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SEVERITY OF BRONCHIAL ASTHMA AMONG SCHOOL CHILDREN IN JAZAN REGION, SAUDI ARABIA

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ABSTRACT

Asthma is a worldwide health problem; its prevalence varies among different countries and cities and age groups. In children asthma is one of the most common chronic diseases and leading causes of morbidity. This study is aimed at identifying important risk factors associated with the severity of bronchial asthma among school children in Jazan region. This cross-sectional study was made using the International Study of Asthma and Allergies in Children (ISAAC) questionnaire. The study surveyed 1505 school children from different geographical areas in Jazan region using multistage cluster sampling technique. The descriptive statistics of the demographics and asthma severity variables were calculated using frequencies, percentages, and tables. The total study population was 1400, most of them were Saudi Arabians (1273-90.9%). The frequency of disturbed sleep at night due to wheezing or breathing problems was 111 (7.9%) in the included students. Nocturnal cough was reported in 332 (23.7%) of participants and 280 (20.0%) of them had wheeze resulting in limitation of speech. Frequency of urgent visits to doctor/emergency department (ED) due to wheezing or breathing problems was reported in 159 (11.4%) with clear statistically significant difference in frequency between male and female (p=0.023). Rate of hospital admission due to wheezing or breathing problems was 89 (6.3%).

KEYWORDS: ***Asthma, Children, Severity, Symptoms, Wheezing, Cough***

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INTRODUCTION

Bronchial asthma (BA) is the most common chronic disease in children[1], which is characterized by airway limitation due to bronchospasm and airway inflammation associated with excessive mucus secretion from agitated mucus gland that occur due to airway hyperresponsiveness[2]. According to Global Initiative for Asthma (GINA), the estimated number of individuals suffering from asthma in the world is 300 million in 2004 and the projections may reach400 million in 2025 with increased urbanization of the world[2]. The international prevalence rate of diagnosed BA was 4.3% with the highest rate of 21% reported in Australia[3]. Bronchial asthma is usually under-reported due to non-specific symptoms. Even in high income countries where patients have higher access to the treatment, BA is often under-diagnosed and under-treated with a considerable risk of death[4]. Asthma in childhood is a significant cause of morbidity, resulting in numerous days of altered activity and school absence[5]. In an attempt to improve the care of patients with asthma, national and international guidelines for asthma management have been developed and revised over the past decade. A central principle in these guidelines is the importance of classifying asthma in a consistent and objective manner and basing therapy on the level of asthma severity[6]. Although the risk of death in asthmatic children is very low (5.2 per 100 000), continued surveillance of asthma mortality rates is essential to monitor progress in asthma care[1]. Despite the availability of asthma medical services and national and international guidelines, recent studies have revealed that the burden of asthma might be significantly increased in children compared to previously estimated figures, particularly in middle- and low-income countries[1]. In Saudi Arabia (SA), an estimation of 11.5% of children suffered from BA in 1992[7]. As the urbanization increases with dependence on oil as the main source of oil production, the prevalence of bronchial asthma is expected to increase in Saudi children. In a study that compared temporal trend in BA prevalence, more urbanized cities such as Riyadh and Jeddah versus Hail and Gizan revealed a significant increase in BA from 8% to 23% ten years later[8]. In Taif, Qassim and Jeddah cities, the prevalence of asthma in children was 13.1%, whereas smoking and familial history were found to be positively associated with the asthma occurrence in Riyadh and Dammam regions[9-10]. The highest prevalence of asthma in urban school children was 17% that reported in Abha region[11]. Recently, a study that compared data from several middle east countries has reported a highest prevalence of outdoor allergens in Saudi Arabia with two sampling sites located in Jazan region[12]. Jazan region consists of plains, coastal and mountain areas with highly populated area in the plains, characterized by hot and humid climate. A previous study conducted by the authors found a prevalence of life-long wheezing and diagnosed asthma to be 17.7% and 10% respectively [13]. This study is aimed at identifying important risk factors associated with the severity of bronchial asthma among school children residing in Jazan region.

