asthma (any severity)
- On regular asthma management for at least 3 months prior to enrollment

Exclusion Criteria

- Other chronic respiratory or systemic conditions
- Non-consent from caregivers

Data Collection

After obtaining consent from caregivers, a total of 107 pediatric patients diagnosed with asthma were enrolled in the study. Baseline data were collected

using a structured questionnaire and medical record review, which included demographic variables such as age, gender, and body mass index (BMI), as well as clinical factors including asthma severity, history of hospitalization, and family history of asthma. Management-related data were also recorded, focusing on daily controller medication adherence, rescue inhaler use, inhaler technique (evaluated by demonstration), frequency of follow-up visits, and whether a written asthma action plan had been provided. Symptom control was measured using the Asthma Control Test (ACT), while quality of life was assessed through the Pediatric Asthma Quality of Life Questionnaire (PAQLQ).

Statistical Analysis

Data were entered and analyzed using SPSS v23. Continuous variables such as age, BMI, ACT scores, nighttime symptoms, school absences, and PAQLQ scores were summarized using means and standard deviations. Categorical variables such as gender, asthma severity, and medication adherence levels were presented as frequencies and percentages.

Results

The average age of the children in this study was **8.6**± 2.3 **years**, and just over half were boys (**54.2**%). The average BMI was **17.9**± 2.5 **kg/m²**, with no significant differences between adherence groups. About **39**% of participants had mild asthma, **44**%had moderate asthma, and **17**% had severe asthma. A history of hospitalization was reported by **36.4**% of participants, and **57**% had a family history of asthma. Comorbid allergic conditions were also common, with **31.8**% having allergic rhinitis and **17.8**% having eczema.

Table 1: Demographic Characteristics of Participants

Characteristic	Total (n=107)	High Adherence (n=62)	Low Adherence (n=45)
Age (years)	8.6 ± 2.3	8.7 ± 2.4	8.5 ± 2.2
BMI (kg/m²)	17.9 ± 2.5	18.1 ± 2.6	17.6 ± 2.4
Duration of Asthma (years)	3.4 ± 1.8	3.5 ± 1.6	3.3 ± 1.9
Comorbidities			
- Allergic Rhinitis	31.8% (34/107)	35.5% (22/62)	26.7% (12/45)
- Eczema	17.8% (19/107)	16.1% (10/62)	20.0% (9/45)

87.9% were prescribed controller medications, and **73.8**% demonstrated proper inhaler technique. The average rescue inhaler usage was **2.1 times per week**. An asthma action plan was provided to **63.6**% of patients, and **75.7**% attended regular follow-up visits. High adherence patients had significantly **better inhaler technique** (**85.5**%) and were more likely to have a written action plan (**77.4**%) and attend regular follow-ups (**88.7**%) compared to low adherence patients.

Table 2: Medication Use and Adherence

Variable	Total (n=107)	High Adherence (n=62)	Low Adherence (n=45)
Controller Medication Use	Yes: 94 (87.9%) / No: 13 (12.1%)	94.0% (58/62)	80.0% (36/45)
Rescue Inhaler Use (per week)	2.1 ± 1.3	1.7 ± 0.8	2.8 ± 1.5
Correct Inhaler Technique	Yes: 79 (73.8%) / No: 28 (26.2%)	85.5% (53/62)	57.8% (26/45)
Asthma Action Plan Provided	Yes: 68 (63.6%) / No: 39 (36.4%)	77.4% (48/62)	44.4% (20/45)

Asthma Control Test (ACT) scores improved significantly in both adherence groups. Overall, the ACT score increased from a baseline of **16.3 to 21.5** over six months ($p < 0.001$). High adherence patients showed improvement from **17.2 to 22.4**, while low adherence patients improved from **15.1 to 20.3**± 3.5.

Table 3: ACT Score Comparison

ACT Score Metric	Total (n=107)	High Adherence (n=62)	Low Adherence (n=45)
Baseline ACT Score	16.3 ± 4.1	17.2 ± 3.9	15.1 ± 4.2
6-Month ACT Score	21.5 ± 3.2	22.4 ± 2.8	20.3 ± 3.5
Score Improvement	5.2 ± 2.6	5.2 ± 2.4	5.2 ± 2.8

Nighttime symptoms dropped from 2.8 to 1.1 times per week, and **school absences decreased from 3.1 to 1.5 days per month**. Emergency room visits reduced by over half, from **1.7 to 0.8**, and activity limitations fell from **4.3 to 2.2 days/month**. All improvements were statistically significant ($p < 0.001$), reflecting effective management of asthma symptoms over time.

