

# Asthma control and its association with knowledge of caregivers among children with asthma

## A cross-sectional study

Abdulmohsen H. Al-Zalabani, MS<sub>c</sub>, ABCM, Mohamad M. Almotairy, SBFM.

### ABSTRACT

**الأهداف:** قياس مستوى التحكم في الربو لدى الأطفال المصابين بالربو في المدينة المنورة، واختبار العلاقة بين مستوى التحكم في الربو والمعرفة لدى من يرعاهم.

**الطريقة:** دراسة مقطعية أجريت في المراكز الصحية بالمدينة المنورة بين 278 طفل مصاب بالربو، أعمارهم من 1 - 12 سنة، ومن يرعاهم. تم استخدام استبيانات معيارية لقياس مستوى التحكم في الربو لدى الأطفال ومستوى المعرفة لدى من يرعاهم. تم استخدام التحليل أحادي العوامل ومتعدد العوامل لاختبار الفرضيات.

**النتائج:** أظهرت النتائج أن 62.8% من الأطفال لم يكن لديهم تحكم جيد في الربو وأن 37.41% فقط لديهم تحكم جيد. كانت علامات المعرفة لدى من يرعى الأطفال تتراوح بين 43 و 64 مع متوسط 52.55. كان متوسط علامات المعرفة أعلى لدى المجموعة ذات التحكم الجيد (55.57) مقارنة بالمجموعة الأخرى (50.76). وقد كان هناك فرق إحصائي مهم بين علامات المعرفة في المجموعتين ( $t=9.892$ ,  $p>0.001$ ).

**الخاتمة:** أظهرت الدراسة أن هناك نسبة عالية من الأطفال لم يكن لديهم تحكم جيد في الربو، كما أن هناك نقص كبير في المعرفة لدى من يرعاهم. إن إيجاد برنامج تثقيفي يستهدف عموم الناس ومن يرعى الأطفال المصابين بالربو يجب أن يطبق ليتم تصحيح المفاهيم الخاطئة بخصوص الربو والعلاجات المستخدمة.

**Objectives:** To investigate the level of asthma control among children and to investigate the association between asthma control and the knowledge of caregivers.

**Methods:** A cross-sectional study was conducted from January 2018 to July 2018 among 278 children with asthma aged 1-12 with their caregivers attending the primary health care centers in Al Madinah Al Munawarah, Saudi Arabia. An asthma knowledge questionnaire was used to measure the parents' knowledge. The Test for Respiratory and Asthma Control in Kids (TRACK) and the Childhood Asthma Control Test (C-ACT) were used to evaluate asthma control among the children. Univariate and multivariate analyses were used to compare

the knowledge level between the controlled and uncontrolled asthma groups.

**Results:** Approximately 62.6% of children had uncontrolled asthma and 37.4% were controlled. The knowledge scores of the caregivers ranged from 43 to 64, with a mean score of 52.55. The mean knowledge score was higher in the controlled group (55.57) than in the uncontrolled group (50.76). There was a statistically significant difference in the knowledge scores between the participant groups ( $t=9.892$ ,  $p<0.001$ ).

**Conclusion:** There is a high percentage of children with uncontrolled asthma and 3 is a high knowledge deficit among the caregivers of children with asthma. An educational program targeting the general population and the caregivers should be implemented to correct any false beliefs regarding asthma and asthma medications.

