

Knowledge About Asthma Among Primary School Teachers in Riyadh City, Saudi Arabia

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ABSTRACT

Background: Adequate asthma knowledge among school teachers is critical for the safety of their students who are suffering from asthma exacerbation during the school time.

Objective: To assess asthma knowledge and its associated demographic and other personal characteristics among school teachers working in boys' primary schools in Riyadh, Saudi Arabia.

Methods: A cross-sectional study design was used to examine school teachers recruited from 20 boys' primary schools in Riyadh between February and March 2015. A structured self-administered questionnaire was used to collect data on demographic characteristics. The Newcastle Asthma Knowledge Questionnaire was translated into Arabic language and used to assess asthma knowledge. The overall and subscale scores of the Newcastle Asthma Knowledge Questionnaire were calculated. Student t-test, analysis of variance (ANOVA) and linear regression analysis were used.

Results: All teachers (N=376) were males, 98.4% were Saudi, 72.4% aged between 30 and 49 years, 83.8% were currently married, 82.7% had one or more children, 17.8% had personal history of asthma, and 43.6% had family history of asthma. Out of a total 31 points, the overall score in teachers was 14.1 which represented 45.4%. Out of a total 7 points, the general knowledge sub-scale score was 3.4 which represented 48.7%. Out of a total 11 points, the acute attack sub-scale score was 3.9 which represented 35.3%. Out of a total 6 points, the maintenance treatment sub-scale score was 3.0 which represented 49.3%. Out of a total 8 points, the false myths sub-scale score was 4.1 which represented 51.4%. Better asthma knowledge was significantly associated with being married

($p=0.001$), having children ($p=0.001$), working for moderate (10-19 years) duration ($p=0.012$), and having family history of asthma ($p=0.006$). However, only having children and having family history of asthma were independently associated with relatively better asthma knowledge in multivariate analysis.

Conclusions: Primary school teachers in Riyadh had poor asthma knowledge, particularly those related to the recognition, triggers, and management of acute attack of asthma. The current findings may indicate the critical need for asthma education programs in our primary schools. Future studies should focus on testing the effect of asthma educational activities on the short-term and long-term knowledge of the teachers and asthma outcomes among students.


Keywords: Asthma, Knowledge, Primary School, Teachers, Saudi Arabia.

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INTRODUCTION

Asthma is the most common chronic medical condition among children worldwide.¹ The prevalence of asthma among children was estimated at 9.3% in the US.² Additionally, the prevalence of asthma symptoms were estimated to range between 5% and 35% among children in different parts of the world, being higher in developed compared to developing countries.³ There was global

increase in the asthma prevalence and mortality over the last decades.⁴ In a big recent study in Saudi Arabia, the overall prevalence of symptoms of asthma in the previous 12 months of conducting that study was estimated at 10.2% among primary school children in Madinah, while those who ever-having asthma symptoms was estimated at 23.6%.⁵

As school children spend almost 30% of their day at school, there is a substantial probability that school children experience severe or life-threatening asthma exacerbations at school.⁶ As more schools in developing countries do not have a permanent full-time nurses or physician compared with developed countries, it is critically important for the school teachers to be aware of early signs of asthma, its precipitating factors, when to call for extra medical help, and making decision regarding physical activity.⁷

The impact of asthma on children's quality of life and school performance is considerable. Inadequately controlled asthma negatively impact the child's quality of life interfering with daily activities and reduce the child's school productivity and attendance.⁸ Additionally, children with asthma who are prohibited to participate in the physical classes may feel isolation and rejection.⁹ Additionally, asthma is the third most common cause of hospitalization among children below 15 years, causing huge direct and indirect health care cost.¹⁰

Diagnosis of asthma in children requires taking a thorough history in addition to complete physical examination. Good history intake should cover the current, past, family, exposures, and medication histories. Current history of cough, wheeze, shortness of breath, and sinus problem is usually present in asthmatic patients.^{11,12} Additionally, there are many conditions with similar presentation as asthma need to be excluded before asthma diagnosis can be established such as infections (pneumonia and bronchiolitis), exposures (hypersensitivity pneumonitis), medications, and foreign body aspiration. Investigations that can help asthma diagnosis or exclusion include allergy testing, spirometry, exercise challenge test, complete blood count, chest X-ray, and sinus CT scan.¹²

The goals of asthma treatment include decreasing mortality, decreasing morbidity, improving quality of life, and reducing the cost of treatment.¹² Therefore, successful treatment should be able to improve the symptoms, reduce the number and severity of asthma exacerbations, reduce the loss of school or work days, and reduce the number of emergency or unscheduled office or clinic visits.¹² In addition to medications, asthma management include control of environmental exposures and self-management education.

