Original Article

The adherence to asthma medication for hospitalized children with asthma: A cross-sectional study in a tertiary hospital in Riyadh, Saudi Arabia

Nawaf Abdullah Alghamdi[1,2,3], Elaf A. Alshammari[1,2,3], Afnan A. Alsahli[1,2,3], Alanoud A. Abuhaimed[1,2,3], Bader Y. Alyousef[2,3], Fatmah Othman[3,4], Tamer A. Abusido[1,2,3], Hamad Abdullah Alkhalaf[1,2,3]

[1]Department of Pediatric, King Abdullah Specialist Children's Hospital, King Abdulaziz Medical City, Ministry of National Guard Health Affairs, [2]Medical Intern, College of Medicine, King Saud Bin Abdulaziz University for Health Sciences, [3]King Abdullah International Medical Research Center, [4]Department of Epidemiology and Biostatistics, College of Public Health and Health Informatics, King Saud Bin Abdulaziz University for Health Sciences, Riyadh, Saudi Arabia

Address for correspondence:
Dr. Hamad Abdullah Alkhalaf, Department of Pediatric, King Abdullah Specialist Children's Hospital, King Abdulaziz Medical City, Ministry of National Guard Health Affairs, Riyadh 14611, Saudi Arabia.
E-mail: khalafha@mngha.med.sa

Abstract:

AIM: The aim of the study was to assess adherence to asthma controller therapy and factors that influence asthma control and to determine the association between asthma knowledge of the caregiver and asthma control among admitted children with asthma.

SETTINGS AND DESIGN: A cross-sectional study was conducted between November 2022 and May 2023 in a tertiary care hospital. Children with a diagnosis of asthma aged 2–14 years, who were admitted to the hospital with an exacerbation of asthma were identified.

METHODS: Caregivers of the admitted children were interviewed using the Asthma Knowledge Questionnaire and Pediatric Inhaler Adherence Questionnaire.

STATISTICAL ANALYSIS USED: Demographic and clinical data were described using descriptive analyses, where mean and standard deviation were used for normally distributed continuous variables, median and interquartile range (IQR), if otherwise. A $P < 0.05$ was set as a cutoff for statistical significance.

RESULTS: A total of 144 caregivers completed the survey. Median score for parents' knowledge of asthma was 64%, with an IQR of 59–67. Both mother's and father's educational levels were associated with a good level of knowledge: odds ratio (OR) = 2.48, 95% confidence interval (CI) = 1.1–5.6, and OR = 5.33, 95% CI = 2.23–12.7, respectively. Median adherence to metered dose inhaler (MDI) was 4 (IQR = 2–6). Children who had been admitted to the general ward in the last 6 months were three times more likely to be nonadherent to MDI (OR = 3.03, 95% CI = 1.18–7.82). Forty-three percent of children who were nonadherent to MDI were less likely to have their asthma controlled (OR = 0.43, 95% CI = 0.17–1.06).

CONCLUSION: This study revealed that a low level of knowledge among caregivers of asthma patients is linked to inadequate adherence to asthma controller therapy. As medication adherence is crucial for achieving desirable asthma control and improving the quality of life for this population, efforts need to be made to enhance the knowledge level of parents of children with asthma.

Keywords:

Adherence, asthma, control, knowledge, medication, pediatric, pulmonology, Saudi Arabia

Bronchial asthma is a reversible obstructive airway disease, that contributes to mortality, emergency visits, hospitalizations, and morbidity worldwide.[1] Clinical presentation of asthma varies, with patients wheezing, coughing, experiencing chest tightness, and shortness of breath.[2,3] According to the World Health Organization (WHO), an

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estimated 262 million people were affected by asthma in 2019, resulting in 455,000 deaths.[4] As the prevalence of asthma among children is increasing, it is important to achieve the therapeutic goals from the management plan. Many studies have reported a prevalence of uncontrolled asthma in children ranging from 46% to 37%.[5,6] Thus, uncontrolled asthma contributes to admission to the pediatric intensive care unit (PICU).[7] Evidence showed increased recurrent asthma attacks and mortality risk if patients had previous PICU admissions.[8,9]

