

ASTHMA CONTROL

Caregiver knowledge and its relationship to asthma control among children in Saudi ArabiaAbdulaziz A. BinSaeed^{1,2}¹Prince Sattam Bin Abdul Aziz Research Chair of Epidemiology and Public Health, College of Medicine, King Saud University, Riyadh, Saudi Arabia and ²Department of Family and Community Medicine, College of Medicine, King Saud University, Riyadh, Saudi Arabia**Abstract**

Objective: The objective of this study was to examine caregiver responses to individual questions of the asthma knowledge questionnaire and to compare the prevalence of uncontrolled asthma among children according to caregiver responses (correct vs. incorrect). **Methods:** We conducted an analytical cross-sectional study among 158 children with asthma aged 4–11 who were attending the pediatric primary care clinic of the King Khalid University Hospital in Riyadh, Saudi Arabia. The asthma knowledge questionnaire for use with parents or guardians of children with asthma was used to measure the knowledge of caregivers. Asthma control in the children was measured using an Arabic version of the childhood asthma control test. Pearson's chi-square or Fisher's exact tests were used to compare the prevalence of uncontrolled asthma according to the caregivers' responses. **Results:** This study showed substantial gaps in knowledge among caregivers of children with asthma. The answer to only one of 17 questions was well known (86.1%); this question involved the harm of smoking near a child with asthma. Answers on 11 of 17 questions were significantly ($p < 0.05$) associated with asthma control in children. Among the key questions explored, the prevalence of uncontrolled asthma was 3.0 (1.8–4.9), 2.5 (95% confidence interval = 1.7–3.9) and 1.8 (1.3–2.5) times higher among children of caregivers who did not disagree with the statements that it is not good for children to use an inhaler for too long, that inhalers can affect or damage the heart, and that children with asthma should use asthma medications only when they have symptoms. **Conclusions:** Although innovations are needed to help patients improve their adherence to treatment and to effectively utilize the benefits of contemporary asthma medications, we observe substantial knowledge-related problems in the asthma management of children in Saudi Arabia.

Keywords

Beliefs, metered dose inhalers, medication adherence, myths, smoking, primary health care

History

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Introduction

Asthma is a chronic disease that affects the airways in the lungs. It is estimated that approximately 300 million people worldwide live with asthma. A cure for this disease remains to be discovered, and the efforts of doctors and patients are predominantly directed toward controlling the disease. If not controlled, asthma can substantially decrease the quality of life of patients and their family members [1,2] and can even lead to life-threatening conditions. There is substantial evidence that symptoms of asthma can be effectively controlled, which may substantially decrease the restrictions imposed by asthma and improve the health-related quality of life [3,4]. Nevertheless, even in developed countries, 40%–70% of patients have an inadequate level of asthma control [5,6].

There is no nationwide estimate of the prevalence of asthma among children in Saudi Arabia, but several studies conducted in different regions of the country have reported prevalence values between 4.9% and 19.6%, depending on the region [7–9].

A recent study among 158 children with asthma who attended a pediatric clinic for routinely scheduled follow-up visits at one of the major public hospitals in Riyadh showed that 59.3% of these children had uncontrolled asthma. The results of the study revealed that in addition to socioeconomic factors, caregiver knowledge of asthma had a significant impact on asthma control in these children [10].

The achievement of asthma control and the prevention of its exacerbation require active patient involvement to obtain the necessary knowledge and skills for effective self-management of the disease. Thus, education is an integral part of the process. In the case of children, education should involve caregivers as well [3,11]. Knowledge is considered an enabling factor in asthma management [12,13], and the effectiveness of educational programs in improving asthma control has been demonstrated in a number of studies [13].

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Various aspects of knowledge related to asthma management, such as poor understanding of the nature of the disease, parental myths and beliefs and a lack of knowledge about main triggers, asthma treatment and medications, have been explored in previous studies [14–18]. Unfortunately, we were not able to identify similar studies conducted in Saudi Arabia.

The objective of this study was to examine answers to individual questions of an asthma knowledge questionnaire and to compare the prevalence of uncontrolled asthma between groups of children whose caregivers provided correct or incorrect answers to questions about asthma knowledge.

Methods

Study design

We conducted an analytical cross-sectional study in the pediatric primary care clinic of the King Khalid University Hospital in Riyadh, Saudi Arabia, between 20 February 2013 and 20 March 2013, on every day except weekends, from 8:00 am to 3:00 pm.