The National Heart, Lung, and Blood Institute (NHLBI) asthma management guidelines¹³ have the following recommendations for classroom teachers; (1) Awareness of asthma policies and procedures; (2) Awareness of their role in student's asthma management; (3) Collaborating with the student and his/her family in handling missed schoolwork; (4) Encouraging student's participation in physical activity; (5) Awareness of asthma triggers for specific students; (6) Help in reducing allergens and irritants that can provoke an asthma attack in the classroom; and (7) Educating all students to be more tolerant with classmates with asthma.

In the developed countries, the majority of these studies showed limited knowledge of school teachers regarding asthma and its management.¹⁴⁻¹⁶ This limited knowledge was even worse among teachers who have no current students with active asthma.¹⁴ Another study among 34 elementary school teachers in Illinois showed 75% knowledge level about asthma symptomatology, triggers, and management.^{15,16} In the developing countries, poor asthma knowledge among primary school teachers was similar or even worse compared with developed countries.^{10,17-20}

Asthma affects considerable proportion of primary school children in Saudi Arabia.⁷ The safety of asthmatic school children greatly depends on the level of asthma knowledge among their teacher.²¹ Improving asthma knowledge among school teachers has been shown to have direct and indirect beneficial outcomes on asthma management in school.²² Data showing asthma knowledge among primary school teacher in Saudi Arabia is limited to one study. Additionally, this study was conducted among female teachers only and did not use standardized validated tool in assessing the teacher knowledge nor assessed false myths associated with asthma and its management. Studying the level of asthma knowledge among primary school teachers in Saudi Arabia is critical to assess the extent of the problem and may point at areas of extensive knowledge defects that need future improvement.

This study aimed to determine the knowledge about asthma among primary school teachers in Riyadh city, and their approach toward asthmatic children in schools.

SUBJECTS AND METHODS

A cross-sectional study was conducted in boys' primary schools in the city of Riyadh, Saudi Arabia. Primary education system in Saudi Arabia is divided into boys and girls sections, with only teacher of the same student gender allowed to teach students. In Riyadh, the Capital and the biggest city in Saudi Arabia, there are approximately 750 boys' primary schools.

The current study targeted primary school teachers working in boys' primary schools in Riyadh. Teachers serving children with special needs were not included as they receive additional education and training for supporting children during health and disease status.

Previous data examining the level of asthma knowledge among primary school teachers in Saudi Arabia is limited. However, studies done in Saudi Arabia and nearby countries with relatively similar culture showed knowledge levels between 35% and 50%.^{10,23} To detect a knowledge level (P) of 40% with 5% confidence limit (d) among primary school teachers with 95% confidence level (1- α /2), the sample size was estimated to be (N) 369 primary school teachers, according to the following equation:

$$N = \frac{(Z)^2 * P * (1 - P)}{(d)^2}$$

Where Z is a constant = 1.96, the knowledge level (P) = 40%, and the confidence limits (d) = 5%

Multistage sampling technique was used in this study. The city of Riyadh is divided into 5 geographic regions; central, eastern, western, northern, southern regions. Four schools have been randomly chosen by using computerized randomization from the list provided from ministry of education of boys' primary schools in each of the five geographic region of Riyadh.²⁴ Approximately 20 teachers have been selected conveniently in each of the 20 chosen schools.

A structured self-administered questionnaire was adapted from previous similar studies and used to collect the study data. The questionnaire had two main sections; (1) demographic characteristics and (2) asthma knowledge. The demographic characteristics included age, nationality, marital status, number of children, and working years. The Newcastle Asthma Knowledge Questionnaire originally developed by Fitzclarence and Henry was

translated into Arabic language and used in the study.²⁵ The Questionnaire is a 31 item test, with 25 true/false items and 6 open ended questions. The questions has been categorized into general assessment of the asthma knowledge (questions 1, 2, 3, 25, 26, 28, and 29), acute attack: recognition, triggers, and management (questions 6, 7, 8, 11, 15, 18, 19, 20, 21, 22, and 23), maintenance treatment (questions 10, 12, 14, 19, 27, and 31), and false myths (questions 4, 5, 9, 13, 16, 17, 24, and 30).²⁶ Correctly answered questions were given a score of “one” while wrongly answered questions were given a score “zero”. The open-ended questions of the questionnaire were rated by the researcher according to the published standard answers for these questions. The overall score value ranges between 0 and 31, with a higher score indicating greater knowledge.