In Saudi Arabia, the prevalence of asthma in the Saudi population varies between rural and urban areas, ranging from 8% to 33%.[10,11] There are many factors that influence asthma control, including medication adherence, exposure to infections, and psychological, environmental, and sociodemographic factors.[12] One of these factors is related to the knowledge level of caregivers. Many asthma guidelines therefore emphasize the importance of knowledge and education for better asthma control. In a study conducted by BinSaeed *et al*. to determine asthma control in children aged 4–11 years, it was found that up to 59.3% of children had uncontrolled asthma, and the severity of asthma was related to poor caregiver knowledge.[13] Other studies reported that a previous severe asthma exacerbation, receiving a corticosteroid course during the previous year, younger age and existing eczema diagnosis are predictors associated with recurrent asthma exacerbation.[14]

There is growing evidence in the literature that has assessed parental level of knowledge and its association with asthma medication adherence and asthma control.[15,16] These studies indicated a moderate level of parents' knowledge about asthma and an association between parental knowledge of asthma medications and asthma control. Nevertheless, there is a need for further studies investigating parental knowledge and its association with asthma control. Therefore, the aim of the current study was to assess adherence to asthma controller therapy prescribed by physicians, to determine the sociodemographic factors that influence asthma control, and to determine the association between caregiver asthma knowledge and asthma control among children with asthma.

Methods

Study design and setting
A cross-sectional study was carried out at King Abdullah Specialized Children's Hospital (KASCH), a tertiary care hospital within King Abdulaziz Medical City under the Ministry of National Guard-Health Affairs, Riyadh, Saudi Arabia. KASCH was established in April 2015 with 600 inpatient beds and provides health-care services to the pediatric population of eligible Saudi National Guard soldiers, employees, and their families.

Study population
All children aged 2–14 years of both genders, who were admitted to the hospital with a diagnosis of asthma (either from emergency room [ER] or outpatient clinics) between November 2022 and May 2023 were identified as the study population. Each child's medical record was then reviewed to identify those children who had been diagnosed with asthma at least 6 months before the current admission. This time was chosen to allow a reasonable amount of time to determine the child's asthma control level. Children with a diagnosis of primary lung disease such as cystic fibrosis, primary ciliary dyskinesia, tuberculosis, cancer and children discharged or transferred from hospital before admission were excluded. Based on a previous estimate of 30% adherence, a precision level of 0.05, and confidence level of 95%, at least 133 children were required to be included in the study.[17] A convenient sampling technique was used in selecting patients.

Data collection and survey development
After agreeing to participate, each caregiver of the admitted child was interviewed by trained interviewers using a standard questionnaire. The first part of the questionnaire contains socioeconomic information such as the parents' education level, employment status, the caregiver's marital status, the type of home the child lives in, and the parents' smoking status. The second part consists of clinical data for the admitted child, which includes existing medical conditions, previous hospitalizations within the past 6 months, previous admissions to PICU, previous ER visits within 30 days, current and usual asthma triggers, and an asthma medication list. The factors that used to categorize the patient into controlled and noncontrolled asthma were based on the history of previous PICU admissions, history of ER visits in the past 30 days, and if used salbutamol as needed in the last 2 weeks or not. These factors were chosen based on objectivity since the targeted population are children and the history will be taken from the caregivers.[10] The third part consists of statements assessing the level of knowledge. This section was adapted from a previous validated survey (The Asthma Knowledge Questionnaire).[18,19] The Asthma Knowledge Questionnaire was developed to measure components of parental asthma knowledge relevant to the management and intervention of pediatric asthma. Some of the items were added by a panel of experts in relation to local culture and behaviors. The 37-item Asthma Knowledge Questionnaire used in this study was then tested for content validity followed by construct validity using confirmatory factor analysis. Finally, the reliability of each factor was assessed with

an overall level of internal consistency (Cronbach's alpha = 0.802).