Table 4: Symptom Frequency and Impact

Outcome Measure	Baseline	6-Month Follow-up	p-value
Nighttime Symptoms (per week)	2.8 ± 1.6	1.1 ± 0.8	<0.001
School Absences (per month)	3.1 ± 1.2	1.5 ± 0.9	<0.001
ER Visits (last 6 months)	1.7 ± 1.1	0.8 ± 0.6	<0.001
Activity Limitation (days/month)	4.3 ± 2.1	2.2 ± 1.3	<0.001

Patients with **severe asthma showed the most improvement**, with a **6-point increase in ACT score**, a **2.3-point reduction in weekly night symptoms**, and a **1.8-point gain in quality of life scores**. Moderate and mild asthma groups also showed meaningful gains, though slightly less pronounced. These trends were statistically significant, indicating that even patients with more severe symptoms can achieve substantial improvement with consistent and well-structured asthma care.

Table 5: Outcomes by Asthma Severity

Asthma Severity	ACT Score Improvement	Nighttime Symptom Reduction	PAQLQ Score Improvement
Mild	4.5 ± 2.7	1.5 ± 1.0	1.3 ± 0.7
Moderate	5.1 ± 2.5	1.9 ± 0.8	1.6 ± 0.8
Severe	6.0 ± 3.0	2.3 ± 1.1	1.8 ± 0.9

Discussion

This study evaluated the real-world effectiveness of current asthma management protocols in pediatric patients, focusing on symptom control and quality of life improvements over a six-month period. The findings show that adherence to standardized asthma management plans, including regular use of controller medications, proper inhaler technique, and scheduled follow-ups, significantly improved asthma control and reduced disease burden in children. The study included a diverse cohort of 107 children with a mean age of 8.6 years. Approximately 44% had moderate to severe asthma, and 36.4% had a history of hospitalization. These figures reflect the substantial clinical burden faced by pediatric asthma patients and align with previous research which has shown that asthma severity is often underrecognized in young children and is frequently complicated by comorbidities such as allergic rhinitis and eczema. Adherence to asthma management protocols emerged as a key determinant of improvement. High-adherence patients demonstrated significantly better outcomes across nearly all domains. For instance, those with high adherence had an ACT score improvement from 17.2 to 22.4, compared to 15.1 to 20.3 in the low-adherence group ($p < 0.001$). This trend is consistent with previous research, which found that patients with higher controller medication adherence experienced greater symptom control, fewer exacerbations, and reduced hospitalizations [12][13]. Correct inhaler technique was present in 73.8% of patients overall, but was significantly more common in the high-adherence group (85.5% vs. 57.8%, $p = 0.002$). Prior studies have shown that improper inhaler technique contributes to poor drug delivery

and suboptimal asthma control, reaffirming the importance of education in asthma care [14]. All patients showed marked improvement in symptom frequency and functional limitations over the study period. Nighttime symptoms were reduced from 2.8 to 1.1 times per week, and school absences dropped from 3.1 to 1.5 per month (both $p < 0.001$). These findings align with earlier studies that demonstrated how guideline-based management plans can reduce missed school days and improve participation in daily activities [15]. Additionally, ER visits dropped from an average of 1.7 to 0.8 in six months, confirming previous research that indicates comprehensive asthma care plans can reduce emergency room dependency and prevent acute exacerbations [16]. These results are in line with previous findings, which have consistently shown that better disease control is associated with improved emotional well-being, social participation, and physical comfort in children with asthma [17][18]. Interestingly, the greatest improvements were observed in children with severe asthma, who showed a 6.0-point gain in ACT scores and the largest decrease in nighttime symptoms. This is consistent with prior research which has noted that while children with mild asthma often have fewer symptoms to begin with, those with severe asthma tend to experience more dramatic gains when provided with consistent, protocol-driven care [19]. Patients who received regular follow-up and had an action plan showed better outcome. For example, 88.7% of high-adherence patients attended regular follow-up visits compared to 57.8% in the low-adherence group ($p < 0.001$). These results underscore previous research findings that ongoing clinical monitoring, caregiver education, and reinforcement of asthma action plans are essential for sustained asthma control in pediatric populations [20]. Overall, this study demonstrates that current asthma management protocols when adhered to effective in reducing symptoms, improving quality of life, and minimizing healthcare utilization in pediatric patients. These results are consistent with the global body of literature emphasizing that asthma control is achievable through evidence-based interventions and continuous caregiver-patient engagement.

Conclusion

Current asthma management protocols significantly improve symptom control and quality of life in pediatric patients over six months. Emphasizing adherence, education, and routine follow-ups remains critical for sustained asthma control. This longitudinal study demonstrated that adherence to current asthma management protocols significantly improves both symptom control and quality of life in pediatric populations. These findings reinforce the value of guideline-based management, particularly in pediatric settings where caregiver involvement and structured monitoring are critical.

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