The Newcastle Asthma Knowledge Questionnaire has been validated and extensively used among different groups that have various levels of knowledge including teachers.²⁷⁻²⁹ Additionally, the Arabic version of the questionnaire was developed by translating the English questionnaire. This was back translated into English by external bilingual reviewer, and comparison was done to confirm its validity, the questionnaire was piloted on 20 volunteer teachers with a positive feedback, the questionnaire was re-administered after a week to the same teachers of the pilot study to check test-retest reliability. The correlation coefficient of the questions from the two administrations was 0.95 and it had a good reliability as indicated by post-data collection estimated Cronbach's Alpha of 0.756. The study outcome was the level of knowledge about asthma as indicated by the total score of the Newcastle Asthma Knowledge Questionnaire. As there are no accepted cut points for the calculated score, the score was used as continues variable in the analysis. Additionally, subscales of

the questionnaire (based on the knowledge components) were calculated and used as described before.²⁶ These included general assessment of the asthma knowledge (questions 1, 2, 3, 25, 26, 28, and 29), acute attack: recognition, triggers, and management (questions 6, 7, 8, 11, 15, 18, 19, 20, 21, 22, and 23), maintenance treatment (questions 10, 12, 14, 19, 27, and 31), and false myths (questions 4, 5, 9, 13, 16, 17, 24, and 30).

The proposal was approved by the research ethics committee in Prince Sultan Military Medical City, Riyadh before starting data collection. Additionally, administrative approval was obtained from the Ministry of Education to conduct the study in the schools.

All categorical variables were presented as frequencies and percentage while continuous variables were presented as means and standard deviations. The overall and subscale scores of the Newcastle Asthma Knowledge Questionnaire were calculated by summing up the points for all questions and individual subscale questions, respectively. Additionally, relative overall and subscale scores were calculated by transforming the absolute values to a 100 point scale. To detect differences in knowledge by demographic and occupational characteristics, overall and subscale scores were compared using student t-test for two-level categorical variables (such as marital status) and analysis of variance (ANOVA) for multi-level categorical variables (such as age groups). To identify the demographic and occupational characteristics independently associated with high knowledge score, linear regression analysis was run, with overall score of Newcastle asthma knowledge is the dependent variable and demographic and occupational characteristics are the independent variables. All P-values were two-tailed. P-value <0.05 was considered as significant. SPSS software (Version 22.0. Armonk, NY: IBM Corp) was used for all statistical analyses.

Table 1: Demographic characteristics of primary school teachers in boys' primary schools in Riyadh, Saudi Arabia (2015)

Characteristics	Number	Percentage
Total	376	100.0%
Age		
<30	67	17.8%
30-39	165	43.9%
40-49	107	28.5%
≥50	37	9.8%
Nationality		
Saudi	370	98.4%
Non-Saudi	6	1.6%
Marital status		
Single	61	16.2%
Married	315	83.8%
Children number		
0	65	17.3%
1-5	258	68.6%
6-10	51	13.6%
>10	2	0.5%
Working years		
<10	154	41.0%
10-19	138	36.7%
≥20	84	22.3%
Personal history of asthma		
No	309	82.2%
Yes	67	17.8%
Family history asthma		
No	212	56.4%
Yes	164	43.6%