Target population

We recruited caregivers and children aged 4–11 years attending the pediatric clinic for routinely scheduled follow-up visits during the study period. The children were diagnosed as having asthma for more than 6 months previously and did not have any other respiratory disease.

Nurses approached caregivers in the waiting area before their appointment with a doctor and presented the purpose of the study. Written consent was obtained from the caregivers, and oral consent was obtained from children aged 7 years and above. The Institutional Review Board of the College of Medicine of the King Saud University approved this study.

Instruments

A valid and reliable asthma knowledge questionnaire for use with parents or guardians of children with asthma containing 17 Likert scale-based items with graded answers from 1 to 5 was used to measure the knowledge of caregivers [19]. The knowledge score (range from 17 to 85) was calculated by summing the grades received for each item, with higher scores indicating a higher level of knowledge. If caregivers answered “strongly disagree” or “disagree” on questions 1–6, 8–10 or 14 or answered “strongly agree” or “agree” on questions 7, 11–13, 15 or 17, the answer was considered correct. To increase the accuracy of the Arabic translation, we asked two different translators to perform a forward and backward translation, which was reviewed by a clinician. The questionnaire was reviewed by an asthma clinician and piloted among caregivers before the study.

Children’s asthma control was measured by an Arabic version of a valid and reliable childhood asthma control test (cACT) designed for children aged 4–11 years. Patients with scores less than or equal to 19 were considered to have uncontrolled asthma [20]. Linguistic validation of the Arabic translation was conducted by the MAPI Research Institute (Lyon, France).

Statistical methods

Data were entered and analyzed with IBM SPSS Statistics for Windows, Version 20.0 (IBM Corp., Armonk, NY). Descriptive statistics were used to explore patterns of asthma knowledge among caregivers. Pearson’s chi-square or Fisher’s exact tests were used to analyze differences in the responses to each question between groups with controlled and uncontrolled asthma. The results of a multivariate regression analysis have been presented elsewhere [10].

Results

Our study population included 189 asthmatic children and their accompanying adults. All of them agreed to participate and were subsequently interviewed. During the analysis, we excluded 31 cases because the accompanying person was not the primary caregiver responsible for managing the child’s asthma. Almost all the caregivers (97.5%) were the mothers of the children. The sociodemographic characteristics and other characteristics of the study population are listed in Table 1 [10].

The results of our study showed that 59.3% of children had uncontrolled asthma. The mean knowledge score of caregivers was 53.4 (SD = 6.5) and ranged from 40 to 75. After controlling for potential confounding factors, with each one-point increase in knowledge, the odds of uncontrolled asthma decreased by 12% (OR = 0.88, 95% confidence interval, CI = 0.83–0.93) [10].

Table 1. Patient characteristics.

Child’s gender, <i>n</i> (%)	
Boy	90 (57%)
Girl	68 (43%)
Child’s age, median (IQR)	7 (6–9)
Mother’s age, mean (SD)	35.2 (5.6)
Marital status, <i>n</i> (%)	
Married	149 (94%)
Divorced	9 (6%)
Number of siblings, <i>n</i> (%)	
0	8 (5%)
1	25 (16%)
2	41 (26%)
3	41 (26%)
4	24 (15%)
5 and more	19 (12%)
Mother’s education, <i>n</i> (%)	
Less than higher	55 (35%)
Higher	103 (65%)
Mother’s employment status, <i>n</i> (%)	
Unemployed	67 (42%)
Employed	91 (58%)
Household income, <i>n</i> (%)	
Less than 15000 SAR	88 (56%)
15000 SAR or more	70 (44%)
Sharing bedroom, <i>n</i> (%)	
Not sharing	66 (42%)
Sharing	92 (58%)
Smoking (any family member), <i>n</i> (%)	
None	94 (60%)
Any	64 (41%)
Number of family members with asthma, median (IQR)	1 (0–2)
Type of house	
Apartment	70 (44%)
Villa	88 (56%)
Asthma control knowledge, mean (SD)	53.4 (6.5)

Table 2. Distribution of correct answers to asthma knowledge questions and prevalence of uncontrolled asthma among children according to caregivers' answers (correct vs. incorrect).