MATERIALS & METHODS

This was a cross-sectional population-based study conducted in Jazan region in the period from May to September 2017. The study recruited school children from different geographical area in Jazan region according to the size of population in each area, thus 63% of the participants were selected from plain areas, 20% from coastal areas, and 17% from mountain areas. The sampling method was multistage cluster sampling technique by which schools were selected randomly from each geographical area using random digital numbers created by computer. At first, a sample size was calculated at precession error of 0.05, confidence level of 95% and expected percentage of 50% to be 384 study participants. As the cluster sampling was used, the sample size was corrected to compensate for the design effect. Then the initial sample size was multiplied by a design effect of 3, which resulted in a minimum sample of 1152. Since the questionnaire used in this study would be filled by the parents, the response rate was expected to be inadequate. To compensate for the non-response rate, an addition of 30% in the number of distributed questionnaires was done and resulted in a sample size of 1498, which finally rounded to 1505 study participants. A cluster of 43 students were selected randomly from a total of 35 schools distributed according to the size of population indifferent geographical areas in Jazan. In case of non-respondent parents, the reminder was sent to them by SMS. If no response was received from parents, other students were selected randomly to compensate for non-respondents. The sample was stratified by gender based on male: female ratio approximately equal to 1.5:1, which was the gender ratio of Jazan school children reported by Directory of education. The students between 10 and 15 years were surveyed because this age is commonly affected by severe asthmatic attacks [14]. Data were

collected using a standardized questionnaire developed by International Study of Asthma and Allergies in Childhood (ISAAC), a written Arabic version, which have been proved to have a high sensitivity and accuracy in detection of asthma prevalence and severity [15]. The ISAAC has 2 forms; one for children <7 and the second for those with 7-12 years. The questionnaire consisted of two parts: Part 1 contained questions about demographics including age, sex, nationality, residency, geographical distribution, and level of education; Part 2 contained questions about asthma severity including frequencies of symptoms attributed to asthma such as disturbed sleep due to wheeze, nocturnal dry cough without flu, wheeze resulting in limited speech, attacks of wheezing, urgent visits to doctor/Emergency Department due to wheezing or breathing problems, and admission due to wheezing or breathing problems. The questionnaire was covered by a letter from researchers explaining the aims of the study and the confidentiality of the provided information associated with the request to sign consent forms by the parents. Ethical approval was obtained by the technical and ethical committee in Faculty of Medicine, Jazan University (No.ETC.112/2017). Field work was supervised by Directors of education from the selected schools.

STATISTICAL ANALYSIS

The collected data were entered into computers using Excel sheets, then exported into Statically package of Social Sciences (SPSS), version 20. The descriptive statistics of the demographics and asthma severity variables were calculated using frequencies, percentages, and tables. The associations between demographics and severity variables were detected using chi-square test. The level of significance was set at 0.05 and any p value less was considered statically significant.

RESULT

Out of total 1505 questionnaires distributed, a total of 1400 questionnaires were collected from students from both primary and intermediate levels of schools. Of them 840 (60.0%) were males and 560 (40.0%) were females with mean±SD of students' age equal to 12.8 ± 1.5 years old. The majority of the students (57.9%) lived in rural areas, while 42.1% of them lived in urban areas. Students with Saudi nationality constituted about 91% of the students (Table 1).