RESULTS

A total 376 primary school teachers working in boys' primary schools in Riyadh were included in the current analysis. The demographic characteristics of the included teachers are shown in Table 1. All teachers were males and the vast majority (98.4%) were Saudi. The majority (72.4%) of the teachers aged between 30 and 49 years. The majority (83.8%) of them were currently married. Approximately 82.7% of the teachers had one or more children. Approximately 41.0% of the teachers were working for less than 10 years and 22.3% were working for 20 years or more. Approximately 17.8% of the teachers had a personal history of asthma with much more (43.6%) had a family history of asthma. Regarding to the responses to the 31 questions of the Newcastle asthma knowledge questionnaire, concerning asthma general knowledge, 87.8% of the teachers were aware that parental smoking may make the child's asthma worse and 72.1% of the teachers were aware that children with asthma have abnormally sensitive air passages in their lungs. On the other hand, only 16.0% of the teachers were aware that doctor listening to the child's chest is not the best way to measure the severity of child's asthma and 33.2% of the teachers were aware that swimming is not the only suitable exercise for asthmatics. Breathlessness (77%), chest tightness (58%), cough (42%), and wheezing (40%) were the most frequently identified symptoms of asthma. Concerning the recognition, triggers, and management of acute attack of asthma, the vast majority (98.4%) of the teachers correctly identified the triggers of asthma; dust (89.4%), smoke (69.7%), perfume (53.5%), plants (39.6%), and viral infections (32.4%). Additionally approximately half of the teachers were aware that the wheeze during the attack of asthma may be due to muscles tightening in the wall of the air passages in the lungs (51.9%) and inhaled medications for asthma (e.g. Ventolin puffers) have fewer side effects than tablets (48.4%). On the other hand, only 23.4% of the teachers were aware that asthma treatments (such as Ventolin) do not damage the heart and only 19.7% of the teachers identified 2 medicines used in the treatment of acute attack of asthma. Approximately 23.7% of the teachers gave the correct reasons for

failure of a medicine to relieve the symptoms of acute attack of asthma. The reasons given by the teacher included wrong drug (53%), low dose (29%), drug resistance (27%), and expired drug (20%). Similarly, 25.0% of the teachers were aware of the correct ways to prevent attacks of asthma during exercise. The ways identified by the teachers included taking drug before exercise (43%), warm up exercise (33%), reduce exercise (32%), and nose breath (29%). Regarding the maintenance treatment of asthma, the majority (85.4%) of the teachers were aware of the need of preventive drugs to children with frequent asthma and the majority (73.7%) of them were aware with the fact that appropriate treatment can lead a normal life with no restrictions on activity among these children. However, only one-third of the teachers correctly gave names of two medicine used in prevention of asthma attacks. Similarly, only between 30% and 40% were aware of the non-importance of antibiotics in the treatment of asthma, inability of allergy injections to cure asthma, and insignificance of the side effects of short courses of oral steroids. About false myths regarding asthma, some of these false myths were correctly identified by the majority of the teachers as false myths such as asthma is infectious (89.4%) and asthma usually causes stunted growth (78.7%). On the other hand, some of these false myths were correctly identified as false myths by only a minority of the teachers such as asthma damages the heart (19.1%) and drinking cow's milk increase mucus in asthmatic children (26.9%). Overall and subscale scores of Newcastle asthma knowledge questionnaire are shown in Figures 1 (absolute) and 2 (relative). Out of a total 31 points, the overall score in teachers was 14.1 which represented 45.4%. Out of a total 7 points, the general knowledge sub-scale score was 3.4 which represented 48.7%. Out of a total 11 points, the acute attack sub-scale score was 3.9 which represented 35.3%. Out of a total 6 points, and the maintenance treatment sub-scale score was 3.0 which represented 49.3%. Out of a total 8 points, the false myths sub-scale score was 4.1 which represented 51.4%.