**Keywords:** asthma, knowledge, children, Saudi Arabia, asthma control

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*From the Department of Family and Community Medicine (Al-Zalabani), College of Medicine, Taibah University, and from Ministry of Health (Almotairy), Al-Madinah Al-Munawarah Health Directorate, Bagedo Primary Healthcare Center, Al-Madinah Al-Munawarah, Kingdom of Saudi Arabia.*

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*Address correspondence and reprint request to: Dr. Abdulmohsen H. Al-Zalabani, Associate Professor, Epidemiology and Community Medicine Head, Department of Family and Community Medicine, College of Medicine, Taibah University, Al-Madinah Al-Munawarah, Kingdom of Saudi Arabia. E-mail: azalabani@taibahu.edu.sa  
ORCID ID: <https://www.orcid.org/0000-0002-4937-6100>*

Asthma is a chronic disease caused by inflammation of the airways in the lungs and characterized by breathing difficulties due to airway obstruction. It is estimated that asthma affects 339 million people worldwide.<sup>1</sup> In Saudi Arabia, asthma is a common chronic disease. Although national surveys on asthma among children are lacking, the prevalence of asthma reported by various surveys conducted in various regions ranges from 9% to 33.7% among children.<sup>2,3</sup> The variation in prevalence could be related to variations between regions in factors such as altitude, temperature, and humidity; but also could be related to using different methods used in different surveys.<sup>2</sup> Also, the estimates reported in these surveys were not consistent regarding the prevalence of asthma among children in rural versus (vs) urban regions.<sup>2</sup> Poor asthma control can lead to a lower quality of life of patients and caregivers. It may result in missed days from school or work, more hospital visits, and more time and effort from the caregivers.<sup>4,5</sup> Various factors may affect asthma control, such as adherence to treatment, inhaler technique, smoking, infections, as well as trigger exposures.<sup>4</sup> Studies also found that low maternal education was associated with uncontrolled asthma.<sup>6</sup>

Studies have suggested that when patients receive good education and instructions on asthma, they can manage mild attacks at home, which results in a significant decrease in the number of days of daytime asthma symptoms.<sup>7,8</sup> Active child and caregiver involvement and obtaining the required knowledge and skills are necessary to achieve asthma control and prevent exacerbation.<sup>9</sup> Caregivers can recognize the symptoms through careful, frequent observation. Furthermore, parental education on the disease was associated with better adherence and less medical visits and hospitalizations for their children.<sup>10,11</sup> Educating patients and their families on lifestyle adjustments and adherence to medications can help achieve optimal management.<sup>6</sup> Evidence has shown that many parents of children with asthma have various misconceptions regarding the disease and the use of medication for the prevention of asthma attacks.<sup>10</sup> In Saudi Arabia, studies on asthma control among children and knowledge among caregivers are scarce.

The aim of this study was to examine the level

of asthma control among children with asthma in Al-Madinah Al-Munawarah, Saudi Arabia and to investigate the association between asthma control and the knowledge of caregivers.

**Methods.** The ethical approval for this study was obtained prior to data collection from the Ethical Committee for Health Research, Al-Madinah Al-Munawarah, Ministry of Health (IRB-109 29-01-1439H). A written consent was obtained from the caregivers and an oral assent was obtained from children aged 7 years and above. The informed consent satisfied all the content required by the National Bioethics Committee guidelines including description of the study, voluntary participation, and assurance of confidentiality. All patient information was kept confidential.

This study was conducted from January 2018 to July 2018 in Al-Madinah Al-Munawarah, which is one of the major cities in Saudi Arabia with an estimated population of approximately 1.2 million.<sup>12</sup> There are 36 primary health care (PHC) centers in Al-Madinah Al-Munawarah, Saudi Arabia. Primary health care is a cornerstone in the national health transformation as a part of the Vision 2030 in Saudi Arabia.<sup>13</sup> Primary health care centers provide preventive, curative, and rehabilitative health services including treatment of common illnesses, immunization, maternal and child health, screening, and oral health. In each PHC center, a dedicated clinic run by a general practitioner and other healthcare professionals is assigned for follow up of children diagnosed with asthma. The clinic provides clinical care as well as educational services for patients. Asthma clinics in PHC centers follow the Saudi guidelines for asthma including management and education for patients. Children with asthma are diagnosed in the hospital by specialist physicians and then referred to the PHC centers for follow up. The number of registered physician-diagnosed children with asthma in the PHC centers in the Madinah region is approximately 1000. The primary data were collected from caregivers of children with asthma coming for a follow-up visit in the asthma clinic in PHC centers in Madinah Al Munawara, Saudi Arabia.