Table 1
The background characteristics of the study population

Demographic characteristics		Frequency (%)		Total (%)
		Boys	Girls	
		840 (60.0)	**560 (40.0)**	**1400 (100)**
Age	10 years old	33 (2.3)	26 (1.9)	59 (4.2)
	11 years old	134 (9.6)	84 (6.0)	218 (15.6)
	12 years old	251 (17.9)	125 (8.9)	376 (26.9)
	13 years old	177 (12.6)	117 (8.4)	294 (21.0)
	14 years old	95 (6.8)	96 (6.8)	191 (13.6)
	15 years old	150 (10.7)	112 (8.0)	262 (18.7)
Nationality	Saudi	751 (53.6)	522 (37.3)	1273 (90.9)
	Non-Saudi	89 (6.4)	38 (2.7)	127 (9.1)
Residency	Urban	315 (22.5)	274 (19.6)	589 (42.1)
	Rural	525 (37.5)	286 (20.4)	811 (57.9)
Geographical Distribution	Coastal	229 (16.4)	101 (7.2)	330 (23.6)
	Plain	465 (33.2)	375 (26.8)	840 (60.0)
	Mountain	146 (10.4)	84 (6.0)	230 (16.4)
Level of education	Elementary	477 (34.1)	280 (20.0)	757 (54.1)
	Intermediate	363 (25.9)	280 (20.0)	643 (45.9)

Significant difference (p<0.05)

Table 2 demonstrates BA-related symptoms in the last year, which indicated the level of BA severity. The frequency of disturbed sleep at night due to wheezing or breathing problems was 111 (7.9%) in the included students. Nocturnal cough reported in 332 (23.7%) of participants and 280 (20.0%) of them had wheeze resulting in limitation of speech. Frequency of urgent visits to doctor/emergency

department (ED) due to wheezing or breathing problems was reported in 159 (11.4%) with clear statistically significant difference in frequency between male and female (p=0.023). Rate of hospital admission due to wheezing or breathing problems was 89(6.3%) with statistically significant difference in frequency between male and female (p = 0.000).

Table 2
Frequency of BA-related symptoms that indicate severity in the last 12 months (n=1400)

In the last 12 months	Frequency (%)			$\chi 2$	p Value
	Male	Female	Total		
Frequency of students with disturbed sleep due to wheeze among all students	54 (3.9)	57 (4.0)	111 (7.9)	4.897	0.179
Frequency of students with nocturnal dry cough without flu among all students	188 (13.4)	144 (10.3)	332 (23.7)	2.261	0.133
Frequency of students with wheeze result in limited speech among all students	168 (12.0)	112 (8.0)	280 (20.0)	0.000	0.526
Frequency of students with attacks of wheezing among all students	81 (5.8)	71 (5.1)	152 (10.9)	3.973	0.264
Frequency of students with urgent visits to doctor/Emergency Department due to wheezing or breathing problems among all students	77 (5.5)	82 (5.9)	159 (11.4)	13.063	0.023*
Frequency of students with admission due to wheezing or breathing problems among all students	32 (2.3)	57 (4.0)	89 (6.3)	27.402	0.000*

Significant difference (p<0.05), χ2: chi-square test

Number of attacks of wheeze during the last 12 months varied significantly according to geographical area (p< 0.001). The highest percentage of students who had > 12 attacks of wheezing in the last year (5.2%) were residents of mountain areas in comparison to those who lived in plain area (only 0.9%) and coastal areas where no students reported >12 attacks per year (Table 3). A significant difference in the frequency of disturbed sleep due to wheezing or breathing problems in the last 12 months was detected between students residing either in urban and rural areas. A higher percentage of students from urban area had > 1 time/ week disturbed sleep due to wheezing or breathing problems in the last year (p=0.001) as demonstrated in Table 4. Gender, nationality and geographical areas showed significant associations with number of urgent visits to doctor/ED due to wheezing or breathing problems in the last year. These urgent visits were more frequent among females than males, among residents of plain areas than coastal and mountain areas, and among Saudis than non-Saudi students (Table 5). Gender, nationality, residence and geographical areas showed significant associations with number of hospital admission due to wheezing or breathing problems in the last year. These admissions were more frequent among females than males, among residents of plain areas than coastal and mountain areas, among urban residents than rural ones and among Saudis than non-Saudi students (Table 6). Similarly, gender, nationality, residence and geographical areas were significantly associated with Frequency of missed school days due to wheezing or breathing problems in the last year. A higher percentage of females missed school days due to wheezing or breathing problems than males and more residents of plain areas missed school days than coastal and mountain areas. More frequent urban residents missed school days due to wheezing or breathing problems than rural residents and more Saudis than non-Saudi students (Table 7).