The fourth part of the survey consists of the Pediatric Inhaler Adherence Questionnaire, a validated questionnaire to measure the adherence of inhaled asthma therapy in children with asthma.[20] The answer options of both questions 1 and 3 were scored from 1 (greater adherence) to 5 (no adherence) the scores were then summed to give a total score ranging from 2 to 10, with higher scores indicating nonadherence to metered-dose inhaler (MDI).

The study obtained all required approvals from the IRB committee of King Abdullah International Medical Research Center, Riyadh, Saudi Arabia. Protocol number NRC22R/570/11. A signed informed consent was obtained for all participants. Furthermore, the obtained data were properly secured to protect the study subjects' confidentiality and privacy. Questionnaire completion is voluntary and anonymous. No identifiers information was collected and data kept in a secure place.

Analysis plan

The demographic and clinical data of patients admitted with an asthma exacerbation and their parents were described using descriptive analyses, where mean and standard deviation were used for normally distributed continuous variables, and median and interquartile range (IQR), if otherwise. The Shapiro–Wilk test was used to test for normality. For categorical variables, frequency and percentage were used. Based on the percentage distribution of knowledge, participants were categorized into good and poor knowledge. Based on an adherence level of 3 or greater, the patients were categorized as (nonadherent) where an adherence level below 3 was grouped in the adherence category. A Chi-square or Fisher's exact test was used to measure the association between parent variables and clinical data, as well as both knowledge and/ or adherence levels. A univariate analysis had been carried out using logistic regression analysis to assess the predictors for adherence/and level of knowledge. The association between the level of knowledge and adherence with the asthma-controlled variables was also assessed. A $P < 0.05$ was set as a cutoff for statistical significance. All analyses were performed using the Stata 15 software system (Stata Corp L. P., College Station, TX, USA).

Results

Description of the study population

A total of 144 caregivers of the admitted asthma patients completed the survey of this study. The socioeconomic characteristics of the children admitted with asthma are

Table 1: Demographic data of the child with asthma and the related information of their caregiver

Variables	Total number (%)
Child's current age, median (IQR)	5 (3.5–8)
Age categories (years)	
2–5	59 (51.7)
6–10	45 (39.4)
10–14	10 (8.7)
Child gender	
Male	71 (62.2)
Female	43 (37.7)
Child's mother's age (mean±SD)	35±5
Marital status of the caregiver "married versus divorced"	
Married	109 (95.6)
Mother's educational level	
High school or less	49 (42.9)
Bachelor and above	65 (57.1)
Mother's employment status	
Unemployed	87 (76.3)
Employed	27 (23.6)
Father's educational level	
High school or less	81 (71.1)
Bachelor and above	33 (28.9)
Father's employment status	
Unemployed	7 (6.1)
Employed	107 (93.8)
Household income (SR)	
<5000	16 (14.1)
5000–15,000	77 (67.5)
>15,000	21 (18.4)
Type of house	
Apartment	57 (50.0)
Villa	50 (43.8)
Other	7 (6.1)
First child	30 (26.3)
Number of siblings	
1	8 (7.1)
2	23 (20.1)
3	26 (22.8)
≥4	55 (48.2)
Sharing bedroom	71 (62.2)
Family members smoking	
No	57 (50.0)
Yes, around the child	16 (14.1)
Yes, not around the child	41 (35.9)
Number of family members with Asthma	
None	52 (45.6)
Mother alone	14 (12.2)
Father alone	11 (9.5)
Siblings	23 (20.1)
>2 members in the family	14 (12)
Types of school	
Not at school	31 (27.1)
Public school	64 (56.1)
Private school	19 (16.6)
Exercise activity during school or at home	

Contd...

Table 1: Contd...

Variables	Total number (%)
Never	35 (30.7)
<3/week	34 (29.8)
>4/week	22 (19.3)
Missing	23 (20.1)
Pets in the home	9 (7.6)

IQR=Interquartile range, SD=Standard deviation

shown in Table 1. Of the 144 children admitted, 62% were male participants, and the median age of children admitted with asthma was 5 years (IQR = 3.5–8 years). Approximately 57% of the children's mothers had a bachelor's degree or higher, while 71% of the children's fathers had a secondary school degree. The majority of the children had a household income between 5000 and 15,000 SR (67%), with 5% of the children living in an apartment.