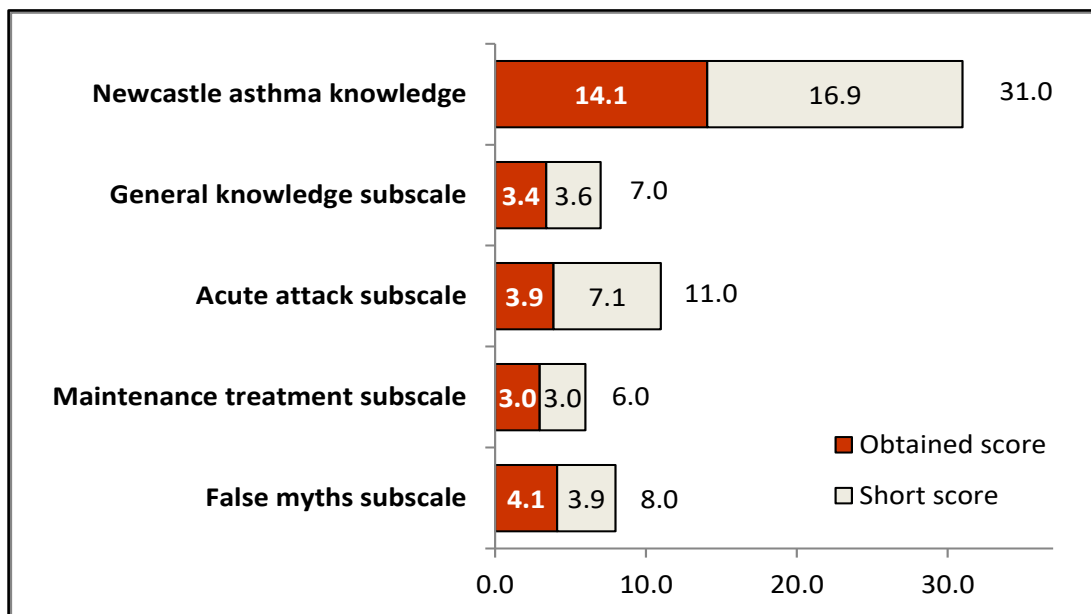


Figure 1: Overall and subscale (absolute) scores of Newcastle asthma knowledge among primary school teachers in boys' primary schools in Riyadh, Saudi Arabia (2015)

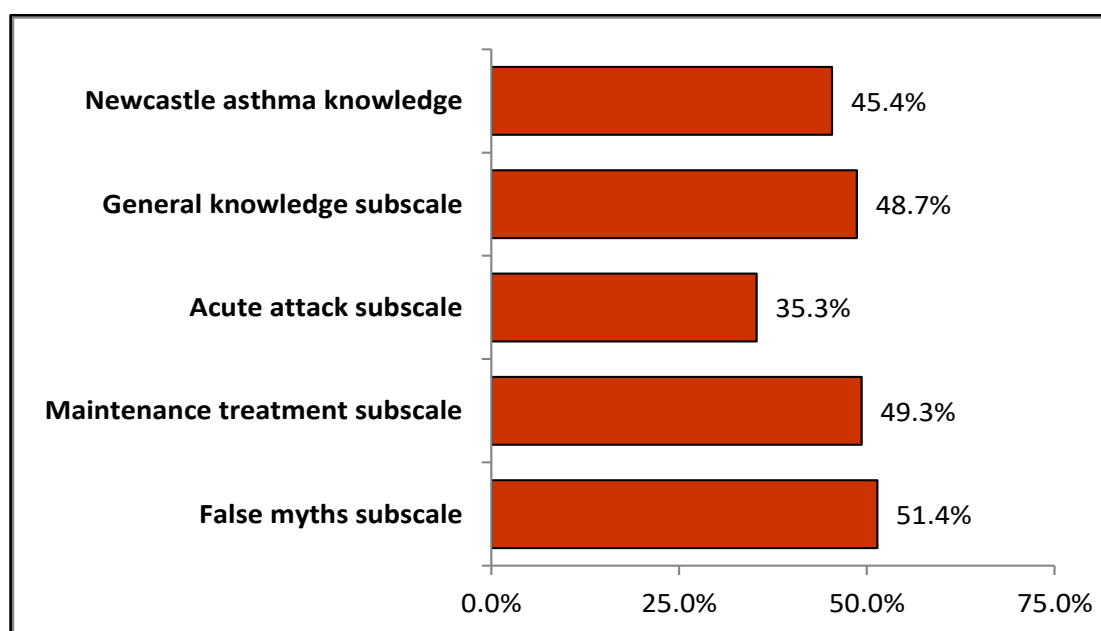


Figure 2: Overall and subscale (relative) scores of Newcastle asthma knowledge scores among primary school teachers in boys' primary schools in Riyadh, Saudi Arabia (2015)

Table 2: Overall and subscales of Newcastle asthma knowledge (relative) scores by demographic characteristics of primary school teachers in boys' primary schools in Riyadh, Saudi Arabia (2015)