Table 3
Number of attacks of wheezing in the last 12 months

		Frequency (%) in the last 12 months					χ2	*p* Value
		0	1-3	4 -12	> 12	Total		
		1248 (89.1)	101 (7.2)	32 (2.3)	19 (1.4)	1400 (100)		
Gender	Male	759 (90.4)	55 (6.5)	15 (1.8)	11 (1.3)	840 (100)	3.973	0.264
	Female	489 (87.3)	46 (8.2)	17 (3.0)	8 (1.4)	560 (100)		
Geographical area	Coastal	304 (92.1)	15 (4.5)	11 (3.4)	0 (0.0)	330 (100)	44.379	0.000*
	Plain	748 (89.0)	64 (7.6)	21 (2.5)	7 (0.9)	840 (100)		
	Mountain	196 (85.2)	22 (9.6)	0 (0.0)	12 (5.2)	230 (100)		
Residence	Urban	528 (89.6)	43 (7.4)	15 (2.5)	3 (0.5)	589 (100)	5.727	0.126
	Rural	720 (88.8)	58 (7.2)	17 (2.1)	16 (1.9)	811 (100)		
Nationality	Saudi	1133 (89.0)	90 (7.0)	31 (2.4)	19 (1.6)	1273 (100)	3.704	0.295
	Non-Saudi	115 (90.6)	11 (8.7)	1 (0.8)	0 (0.0)	127 (100)		

Significant difference (p<0.05), χ2: chi-square test

Table 4
Frequency of disturbed sleep due to wheezing or breathing problems in the last 12 months

		Frequency (%) in the last 12 months				χ2	*p* Value
		0	<1/Week	>1 /Week	Total		
Gender	Male	786 (93.6)	34 (4.0)	20 (2.4)	840 (100)	4.897	0.179
	Female	503 (89.8)	33 (5.9)	24 (4.3)	560 (100)		
Geographical area	Costal	304 (92.2)	16 (4.8)	10 (3.0)	330 (100)	12.456	0.053
	Plain	771 (91.8)	43 (5.1)	26 (3.1)	840 (100)		
	Mountain	214 (93.0)	8 (3.5)	8 (3.5)	230 (100)		
Residence	Urban	532 (90.3)	32 (5.4)	25 (4.2)	589 (100)	15.747	0.001*
	Rural	757 (93.3)	35 (4.3)	19 (2.4)	811 (100)		
Nationality	Saudi	1172 (92.1)	57 (4.5)	44 (3.4)	1273 (100)	7.737	0.052
	Non-Saudi	117 (92.1)	10 (7.9)	0 (0.0)	127 (100)		

Significant difference (p<0.05), χ2: chi-square test

Table 5
Number of urgent visits to doctor/ED due to wheezing or breathing problems in the last 12 months

		Frequency (%) in the last 12 months					χ2	*p* Value
		0	1-3	4 -12	> 12	Total		
		1241 (88.6)	131 (9.4)	17 (1.2)	11 (0.8)	1400 (100)		
Gender	Male	763 (90.8)	65 (7.7)	7 (0.8)	5 (0.6)	840 (100)	13.063	0.023*
	Female	478 (85.4)	66 (11.8)	10 (1.8)	6 (1.0)	560 (100)		
Geographical area	Costal	296 (89.7)	28 (8.5)	6 (1.8)	0 (0.0)	330 (100)	36.110	0.000*
	Plain	729 (86.8)	95 (11.3)	11 (1.3)	5 (0.6)	840 (100)		
	Mountain	216 (93.9)	8 (3.5)	0 (0.0)	6 (2.6)	230 (100)		
Residence	Urban	521 (88.5)	59 (10.0)	7 (1.2)	2 (0.3)	589 (100)	6.144	0.292
	Rural	720 (88.8)	72 (8.9)	10 (1.2)	9 (1.1)	811 (100)		
Nationality	Saudi	1114 (87.5)	131 (10.3)	17 (1.3)	11 (0.9)	1273 (100)	18.329	0.003*
	Non-Saudi	127 (100)	0 (0.0)	0 (0.0)	0 (0.0)	127 (100)		