Item	Correct answers	Uncontrolled asthma		PR ^a (95% CI ^b)	p Value
		Correct	Incorrect		
Q1. Inhaler use can lead to dependence or addiction.	89 (56.3%)	39 (43.8%)	50 (72.5%)	1.7 (1.3–2.2)	<0.001^c
Q2. Inhalers can affect or damage the heart.	53 (33.5%)	15 (28.3%)	74 (70.5%)	2.5 (1.7–3.9)	<0.001^c
Q3. It is not good for children to use an inhaler for too long.	50 (31.6%)	12 (24.0%)	77 (71.3%)	3.0 (1.8–4.9)	<0.001^c
Q4. After a child's asthma attack, once the coughing is over, the use of the inhaler and medications should stop.	69 (43.7%)	31 (44.9%)	58 (65.2%)	1.5 (1.1–2.0)	0.011^c
Q5. Children with asthma should use asthma medications only when they have symptoms (coughing, congestion or wheezing).	65 (41.1%)	25 (38.5%)	64 (68.8%)	1.8 (1.3–2.5)	<0.001^c
Q6. It is better to use inhalers directly, without a holding chamber, so the medication can go directly to the lungs.	61 (38.6%)	29 (47.5%)	60 (61.9%)	1.3 (1.0–1.8)	0.077
Q7. The main cause of asthma is airway inflammation.	89 (56.3%)	41 (46.1%)	48 (69.6%)	1.5 (1.2–2.0)	0.004^c
Q8. Parents should ask a doctor to tell the school that an asthmatic child should not exercise or participate in physical education classes.	38 (24.1%)	22 (57.9%)	67 (55.8%)	1.0 (0.7–1.3)	0.853
Q9. Children who have asthma should not participate in sports that make them run too much.	36 (22.8%)	21 (58.3%)	68 (55.7%)	1.0 (0.7–1.3)	0.850
Q10. When a child has an asthma attack, it is best to go to the emergency room even if symptoms are mild.	98 (62.0%)	51 (52.0%)	38 (63.3%)	1.2 (0.9–1.6)	0.165
Q11. Asthma attacks can be prevented if medications are taken even when there are no symptoms between attacks.	72 (45.6%)	32 (44.4%)	57 (66.3%)	1.5 (1.1–2.0)	0.007^c
Q12. Flu infections are the main causes or triggers of asthma attacks.	65 (41.1%)	36 (55.4%)	53 (57.0%)	1.0 (0.8–1.4)	0.841
Q13. It is best not to smoke or let anyone else smoke near a child who has asthma.	136 (86.1%)	71 (52.2%)	18 (81.8%)	1.4 (1.2–2.0)	0.010^c
Q14. If the parents of a child with asthma smoke outside the house, it will not affect the child.	35 (22.2%)	26 (74.3%)	63 (51.2%)	0.7 (0.5–0.9)	0.020^c
Q15. If an asthmatic child gets the flu, inhalers should be used even if there is no coughing or wheezing.	80 (50.6%)	37 (46.3%)	52 (66.7%)	1.4 (1.1–1.9)	0.011^c
Q16. Asthmatic children might have attacks that are severe enough to require hospitalization in an intensive care unit or might even die from an attack.	92 (58.2%)	51 (55.4%)	38 (57.6%)	1.0 (0.8–1.4)	0.871
Q17. Some medications for asthma do not work unless they are administered every day.	71 (44.9%)	31 (43.7%)	58 (66.7%)	1.5 (1.1–2.1)	0.006^c

^aprevalence ratio, ^bconfidence interval, and ^c $p < 0.05$.

Bold values represent statistical significance.

The analysis of questions revealed that 11 of 17 questions were answered correctly by less than half of respondents, five questions received correct answers from 50.6%–62.0% of caregivers and the answer to only one question was well known by a comfortable majority (86.1%) of respondents. Among the least known questions, question 14, which concerned the harmful effects of third-hand smoke, questions 8 and 9 about unnecessary restrictions on the physical activities of the child and questions 2 and 3 regarding misbeliefs among respondents on asthma inhaler use received correct answers from 22.2%–33.5% of respondents. The distribution of correct answers is listed in Table 2.

The results of a bivariate analysis showed that 11 of 17 questions were positively associated ($p < 0.05$) with asthma control status. These questions were mainly about myths, beliefs and knowledge regarding asthma inhaler and medication use as well as the harmful effect of tobacco smoke on asthma. The question about third-hand smoke (Q14) had a negative association with asthma control (Table 2).

Discussion

Key results

The results of our study suggest the presence of substantial gaps in the knowledge of caregivers of children diagnosed with asthma more than 6 months earlier and who presented at

a pediatric primary care clinic for a routinely scheduled follow-up visit. The answer to only 1 of 17 questions was well known (86.1%); this question involved the harm of smoking near a child with asthma. Answers to 11 of 17 questions were significantly ($p < 0.05$) associated with asthma control in children. Eight of the questions were about myths, beliefs and knowledge regarding asthma inhaler and medication use. Two questions tested caregivers' knowledge of tobacco smoke. One question explored caregivers' awareness that the main cause of asthma is airway inflammation.