Characteristics	Newcastle asthma knowledge	General knowledge subscale	Acute attack subscale	Maintenance treatment subscale	False myths subscale
Age					
<30	0.43±0.14	0.46±0.20	0.30±0.15	0.46±0.22	0.52±0.26
30-39	0.46±0.15	0.49±0.20	0.35±0.17	0.49±0.23	0.53±0.23
40-49	0.48±0.14	0.52±0.18	0.39±0.16	0.52±0.23	0.52±0.23
≥50	0.41±0.16	0.44±0.21	0.34±0.16	0.47±0.23	0.43±0.22
<i>P-value</i>	0.067	0.097	0.003	0.413	0.228
Nationality					
Saudi	0.45±0.15	0.49±0.20	0.35±0.16	0.49±0.23	0.51±0.23
Non-Saudi	0.55±0.13	0.52±0.15	0.50±0.16	0.64±0.19	0.54±0.25
<i>P-value</i>	0.124	0.610	0.039	0.101	0.957
Marital status					
Single	0.40±0.16	0.42±0.23	0.28±0.16	0.42±0.23	0.50±0.25
Married	0.46±0.14	0.50±0.18	0.37±0.16	0.51±0.22	0.52±0.23
<i>P-value</i>	0.001	0.005	<0.001	0.005	0.454
Children number					
0	0.39±0.17	0.41±0.23	0.27±0.17	0.41±0.23	0.49±0.26
1-5	0.47±0.14	0.50±0.18	0.37±0.16	0.51±0.22	0.52±0.23
≥6	0.47±0.15	0.50±0.19	0.38±0.16	0.54±0.25	0.49±0.21
<i>P-value</i>	0.001	0.003	<0.001	0.003	0.405
Working years					
<10	0.44±0.15	0.47±0.20	0.33±0.16	0.48±0.24	0.50±0.23
10-19	0.48±0.14	0.51±0.19	0.38±0.16	0.51±0.21	0.55±0.24
≥20	0.44±0.15	0.48±0.20	0.34±0.16	0.49±0.23	0.47±0.22
<i>P-value</i>	0.012	0.114	0.003	0.446	0.034
Personal history of asthma					
No	0.45±0.15	0.48±0.20	0.35±0.16	0.49±0.23	0.51±0.23
Yes	0.48±0.12	0.53±0.18	0.37±0.16	0.52±0.19	0.55±0.24
<i>P-value</i>	0.082	0.068	0.239	0.213	0.162
Family history asthma					
No	0.43±0.16	0.46±0.21	0.34±0.17	0.46±0.23	0.50±0.24
Yes	0.48±0.13	0.53±0.17	0.37±0.16	0.53±0.22	0.53±0.23
<i>P-value</i>	0.006	0.001	0.088	0.003	0.095

Overall and subscale (relative) scores of Newcastle asthma knowledge questionnaire by demographic characteristics are shown in Table 2. For the overall score, better asthma knowledge was significantly associated with being married ($p=0.001$), having children ($p=0.001$), working for moderate (10-19 years) duration ($p=0.012$), and having family history of asthma ($p=0.006$). Additionally, there were trends of associations with middle age (40-49 years) and having personal history of asthma ($p=0.067$ and $p=0.082$, respectively). For the sub-scale scores, similar findings were generally observed but with variable degree of difference significance. Differences were clearer with acute attack subscale but were less clear with false myths subscale.

The results of the linear regression analysis for overall (relative) score of Newcastle asthma knowledge questionnaire by demographic characteristics are shown in Table 3. In a model that included teacher characteristics showed significant (or trends of) associations with asthma knowledge, having family history of asthma was associated with 5% better knowledge ($p=0.004$) and having children was associated with 6% better knowledge ($p=0.050$).

Re-running the model after removing marriage status that was closely associated with having children, the knowledge association with having children became stronger and highly significant (8% better knowledge with $p<0.001$).

Table 3: Linear regression analysis for overall (relative) score of Newcastle asthma knowledge by demographic characteristics among primary school teachers in boys' primary schools in Riyadh, Saudi Arabia (2015)

Characteristics	Comparison	Beta	Standard error	t-test	P-value	95% Confidence Interval	
						Lower Bound	Upper Bound
Age groups	≥40 vs. <40	-0.01	0.019	0.64	0.520	-0.05	0.02
Marital status	Married vs. single	0.02	0.032	0.71	0.478	-0.04	0.09
Having children	Yes vs. no	0.06	0.032	1.97	0.050	0.00	0.12
Working years	<10 vs. ≥10	0.01	0.019	0.66	0.509	-0.02	0.05
Personal history of asthma	Yes vs. no	0.02	0.020	0.87	0.387	-0.02	0.06
Family history of asthma	Yes vs. no	0.05	0.016	2.87	0.004	0.01	0.08

DISCUSSION

Adequate asthma knowledge among school teachers is critical for the safety of their students who are suffering asthma exacerbation during the school time.²¹ The current study showed approximately 45% overall knowledge level among primary school teachers in Riyadh, Saudi Arabia. While the finding is reconfirming what was reported in several parts of the world, the degree of poor knowledge observed in the current study is alarming and point to a huge knowledge deficiency.