Significant difference (p<0.05), χ2: chi-square test

Table 6
Number of hospital admission due to wheezing or breathing problems in the last 12 months

		Frequency (%) in the last 12 months					χ2	*p* Value
		0	1-3	4 -12	> 12	Total		
Gender	Male	808 (96.2)	24 (2.9)	8 (0.9)	0 (0.0)	840 (100)	27.402	0.000*
	Female	503 (89.9)	51 (9.1)	5 (0.9)	1 (0.1)	560 (100)		
Geographical area	Costal	310 (93.9)	20(6.1)	0 (0.0)	0 (0.0)	330 (100)	26.342	0.000*
	Plain	777 (92.5)	55 (6.5)	7 (0.9)	1 (0.1)	840 (100)		
	Mountain	224 (97.4)	0 (0.0)	6 (2.6)	0 (0.0)	230 (100)		
Residence	Urban	530 (90.0)	57 (9.7)	2 (0.3)	0 (0.0)	589 (100)	41.417	0.000*
	Rural	781 (96.3)	18 (2.2)	11 (1.4)	1 (0.1)	811 (100)		
Nationality	Saudi	1184 (93.0)	75 (5.9)	13 (1.0)	1 (0.1)	1273 (100)	9.675	0.022*
	Non-Saudi	127 (100)	0 (0.0)	0 (0.0)	0 (0.0)	127 (100)		

Significant difference (p<0.05), χ2: chi-square test

Table 7
Frequency of missed school days due to wheezing or breathing problems in the last 12 months

		Frequency (%) in the last 12 months					χ2	*p* Value
		0	1-3 days	4 -12 days	> 12 days	Total		
Gender	Male	770 (91.7)	55 (6.5)	8 (1.0)	7 (0.8)	840 (100)	14.493	0.006*
	Female	479 (85.5)	63 (11.3)	8 (1.5)	10 (1.7)	560 (100)		
Geographical area	Costal	306 (92.7)	20 (6.1)	0 (0.0)	4 (1.2)	330 (100)	48.282	0.000*
	Plain	728 (86.7)	96 (11.4)	10 (1.1)	6 (0.7)	840 (100)		
	Mountain	215 (93.5)	2 (0.9)	6 (2.6)	7 (3.0)	230 (100)		
Residence	Urban	506 (85.9)	67 (11.4)	6 (1.0)	10 (1.7)	589 (100)	15.827	0.003*
	Rural	743 (91.6)	51 (6.3)	10 (1.2)	7 (0.8)	811 (100)		
Nationality	Saudi	1131 (88.8)	109 (8.7)	16 (1.2)	17 (1.3)	1273 (100)	3.994	0.407
	Non-Saudi	118 (92.9)	9 (7.1)	0 (0.0)	0 (0.0)	127 (100)		