The study objectives were achieved using a cross-sectional study design. The inclusion criteria of the study were: i) children diagnosed with asthma; ii) children aged one to 12 years old; iii) visiting PHC centers with their caregivers for follow up; and iv) caregivers can speak Arabic. Children with other chronic diseases or their caregiver was not a first-degree relative were excluded from this study.

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The sample size for the study was calculated to be 278 participants based on an assumed frequency of outcome variable of 50% with an accepted margin of error of plus-or-minus 5 and a confidence level of (95%). Eight PHC centers were randomly selected to be included in the study: Wa'era, Al-Azizia, Quba, Al-Salam, Al-Aqool, Al-Hijra, Al-Aous, and Do'aitha PHC centers. These centers were selected from the list of PHC centers in Madinah Al Munawarah, Saudi Arabia using simple random sampling technique. Within these centers, caregivers of children with asthma attending a follow-up visit in the asthma clinic were recruited sequentially.

After the informed consent was obtained, a trained nurse interviewed the caregiver to fill the questionnaire. The interview was conducted in a dedicated waiting room in the PHC center. A self-administered questionnaire was used for data collection. The questionnaire was composed of 3 sections. The first section collected data on sociodemographic variables including child age, caregiver age, education, relationship, marital status, current smokers in the family, housing type, and number of siblings. Housing type was categorized as "old/traditional house" indicating houses not built on modern standards (and known to be linked to low socioeconomic status), "apartment" or "detached house".

The second section collected data on asthma control using either the Test for Respiratory and Asthma Control in Kids (TRACK) for children less than 5 years old, or the Childhood Asthma Control Test (C-ACT) for children aged 5-12 years. The third section used the Asthma Knowledge Questionnaire (AKQ) to collect data on asthma knowledge of caregivers. The TRACK was developed and validated for use among kids aged less than 5 years.<sup>14</sup> The TRACK questionnaire consists of 5 questions to be answered by the caregiver. Each question score ranges from 0 to 20, with a total score of 100. The TRACK questionnaire was found to be a valid instrument to measure the control level of asthma symptoms with the cutoff point of 80 as the best point to differentiate between controlled and uncontrolled asthma.<sup>14</sup> The C-ACT was developed and validated for use among kids aged 4-12 years. The test consisted of 7 items, 4 items to be answered by the child and 3 items to be answered by the caregiver. The C-ACT questionnaire was found to be a valid instrument to measure the control level of asthma symptoms.<sup>15</sup> The total score of the test ranges from zero to 27; the cutoff point of 19 was found to be the best point to differentiate between controlled and uncontrolled asthma, with a specificity 74% and a sensitivity 68%.<sup>15</sup> At the time of the study,

there was no Arabic version for TRACK or C-ACT. So, we followed the recommended practice of translation by expert translator and back-translation. Face validity of the translated instrument was checked by family and community medicine consultants. The AKQ consisted of 17 items and was originally developed and validated in English by Rodriguez Martinez and Sossa.<sup>16</sup> An Arabic version of the AKQ was culturally adapted and validated by Al-Anazi et al<sup>17</sup> and found to have a good internal consistency (Cronbach Alpha=0.714) and test-retest reliability (Interclass Correlation Coefficient=0.59). The AKQ was targeted to the caregivers; it comprised 17 Likert scale-based items with answers graded from 1 to 5. The AKQ is composed of 3 subcomponents: myths and beliefs on asthma management (7 items); knowledge on the disease (6 items); and knowledge on other aspects (4 items).