The clinical data of the children admitted with a diagnosis of asthma are shown in Table 2. About 40% of the children had been hospitalized within the last 6 months, 21% had PICU admission within a year, and 58% had ER visits due to respiratory illness within the last 30 days. The most common asthma triggers for both common asthma triggers (the usual cause that triggers asthma in the child) and current asthma triggers (the cause that triggers asthma during this admission) were viral illnesses (79% and 70%, respectively), followed by colds (70% and 45%, respectively) and dust (72% and 22%, respectively).

Asthma knowledge scores

The median parents' asthma knowledge percentage score was 64 (IQR = 59–67) as the results of the Shapiro–Wilk test showed a nonnormal distribution of the data; therefore, we used the median and IQR to interpret the knowledge scores. The percentage of correct answers for each statement in the asthma knowledge questionnaire is shown in Supplementary Table 1. Based on the median score, parents' knowledge scores were categorized as poor knowledge score (*n* = 73, 64%) and good knowledge score (*n* = 41, 36%). Table 3 shows the association between the parents' level of education and previous admissions to the knowledge percentage score categories. There was an association between a mother's education and knowledge level score as mothers with a bachelor's degree or higher were twice more likely to have a good knowledge score compared to mothers with a high school degree, odds ratio (OR) = 2.48, 95% confidence interval (CI) = 1.1–5.6. Father's level of education was associated with good knowledge, OR = 5.33 (95% CI = 2.23–12.7). Neither previous hospitalizations nor ER visits were associated with knowledge percentage score Table 3.

Table 2: Childs's admission clinical information

Variables	Total number (%)
History of atopy	36 (31.5)
Coexisting comorbidities	
CVS	3 (2.6)
CNS	2 (1.7)
Others	8 (7.8)
Previous admission in general ward within the last 6 months	46 (40.3)
Previous PICU admission within the year	24 (21.1)
Previous requirements of noninvasive ventilation	6 (25.0)
Require PICU in this admission	11 (9.6)
If yes, how many days	5 (2–8)
Any noninvasive intervention	
Nasal cannula	3 (27.2)
HFNC	4 (36.3)
Face mask	2 (18.1)
Length of stay in hospital in the current admission (days)	
1–2	72 (63.1)
3–4	28 (24.5)
5 or more	14 (12.2)
ER visit due to respiratory illness in the past 30 days	67 (58.7)
Usual asthma trigger	
Viral illness	91 (79.8)
Cold	80 (70.1)
Dust	83 (72.8)
Perfume	46 (40.3)
Allergic triggers	11 (9.6)
Exercise	21 (18.4)
Animals	18 (15.7)
Current asthma trigger	
Viral illness	80 (70.1)
Cold	52 (45.6)
Dust	26 (22.8)
Perfume	9 (7.8)
Allergic triggers	5 (4.3)
Exercise	4 (3.5)
Animals	5 (4.3)
Did the patient received asthma medication	92 (80.7)
Asthma medication list	
Salbutamol	90 (97.8)
Fluticasone	76 (82.6)
Montulokast	29 (31.5)
Budesonide	2 (2.1)
Seretide	15 (16.3)

PICU=Pediatric intensive care unit, ER=Emergency room, HFNC=High-flow nasal cannula, CVS=Cardiovascular system, CNS=Central nervous system