Significant difference (p<0.05), χ2: chi-square test

DISCUSSION

This study was conducted to assess the severity of BA among children using ISAAC phase I questionnaire, Arabic version. A total of 1400 questionnaires were collected from parents of selected students who were older than 10 years old, since asthmatic attacks that occur in this age are more likely to persist till adulthood[14]. In addition, a school sample from adolescents aged more than 15 years old is well known for its' questionable validity. Several studies were conducted in Saudi Arabia in the last decades a wide range of 8% to 25% prevalence of asthma in school children[8,11,16-17] was found. The prevalence of life-long wheezing in Jazan region was found as high as 17% among school children in the previously published data[12]. This study was aimed at assessing the level of asthma severity and the effect of sex, nationality, residency, geographical distribution, and level of education on the morbidity and disability attributed to asthma. The current study showed that about 8% of students had disturbed sleep at night due to wheezing or breathing problems. A higher prevalence of 10.7% was found among secondary school students in Riyadh city[17]. The frequency of attacks of wheezing during the last 12 months was 10.9% which was similar to the previous study conducted by Hasnain *et al*. (9.0%)[12]. Only 10.9% of the students had different attacks of wheeze during the last 12 months, in which 1.45 of them had more than 12 attacks. This study found that 20.0% of them had wheeze resulting in limitation of speech, while the speech limitation due to wheezing was as high as 34.6% in the secondary school students in Riyadh city[17]. About 23% of the students enrolled in the current study had nocturnal cough, while in Abha region, which is adjacent to Jazan region, the prevalence of nocturnal dry cough was only 9% [11]. This could be attributed to the different climate and topographical characteristics between mountainous Abha region and Jazan that mostly contains plain and coastal areas. In addition, Abha study conducted in 2000 may explain this

difference, since asthma prevalence in Saudi Arabia was found to increase significantly with time[8]. Conversely, a slightly higher prevalence found in Riyadh city compared to our findings, were 26% of the secondary school students in Riyadh city reported the presence of nocturnal cough[17]. As the asthmatic severity decreases with age, the prevalence of asthmatic symptoms should be lower in older aged students in Riyadh city compared to relatively younger students in Jazan region. However, all students in Riyadh study live in urban areas which is already characterized by a higher prevalence of asthmatic symptoms. The current study found a significant higher percentage of students living in mountain areas had > 12 attacks of wheezing in the last year compared to those who lived in plain and coastal areas. Similarly, a study conducted in Kurdistan found a higher prevalence of wheezing attacks in mountainous regions[18]. Occasionally, it could be linked to the natural flora of trees that grow in these areas[12]. Moreover, the present study showed a significant higher prevalence of disturbed sleep due to wheezing or breathing problems in students who lived in urban areas than those who lived in rural areas. Similar findings reported in Saudi Arabia, Ethiopia, Great Britain, and United States [16, 19-21].

LIMITATIONS OF THE STUDY

Although the present study is the first to consider use of ISAAC protocol to identify the severity of BA symptoms among children in JR, SA, it has some significant limitations. Our participants were school age students and the questionnaire wasfilled by their parents, whom may give an over/under estimated answers. Third, this study depends on recall of the symptoms, which can be missed or misinterpreted by the parents of children. Finally, the case identification would be more accurate if the BA-related symptoms were confirmed by further investigation like laboratory tests, chest X ray and spirometry. Despite the fact that the prevalence of confirmed BA was reported in this study, it was only a population-based epidemiological survey that was conducted to assess the severity of BA-related symptoms reported by the parents of children.

CONCLUSION

About a quarter of school children in Jazan region had BA-related symptoms and the majority of them had nocturnal cough and wheezing resulted in limitation of speech. About a half of the complaining children visited doctor/emergency department (ED) due to wheezing or breathing problems and approximately half of them were admitted in the hospital. The demographical factors such as gender, geographical area, residence, and nationality were found significantly associated with different BA related symptoms. We recommended conduction of further longitudinal research about asthma in Southern Saudi region to explore the risk factors and allergens present in Southern region of Saudi Arabia.

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AUTHORS CONTRIBUTION STATEMENT

Abdulhameed Basudan and Abuobaida Yassin planned and wrote the proposal, presented the theoretical framework, and wrote the methods and discussion section of the paper. They supervised the project in all stages. Abdulrahman Moafa, Mohammed Faqihi and Mohammed Alhazmi collected and analyzed the data and presented the results in the form of tables. Taher Mahnashi, Alhussen Khawaji, and Yaseen Haddadi participated in data collection and wrote the introduction section of the paper.

CONFLICT OF INTEREST

Conflict of interest declared none.

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