**Statistical analysis.** All analyses of the data were conducted using the Statistical Package for Social Sciences for Windows, version 23 (IBM Corp, Armonk, NY, USA). Hypothesis testing was conducted at an alpha of 0.05. Means with standard deviation were used to report continuous variables while proportions were used to report categorical variables. Each question in the AKQ had a score of 1 to 5 with the sum of a total score ranging from 17 to 85 where a higher score indicated a higher level of knowledge. The total score of knowledge was calculated as the sum of scores for all AKQ questions. The total score was categorized into quartiles and used as a categorical variable in the analyses. The TRACK for kids aged less than 5 was used to divide the groups to controlled and uncontrolled depending on a score out of 100. A score of less than 80 indicated uncontrolled asthma and a score of 80 and higher indicated controlled asthma. For the C-ACT, the controlled group was the children with a total score of more than 19 points while the uncontrolled group was the ones with a score equal to or less than 19 points.

**Results.** The study included 278 children with asthma and their caregivers who were recruited from 8 different PHC centers in Madinah Al Munawara, Saudi Arabia (Table 1). The mean age of included children was 6.45 (standard deviation [SD] 3.3) and ranged from one to 12. The number of children with asthma in the participating families ranged from one to 4 children, with 89.2% having at least 2 children with asthma. Approximately 33.5% of the participants had 5 or more siblings living in the same home.

The participant's caregivers were the father in 57.9% of the sample while 41% were the mother of the child with asthma. The mean age of caregivers was 39.66 with

**Table 1** - Sociodemographic characteristics in relation with asthma control.

Variable	Asthma control		Total (n=278)
	Controlled (n=104)	Uncontrolled (n=174)	
<i>Age of the child</i>			
≤2	15 (14.4)	12 (6.9)	27 (9.7)
3 to 5	27 (26.0)	72 (41.4)	99 (35.6)
6 to 8	21 (20.2)	39 (22.4)	60 (21.6)
9 to 12	41 (39.4)	51 (29.3)	92 (33.1)
Mean (SD)	6.63 (3.5)	6.34 (3.2)	6.45 (3.3)
<i>Siblings</i>			
None	6 (5.8)	15 (8.6)	21 (7.6)
One to four	65 (62.5)	99 (56.9)	164 (59.0)
Five or more	33 (31.7)	60 (34.5)	93 (33.5)
<i>Number of children with asthma*</i>			
One	74 (71.2)	78 (44.8)	152 (54.7)
Two	27 (26.0)	69 (39.7)	96 (34.5)
Three	3 (2.9)	24 (13.8)	27 (9.7)
Four	0	3 (1.7)	3 (1.1)
<i>Relation</i>			
Father	74 (71.1)	87 (50.0)	161 (57.9)
Mother	30 (28.9)	84 (48.3)	114 (41.0)
Brother/Sister	0	3 (1.7)	3 (1.1)
<i>Education</i>			
No education/Primary school	12 (11.5)	27 (15.5)	39 (14.0)
Intermediate school	18 (17.3)	24 (13.8)	42 (15.1)
High school	30 (28.9)	63 (36.2)	93 (33.5)
University degree	44 (42.3)	60 (34.5)	104 (37.4)
<i>Marital Status</i>			
Married	101 (97.1)	168 (96.6)	269 (96.8)
Divorced/ Widowed/Single	3 (2.9)	6 (3.5)	9 (3.2)
<i>Type of House</i>			
Old House	33 (31.7)	54 (31.0)	87 (31.3)
Apartment	68 (65.4)	105 (60.3)	173 (62.2)
Detached house	3 (2.9)	15 (8.6)	18 (6.5)
<i>Residence Ownership</i>			
Owned	56 (53.2)	81 (46.6)	137 (49.3)
Rented	48 (46.2)	93 (53.5)	141 (50.7)
<i>Current smoker in the home</i>			
No	57 (54.8)	96 (55.2)	153 (55.0)
Yes	47 (45.2)	78 (44.8)	125 (45.0)
<i>Caregiver's age, mean (SD)</i>	38.09 (9.1)	40.60 (10.0)	39.66 (9.8)

\*Including those with no siblings

an SD of 9.75, and it ranged from 24 years to 65 years. Approximately 62.6% of the caregivers had less than university education while only 37.4% had a university degree. Most of those caregivers are married with a 96.8% while the remaining 3.2% are either divorced or widowed. A high percentage of the participants lived in modern apartments which were 62.2%, while approximately 31.3% lives in old/traditional houses. Approximately, half (49.3%) of the participants live in an owned home while the others live in rented homes. When asked if anyone smokes in the home, 55% of the participants answered negatively while 45%

answered in the affirmative. **Table 1** provides additional demographics.