Adherence to metered dose inhaler

The median adherence to MDI was 4 (IQR = 2–6). Figure 1 shows the percentage of responses to the questions on adherence to the use of MDI. Twenty-one percent of parents reported missing 1–5 fluticasone doses, whereas 22% reported giving extra 1–5 short-acting beta 2 agonist doses. Parents stated that feeling their children were better was a common reason for skipping doses of fluticasone (62%), followed by the decision that the
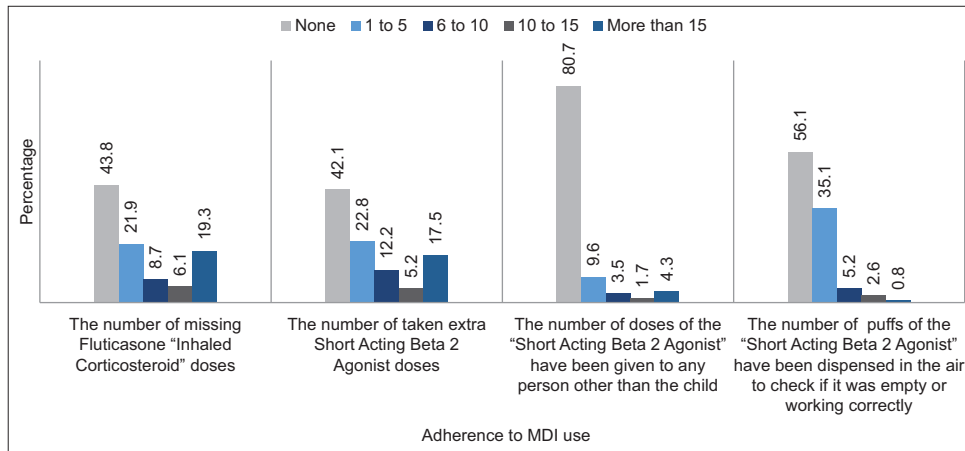
Figure 1: The percentages of the parents' responses to the question of the pediatric inhaler adherence questionnaire

child no longer needed it (48%) [Figure 2]. For the need for extra puffs of the short-acting beta 2 agonists, 53% reported that the child was getting worse, and 43% reported that motivation for the child to get better faster was the reason [Figure 3].

Table 4 presents the association between parents' education level and previous admission history with the adherence categories. Based on the adherence score, 83 (72.8%) patients were considered as nonadherence. Children who had been admitted to the general ward within the last 6 months were 3 times more likely to be nonadherent to MDI (OR = 3.03, 95% CI = 1.18–7.82).

Association between level of knowledge, adherence, and asthma control

Table 5 shows the univariate relationship in asthma children and their parents, respectively, between adherence and knowledge and asthma control. There was no difference in the knowledge score and asthma control in children. For adherence, children not adhering to MDI were less likely to have their asthma controlled (43%), however, this finding was not significant (OR = 0.43, 95% CI = 0.17–1.06).

Discussion

Poor adherence to treatment is a significant issue in the management of chronic diseases, according to the WHO, and it has been suggested that improving treatment adherence rather than specific treatments will have a more positive influence on health outcomes.[21] In asthma, poor adherence to the treatments is associated with an increased risk of disease exacerbations.

There are different factors that can affect treatment adherence including misconceptions about how the medication works and the nature of the disease. A systematic review study conducted by Howell evaluating the factors affecting treatment adherence
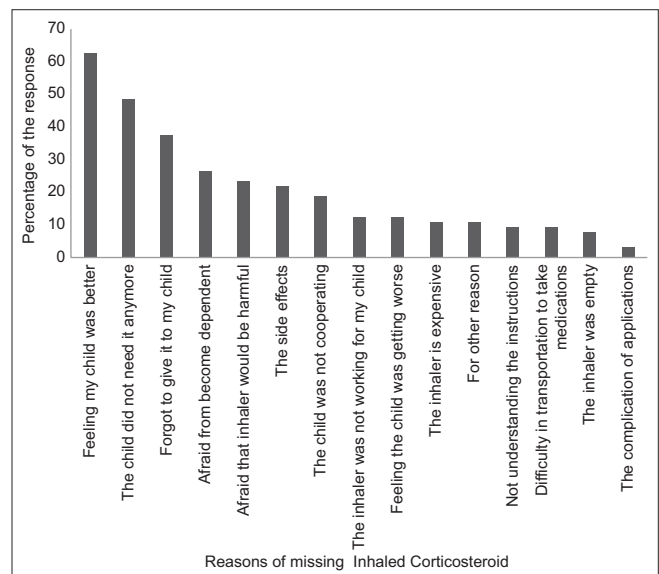

Figure 2: The percentage of the parent's response for missed fluticasone doses during the past 15 days

showed that a poor understanding of how the controller medications work is significantly associated with a lack of adherence.[22] These findings are consistent with the findings of this study, as 62% of caregivers reported that the main reason for skipping fluticasone doses is the clinical improvement of their children and 48% reported that the child no longer need the inhaler.