Interpretation

Currently, there is no cure for asthma, and the main efforts of physicians and patients are to reduce and control symptoms. Medications are the major components of asthma treatment directed toward controlling the disease, and adherence to the medication plan is essential [3]. Adherence is a multidimensional phenomenon that plays a special role in chronic diseases such as asthma. Knowledge is one of the main dimensions [2] and has been shown to improve asthma control [13].

Questions 1–3 were specifically about caregivers' beliefs and concerns regarding the safety of asthma inhaler use. The correct answers on those questions ranged from 31.6% to 56.3%. The prevalence of uncontrolled asthma among

children with caregivers who did not provide a correct answer to question 3, which stated that it is not advisable for children to use an inhaler for too long, was three times higher ($PR = 3.0$, 95% $CI = 1.8-4.9$) than the prevalence of uncontrolled asthma in children whose caregivers answered correctly. Similarly, the prevalence of uncontrolled asthma was 2.5 (95% $CI = 1.7-3.9$) and 1.7 (95% $CI = 1.3-2.2$) times higher, respectively, among children of caregivers who did not disagree with the statements that inhalers can affect or damage the heart and that inhaler use can lead to dependence or addiction.

Our findings are consistent with other studies. For example, a multi-center survey conducted in China revealed that 67.3% of parents thought that inhaled corticosteroids could affect the growth of the child. Another 40.6% of parents were concerned with possible drug dependence and 24.0% worried about the influence of inhalers on the child's intelligence [21]. Inhaled medications are an important part of asthma treatment, and low adherence to inhalers is associated with a higher risk of emergency department visits and hospital admissions in children [22]. Unfortunately, although the quality, safety and effectiveness of inhalers has significantly improved [23], many studies report that beliefs and concerns lead to chronic under-use of asthma inhalers and medications and, as a result, to poor asthma control [24,25].

Other important deficiencies were noted in questions 5, 17, 11 and 4, which explored caregiver knowledge of the appropriate usage of asthma medications. The prevalence of correct answers on these questions ranged from 41.1% to 45.6%. Children whose caregivers failed to disagree with the statement that children with asthma should use asthma medications only when they have a cough, congestion or wheezing had a 1.8-fold higher prevalence ($PR = 1.8$, 95% $CI = 1.3-2.5$) of uncontrolled asthma. Uncontrolled asthma was 1.5 times more prevalent in children whose caregivers did not answer positively that some medications for asthma do not work unless they are administered every day ($PR = 1.5$, 95% $CI = 1.1-2.1$) and that asthma attacks can be prevented if medications are taken even when there are no symptoms between attacks ($PR = 1.5$, 95% $CI = 1.1-2.0$). Similarly, the prevalence of uncontrolled asthma was 50% greater in children whose caregivers did not provide correct answers to the statement that when the cough has ended after a child's asthma attack, the use of the inhaler and medications should be stopped ($PR = 1.5$, 95% $CI = 1.1-2.0$).

These findings are consistent with a study conducted in the United States that found that among 706 parents, 38.2% were concerned about the daily use of asthma medications. Half of these concerns were related to side effects, and approximately one-third of them were related to the regimen aspects [17]. Grover et al. conducted a systematic review of publications evaluating medication use in children with asthma and found that parental knowledge regarding asthma and asthma medications, information provided to parents and parental beliefs and fears were among the key factors influencing adherence to medication regimens [14].

Misunderstandings about the disease and the way that medications work are among the patient-related factors that affect treatment adherence [16,18]. In our study, 56.3% of

caregivers correctly agreed that the main cause of asthma is airway inflammation (Q7), and there was a statistically significant association between knowledge about the inflammatory nature of the disease and the presence of controlled asthma ($PR = 1.5$, 95% $CI = 1.2-2.0$).

Similarly, a study in China reported that 63.3% of parents knew that asthma is due to inflammation and swelling of the lungs [15]. A systematic review of factors affecting adherence to asthma treatment by Howel [26] showed that a poor understanding of the role of controller medications is significantly associated with a lack of adherence.