Comparing the current findings to local and international published reports is not an easy task. This is due to the differences in study methodology, the tool used in assessing the asthma knowledge, type and depth of the knowledge components assessed, and school type sampled. Nevertheless, our primary school teachers had generally poor asthma knowledge similar to that reported in Saudi Arabia and in developing countries but even worse than seen in many developed countries. For example, correct general asthma knowledge and management practices were estimated at 35% and 40.1% (respectively) among school staff in primary, elementary and secondary schools in Saudi Arabia.¹⁰ Additionally, correct answers about asthma symptomatology, triggers, and/or management ranged between 24% and 82% among Bahraini teachers¹⁷, 38% and 94% among Turkish teachers¹⁸, and 7.5% and 78.5% among Malaysian teachers.²⁰ On the other hand, overall asthma knowledge (using different tools) was estimated at 85% among Australian teachers³⁰, 69% to 75% among US teachers^{14,15} and 58% among teachers in Spain.¹⁶

Out of the four knowledge components of the Newcastle asthma knowledge questionnaire used in the current study, knowledge related to recognition, triggers, and management of acute attack of asthma was the worst (35% compared with almost 50% in all other components including general asthma information,

maintenance treatment, and false myths). Similarly, primary school teachers in South Africa were found to have poor overall knowledge about asthma with the poorest knowledge seen with symptoms and medication treatment of severe acute asthma attack.¹⁹ Additionally, primary school teachers in Turkey were found to have satisfactory general knowledge about asthma, but they lacked knowledge on triggers and management of acute asthma attacks.¹⁸ Poor knowledge of triggers and management acute attack in the current study probably indicate that the self-efficacy of our teachers in helping their students is expected to be low, which may endanger the safety of these students.

Relatively better asthma knowledge in the current study was associated with having children and having family history of asthma. This can be explained by the additional healthcare knowledge gained during the management received by a family member or a student with asthma attacks. Supporting the current findings, a number of studies showed that teachers who had contact with an asthmatic individual, had exposure/experience with asthma in the classroom, or who had received previous training on asthma have better asthma knowledge.^{14,15,28} However, some studies even failed to find better knowledge among teachers who have contact with asthmatic individuals.¹⁹ Additionally, most of the studies could not find any significant association between asthma knowledge in primary school teachers and all or the majority of demographic and occupational characteristics, including age, gender, years of teaching experience, and educational qualification.^{18,19,30}

The current study finding may indicate the critical need to better educate primary school teachers about asthma and other chronic disease that may manifest in the classroom. Improving the teacher knowledge about how to deal with the asthmatic children, especially during emergency situations may increase the teacher's

confidence and ability to help their students.³¹ Several studies showed that short educational program was followed by immediate improvement of their asthma knowledge that was shown to last for considerable duration of time.^{10,22,32,33} For example, simple educational intervention among school teachers in Saudi Arabia using pamphlets and demonstration of inhaler use was significantly successful in enhancing staff's asthma-related knowledge and management practices from 35% and 40.1% (respectively) before intervention to 83.9% and 68.6% (respectively) after intervention.¹⁰ Additionally, it was found that teacher-led asthma education program have direct and indirect beneficial outcomes on asthma management in school, that was sustained for 5 years.²² The current study had several strengths and few limitations. The current study is considered the first local study to examine in details asthma knowledge among primary school teachers using a validated assessment tool and adequate sample size of teachers recruited from different geographic areas in Riyadh. An overall percentage knowledge score as well as specific-component percentage knowledge scores were presented. Additionally, the study examined the association of the knowledge with potential demographic and occupational characteristics. Moreover, asthma myths examined in this study have never been examined in Saudi Arabia. Nevertheless, we acknowledge few limitations. For example, the cross sectional design did not allow for detection of causation, but rather associations. Although we stratified the sample by geographic regions to improve the generalizability of the current findings, the convenience sampling used may have limited our efforts. Additionally, as the questionnaire was self-administered, recall bias cannot be excluded. However, limited generalizability and recall bias are almost unavoidable limitations in almost all similar studies.

In conclusion, Primary school teachers in Riyadh had poor asthma knowledge, particularly those related to the recognition, triggers, and management of acute attack of asthma. The current findings may indicate the critical need for asthma education programs in our primary schools. Future studies should focus on testing the effect of asthma educational activities on the short-term and long-term knowledge of the teachers and asthma outcomes among students.

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