Based on the evidence, the management of asthma is multifaceted including the caregiver's level of knowledge. Thus, current studies indicated that caregivers' knowledge about asthma is an important factor in maintaining asthma control.[23] Thus, studies found that a significant reduction in asthma exacerbation is correlated with the level of education and knowledge of caregivers.[13] On the other hand, the socioeconomic status of caregivers plays a role in asthma adherence to medication and asthma control, as it is consider as

Table 3: Knowledge percentage score categories and their association with parent's educational level and previous medical history of the admitted child

	Knowledge percentage score		P	OR (95% CI)
	Poor knowledge score, (*n*) %	Good knowledge score, (*n*) %		
Total	73 (64.1)	41 (35.9)		
Mother's educational level			0.027	
High school or less	37 (50.6)	12 (29.2)		Reference
Bachelor and above	36 (49.3)	29 (70.7)		2.48 (1.10–5.60)
Father's educational level			<0.001	
High school or less	61(83.5)	20 (48.7)		Reference
Bachelor and above	12 (16.4)	21 (51.2)		5.33 (2.23–12.74)
Household income (SR)			0.006	
<5000	14 (19.1)	2 (4.8)		Reference
5000–15,000	51 (69.8)	26 (63.4)		3.56 (0.75–16.89)
>15,000	8 (10.9)	13 (31.7)		11.37 (2.02–20.75)
Previous admission in the general ward within the last 6 months			0.855	
No	44 (60.2)	24 (58.5)		Reference
Yes	29 (39.7)	17 (41.4)		1.07 (0.49–2.34)
Previous PICU admission within a year			0.208	
No	55 (75.3)	35 (85.3)		Reference
Yes	18 (24.6)	6 (14.6)		0.52 (0.18–1.44)
ER visit due to respiratory illness in the past 30 days			0.450	
No	32 (4.8)	15 (36.5)		Reference
Yes	41 (56.1)	26 (63.4)		1.35 (0.61–2.96)

Based on the median score, the parent's knowledge scores were categorized into the poor knowledge score category (≤64) and the good knowledge score category (>64). OR=Odd ratio, CI=Confidence interval, PICU=Pediatric intensive care unit, ER=Emergency room

Table 4: Adherence to metered dose inhaler and its association with parent's educational level and previous medical history of the admitted child

	Adherence		P	OR (95% CI)
	Adherence, *n* (%)	Nonadherence, *n* (%)		
Total	31 (27.1)	83 (72.8)		
Mother's educational level			0.774	
High school or less	14 (45.1)	35 (42.1)		Reference
Bachelor and above	17 (54.8)	48 (57.8)		1.12 (0.49–2.59)
Father's educational level			0.360	
High school or less	24 (77.4)	57 (58.6)		Reference
Bachelor and above	7 (22.5)	26 (31.3)		1.56 (0.59–4.89)
Household income (SR)			0.614	
<5000	3 (9.6)	13 (15.6)		Reference
5000–15,000	21 (67.7)	56 (67.4)		0.61 (0.15–2.37)
>15,000	7 (22.5)	14 (16.8)		0.46 (0.09–2.17)
Previous admission in the general ward within the last 6 months			0.018	
No	24 (77.4)	44 (53.1)		Reference
Yes	7 (22.5)	39 (46.9)		3.03 (1.18–7.82)
Previous PICU admission within a year			0.606	
No	26 (83.8)	64 (77.1)		Reference
Yes	5 (16.1)	19 (22.8)		1.54 (0.52–4.57)
ER visit due to respiratory illness in the past 30 days			0.169	
No	16 (51.6)	31 (37.3)		Reference
Yes	15 (48.3)	52 (62.6)		1.78 (0.77–4.11)

PICU=Pediatric intensive care unit, ER=Emergency room, OR=Odd ratio, CI=Confidence interval

dictates access to educational resources. Several studies showed an association between parental education level and asthma control, as lower parent education was associated with an increase in childhood asthma.[23]

This study showed that mothers with high levels of education (bachelor and higher) were associated with children with controlled asthma compared to mothers with low educational level.