**Asthma knowledge.** The total knowledge score for the caregivers ranged from 43 to 64 with a mean of 52.56 and a standard deviation of 4.56. The mean total knowledge score was higher (55.57) in the controlled group than in the uncontrolled group (50.76) (**Table 2**).

**Asthma control.** Out of the 278 children with asthma, 62.6% had uncontrolled asthma and only 37.4% were controlled (**Table 1**). As shown in **Table 3**, when a family has 2 children with asthma the asthma

**Table 2** - Knowledge score (total and subcomponents) by status of asthma control.

Knowledge subcomponents	Knowledge score Mean (SD)		P-value
	Controlled asthma (n=104)	Uncontrolled asthma (n=174)	
Myths and beliefs	22.02 (2.2)	18.66 (2.6)	<0.001
Knowledge	20.90 (3.3)	19.16 (3.4)	<0.001
Associated aspects	12.64 (2.5)	12.95 (2.1)	0.30
Total score	55.57 (4.1)	50.76 (3.9)	<0.001

was less likely to be controlled in comparison to families with one child with asthma (crude OR=0.41, 95% CI=0.24-0.71; adjusted OR=0.25, 95% CI=0.12-0.51). Similarly, a child was more likely to have uncontrolled asthma when the family has 3 to 4 children with asthma (crude OR=0.12, 95% CI=0.03-0.40; adjusted OR=0.13, 95% CI. 0.03-0.61).

Age of the caregiver was significantly lower among the group of controlled asthma compared to the group of uncontrolled asthma (mean=38.09±9.12 versus mean=40.60±10.02;  $p=0.033$ ; OR=0.97, 95% CI. 0.95-0.99). However, this association became non-significant in the multivariable model after adjustment for number of children with asthma, child age, and knowledge score.

**Table 3** - Crude and adjusted odds ratio for the determinants of asthma control.

Characteristic	Crude odds ratio		Adjusted odds ratio*	
	OR	95% C.I.	OR	95% C.I.
<i>Knowledge score</i>				
1 <sup>st</sup> quartile	Ref	-	Ref	-
2 <sup>nd</sup> quartile	3.46	1.39 – 8.60	7.22	2.52 – 20.71
3 <sup>rd</sup> quartile	9.64	4.30 – 21.61	14.44	5.81 – 35.90
4 <sup>th</sup> quartile	26.25	10.14 – 67.93	57.28	18.33 – 178.96
<i>Number of children with asthma</i>				
One	Ref	-	Ref	-
Two	0.41	0.24 – 0.71	0.25	0.12 – 0.51
Three or four	0.12	0.03 – 0.40	0.13	0.03 – 0.61
Caregiver's age	0.97	0.95 – 0.99	0.98	0.94 – 1.02
Age of the child	1.03	0.95 – 1.11	1.03	0.93 – 1.14
<i>Siblings</i>				
None	Ref	-		
One to four	1.64	0.61 – 4.45		
Five or more	1.38	0.49 – 3.88		
<i>Education</i>				
No education/Primary school	Ref	-		
Intermediate school	1.69	0.68 – 4.21		
High school	1.07	0.48 – 2.40		
University degree	1.65	0.75 – 3.61		
<i>Marital status</i>				
Married	Ref	-		
Divorced/Widow/Single	0.83	0.20 – 3.40		
<i>Type of house</i>				
Old house	Ref	-		
Apartment	1.06	0.62 – 1.80		
Detached house	0.33	0.09 – 1.22		
<i>Residence ownership</i>				
Owned	Ref	-		
Rented	0.75	0.46 – 1.22		
<i>Current smoker</i>				
No	Ref	-		
Yes	1.01	0.62 – 1.65		

\*Adjusted for number of children with asthma, caregivers age, and child age.