The negative effect of environmental tobacco smoke (ETS) on asthma control in children has been explored in many studies [27-29]. Similar to other studies that have reported a high level of knowledge about ETS among parents or caregivers [30,31], the comfortable majority of our caregivers (86.1%) were aware that it is best not to smoke or to let anyone else smoke near a child who has asthma. As expected, the prevalence of uncontrolled asthma in children whose caregivers did not know about the harmful effect of ETS was significantly higher ($PR = 1.4$, 95% $CI = 1.2-2.0$) than among children whose parents knew about this effect.

The harmful effect of third-hand smoke is becoming a widely explored issue, and some studies suggest that third-hand smoke should be considered an important factor in the airway inflammation of asthma patients [32]. There was little knowledge about this issue among our study population; only 22.2% disagreed that if the parents of a child with asthma smoke outside the house, it will not affect the child. Surprisingly, we observed an inverse relationship between the prevalence of uncontrolled asthma and caregiver knowledge about third-hand smoke ($PR = 0.7$, 95% $CI = 0.5-0.9$). This finding can potentially be explained by our data, which showed that among caregivers who correctly answered this question, the proportion of correct answers for question 3 (regarding the danger of using inhalers for too long) was half that of caregivers who failed to provide the correct answer (17.1% vs. 35.8%, $p = 0.041$). In addition, because the harmful effects of smoking were well known by the caregivers, who were mainly the patients' mothers (97.5%), it is possible that the frequent symptoms of asthma were attributed to the smoking of other family members, mainly fathers (90.6%), and the respondents' concern regarding tobacco smoke influenced their answers. Our data do not include the appropriate information to test this hypothesis; thus, we recommend further studies to explore this issue.

In our study, half of the respondents (50.6%) answered that if an asthmatic child contracts the flu, they should use inhalers even if there is no coughing or wheezing. This answer was associated with improved asthma control in children ($PR = 1.4$, 95% $CI = 1.1-1.9$).

Our data showed that questions 1-5, 11 and 17, which were about caregiver beliefs and knowledge regarding asthma inhaler and medication use, were significantly ($p < 0.05$) or marginally significantly (for question 3, $p = 0.061$) associated with this question. Therefore, it is possible that better asthma control in this group of children was due to better asthma knowledge in other areas.

Question 6 showed that only 38.6% of respondents correctly disagreed with the statement that it is better to use

inhalers directly without a holding chamber so that the medication can go directly to the lungs. The prevalence of uncontrolled asthma was 30% higher ($PR=1.3$, 95% $CI=1.0-1.8$) in children whose caregivers did not provide the correct answer to this question.

We are not aware of other studies that have investigated caregiver knowledge of the benefits of spacer use. However, Cheng et al. [33] found that among children who arrived at an emergency department because of a mild or moderate asthma attack, the main reason for not using a spacer was the parent's preference. Systematic reviews of studies exploring the optimal use of asthma medications in children show that holding chambers substantially improve drug delivery to children's lungs and reduce side effects [34,35].

Limitations

A minority of children (16.4%) visited the asthma clinic with an adult who was not the main caregiver responsible for asthma management, and we did not include their results in this report. Although this omission is a source of potential bias, we did not find a statistically significant difference in asthma control ($p=0.878$) or in caregiver knowledge ($p=0.236$) between these children and the children included in this study. It was found that caregivers with poor asthma knowledge were more likely to report fewer asthma symptoms in their children, which is essential for assessing asthma control [36]. This phenomenon may potentially underestimate the role of asthma knowledge in asthma control reported in our study. No validation study has been undertaken for the Arabic versions of the cACT and the asthma knowledge questionnaire, although appropriate measures were taken to obtain an accurate translation of our instruments, and the relevance of the questions for the Saudi population was assessed with help of an asthma clinician and a group of caregivers during the pilot study. Although the cACT is widely used in research, it is recommended that in clinical practice, the cACT should be used along with a clinician's assessment to accurately reflect the asthma control level of patients [3]. The limitations of this study include a comparably small sample size and non-probability sampling. All participants were selected from the King Khalid University Hospital in Riyadh, Saudi Arabia, which may limit the generalizability of the findings.

Conclusions/key findings

This study found a substantial gap in almost all assessed aspects of the asthma knowledge of caregivers. Misunderstanding of the disease and misconceptions regarding asthma inhaler and medication use were among the key factors identified. Although innovations are needed to help patients improve their adherence to treatment to effectively utilize the benefits of contemporary asthma medications, we observe knowledge-related problems in asthma management.

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Declaration of interest

The authors report no conflicts of interest. The authors alone are responsible for the content and writing of this article.

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