Table 5: Association between level of knowledge, adherence, and asthma control

	Asthma control		P	OR (95% CI)
	Uncontrolled	Controlled		
Mother's educational level			0.946	
High school or less	36 (42.8)	13 (43.3)		Reference
Bachelor and above	48 (57.1)	17 (56.6)		0.98 (0.42–2.27)
Father's educational level			0.882	
High school or less	60 (71.4)	21 (70.0)		Reference
Bachelor and above	24 (28.5)	9 (30.0)		1.07 (0.42–2.67)
Household income (SR)			0.060	
<5000	10 (11.9)	6 (20.0)		Reference
5000–15,000	62 (73.8)	15 (50.0)		0.40 (0.12–1.28)
>15,000	12 (14.2)	9 (30.0)		1.24 (0.33–4.73)
Knowledge score			0.429	
Poor knowledge score	52 (61.0)	21 (70.0)		Reference
Good knowledge score	32 (38.1)	9 (30.0)		0.68 (0.28–1.70)
Adherence			0.066	
Adherence	19 (22.6)	12 (40.0)		Reference
Nonadherence	65 (77.3)	18 (60.0)		0.43 (0.17–1.06)

OR=Odd ratio, CI=Confidence interval
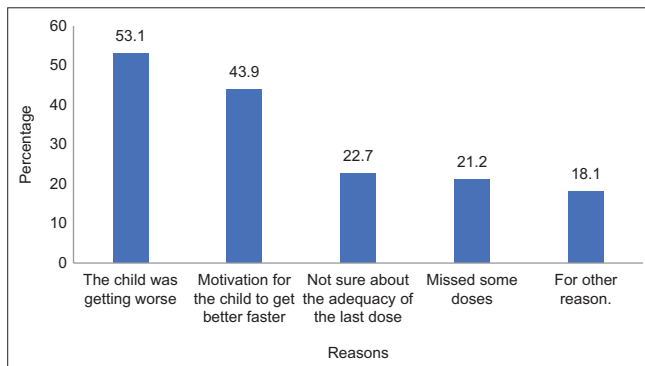
Figure 3: The percentage of the parent's response for giving EXTRA puffs of the "Short-acting Beta 2 Agonist" to the child

This study assessed the association between the level of knowledge, medication adherence, and asthma control. Parents with a high level of education were found to have higher knowledge scores than parents with a low level of education. Our data evaluated caregivers' knowledge of asthma etiology, and 79.8% acknowledged that airway inflammation is a leading pathophysiological factor. Similarly, a study in China reported that 63.3% of caregivers agreed with the same answer.[24] In addition, it has been found that patients with recurrent admissions are three times more likely to have poor medication adherence. In this study, there was no significant difference between parents with high and low knowledge scores in terms of asthma control and medication adherence. In comparison, there is a systematic review by Grover *et al*. that examined parental knowledge of asthma medications and concluded that parental beliefs are among the key factors influencing adherence to medication regimen.[25]

The current study has many strengths, including the use of validated questionnaires consisting of multiple dimensions that include demographic information, caregivers' knowledge of asthma, and medication adherence, allowing for a deeper understanding of the factors that influence asthma management and providing a holistic view of the patient's care. When interpreting the findings of the current study, some limitations must be taken into account. First, the study design is cross-sectional in which other factors and residual confounders may affect the validity of the results. In addition, it is a single-center study, which limits the generalizability of the results to other health-care settings. For asthma control, the factors that were used to classify patients into controlled and noncontrolled asthma, were more objective measurement factors since the population were children and there was subjectivity in memorizing some of the measurement factors as per the Saudi Initiative for Asthma.[10]