**Asthma-related knowledge and control.** Table 3 shows the results of univariable and multivariable analyses of the association between asthma control and total knowledge score as well as various sociodemographic factors. The odds ratio of asthma control increased with increased total knowledge score with a dose response pattern. This association remained, and in fact was augmented, after adjusting for other factors in the multivariable model (number of children with asthma, caregivers age, and child age).

**Discussion.** The study results revealed a gap in the asthma control in Saudi Arabia and help define targets for asthma education programs. These results showed that 62.6% of the children have uncontrolled asthma and only 37.4% are controlled. This prevalence of asthma control is consistent with a previous study carried out in Riyadh, Saudi Arabia where the children with uncontrolled asthma were 59.3% of the participants.<sup>9</sup> Moreover, better knowledge among caregivers was associated with better asthma control in the children with asthma. The mean knowledge score of the caregivers was 52.55 with (SD= 4.55) and the controlled group had a higher mean score compared to the uncontrolled group. This difference shows that an increased knowledge toward asthma results in a better control. This result is consistent with another study conducted in Riyadh, Saudi Arabia that showed the mean knowledge score of the same scoring system was 53.4 (SD= 6.5) and that the odds of uncontrolled asthma was inversely associated with the knowledge score.<sup>9</sup> Studies from Saudi Arabia<sup>4</sup> and other countries showed that asthma was controlled better in children whose caregivers had a higher knowledge of asthma.<sup>4,18</sup> It has also been reported better education on asthma is associated with better adherence to medications and less emergency departments visits.<sup>7</sup>

The current study also highlighted the gap in knowledge among caregivers. Although various levels of knowledge were reported by studies in Saudi Arabia, it seems that the gap in knowledge is consistent among various regions and local communities.<sup>5,19,20</sup> The determinants of this knowledge deficit need to be further investigated. More importantly, intervention programs need to be planned and deployed at a national level. Currently, the national guidelines outline asthma education required to be delivered to patients as a strategy to improve asthma control and quality of life.<sup>21</sup> However, implementation plans need to be in place to ensure proper reach and effective execution.

Although most of the knowledge questions were answered incorrectly by more than half of the

participants, most of them correctly answered a question regarding smoking near a child with asthma. This is mostly due to the well-known effect of smoking on asthma and children in general. Similar finding was reported by another study conducted in Riyadh that showed 86.1% of participants believed that smoking near a child with asthma is harmful.<sup>9</sup> Another interesting finding in the current study was that higher number of children with asthma in the family was associated with worse asthma control among children. Previous studies similarly showed that family history of asthma was associated with uncontrolled asthma.<sup>22</sup> This finding could be related to the severity of the disease or other confounding factors among families with more than one child with asthma e.g. compliance with medications.

**Study limitation.** This study was a cross-sectional design. Although the results showed an association between caregivers' knowledge and asthma control, a causal association cannot be confirmed using cross-sectional study design and longitudinal studies are needed. In addition, data were collected using questionnaires and consequently were subject to recall bias. Moreover, the study used a sample of children with asthma from Al Madinah Al Munawarah, Saudi Arabia which may require caution when generalizing the results to other regions.

In conclusion, the study showed that a high percentage of the children had uncontrolled asthma. It also showed that there is a lower knowledge score among caregivers of children with uncontrolled asthma compared to those with controlled asthma. In addition, it showed that a high percentage of the population believe in myths and beliefs regarding asthma and its medication. These results suggest that we need to implement educational programs and increase the awareness among the general population in general and the caregivers in particular to improve their knowledge and thus, improve the asthma control status of their children.

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