Conclusion

In this study, we found that inadequate asthma knowledge among caregivers is linked to substandard adherence to asthma controller therapy. Moreover, research has shown that caregivers with a good understanding of asthma education are more likely to effectively manage asthma in children. However, when it comes to knowledge about asthma, most caregivers of patients with asthma were found to have "poor knowledge," which was associated with their level of education. Moreover, the caregiver's level of knowledge about asthma did not show a significant association with controlling asthma and ensuring their children's adherence to medication. It has been observed that caregivers are more likely to be nonadherent to medications if they have a history of previous admissions. As adherence to medication is crucial for

achieving desirable asthma control and improving the quality of life of this population, efforts must be made to enhance parents' knowledge of asthma in children.

Conflicts of interest
There are no conflicts of interest.

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Supplement Table 1: Asthma knowledge questions used for caregivers of children with asthma

	Correct response	n (%) of the correct answer
Coughing is not a symptom of asthma	F	83 (72.8)
Cough can be the only symptom of asthma	T	21 (18.4)
Asthma is due to inflammation in the lungs	T	91 (79.8)
Smoking in the home can make a child's asthma worse	T	106 (92.9)
Smokers should change their clothes before contacting asthma patients	T	93 (81.5)
Asthma attacks can happen when you breathe things like paint fumes, gasoline, smoke, or pollution	T	106 (92.9)
Keeping an asthma attack from happening is something only a doctor can do	F	81 (71.1)
If you start to have an asthma attack, you might notice a tight feeling in your chest before wheezing starts	T	106 (92.9)
A peak flow meter is used to make sure your sinuses are open	F	38 (33.3)
If asthma symptoms such as tightness and wheezing do not occur for several years, a child has outgrown his/her asthma	F	27 (23.6)
Asthma is an emotional or psychological disease	F	98 (85.9)
Most children with asthma have to go to the hospital for asthma attacks	F	7 (6.1)
For some people, asthma becomes less severe as they get older	T	99 (86.8)
Doctors are not sure why some people have asthma, but they know what can start an attack	T	99 (86.8)
With appropriate treatment, most children with asthma should lead a normal life with no restrictions on activities	T	104 (91.2)
Anger, crying, or laughing can start an asthma attack	T	104 (91.2)
If you don't have asthma by the time you are 40 years old, you will never get it	F	73 (64.1)
Children with asthma should not play sports in which they have to run a lot	F	29 (25.4)
In young children, asthma sometimes starts after a viral respiratory illness	T	97 (85.1)
When my child has a viral illness, I usually start an asthma action plan. (use ventolin as a rescue medication)	T	101 (88.6)
An allergen is an antibody missing in people with asthma	F	39 (34.2)
It is possible for your asthma to be worse without noticing a change in your breathing	T	47 (41.2)
Exercising in cold weather can start an asthma attack	T	93 (81.5)
Fish and birds are both good pets for a child with asthma	F	85 (74.5)
A rescue inhaler (i.e., bronchodilator) is taken to reduce inflammation in the lungs	F	12 (10.5)
Some asthma medications don't work unless you take them every day	T	73 (64.1)
You don't need to shake most asthma medication inhalers before using them	F	97 (85.1)
Fewer people have asthma today than 10 years ago	F	69 (60.5)
I usually use fluticasone "orange puffer" every day	T	93 (81.5)
I usually use salbutamol "Blue puffer" every day	F	78 (68.4)
I believe nebulizers are more effective than puffers	F	36 (31.5)
I believe it is not necessary to use spacers with puffers	F	91 (79.8)
As my child gets older, there is no need to use spacers	F	51 (44.7)
To clean the spacer, there is no need to use soap and no need to dry it	T	29 (25.5)
I don't need to change the spacer frequently	F	84 (73.6)
Prolong use of inhalers will cause oral thrush to my child	F	51 (44.7)
Prolong use of inhalers will cause short stature to my child	F	98 (85.9)

F=False, T=True