

# Evaluation of Allergic Symptoms Prevalence and Its Relationship with Acetaminophen/Antibiotic Use and Hospitalization Among School-Aged Children in Tehran, Iran

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Received 2017 January 23; Revised 2017 March 13; Accepted 2017 April 12.

## Abstract

**Background:** Increasing of childhood allergic diseases throughout the world and its heavy socioeconomic burden have posed an important health concern. Therefore, providing the updated relevant epidemiological information is robustly recommended.

**Objectives:** The study aimed to determine the prevalence of asthma, allergic rhinitis (AR), and eczema symptoms in primary school children aged 6 - 7 years and ascertain the association of acetaminophen use, antibiotic consumption, and hospitalization for respiratory infection in early life with allergic symptoms.

**Methods:** In this cross-sectional study conducted on primary school children aged 6 - 7 years from May to July 2012 in Tehran (Iran), a total of 4993 individuals took part. Cluster sampling was used for random selection of primary schools. Data were gathered by using a modified questionnaire of international study of asthma and allergies in childhood (ISAAC). Then, the questionnaires were completed by parents of the children.

**Results:** The prevalence rates of current wheeze, wheeze ever, current itching rash, itchy rash ever, and rhinitis ever were found to be 19.64%, 27.49%, 8.95%, 8.28%, and 21.87%, respectively. Physician-diagnosed asthma, eczema, and AR were reported in 4.32%, 7.29%, and 9.61% of children, respectively. Univariate logistic regression analysis showed that antibiotic use was significantly associated with symptoms of allergic rhinitis ( $P = 0.001$ ). Also, the strongest association was found between asthma and atopic dermatitis symptoms and hospitalization due to respiratory infection in early life by multivariate analysis ( $P = 0.002$  and  $P = 0.009$ , respectively).

**Conclusions:** This study determined the rising pattern of allergic symptoms in 6 - 7 year old children in Tehran. Moreover, acetaminophen/antibiotic use and hospitalization due to respiratory infection in early life were detected as significant risk factors for the appearance of childhood allergic symptoms.

**Keywords:** Asthma, Allergic Rhinitis, Atopic Dermatitis, Prevalence, Risk Factors

## 1. Background

Allergic diseases such as allergic asthma, allergic rhinitis (AR), and atopic dermatitis are the most prevalent chronic disorders worldwide (1). On the basis of the reports issued by the World Health Organization, allergic diseases are the sixth leading cause of morbidity (2). Furthermore, many investigations have indicated the increasing prevalence of these diseases in recent decades, particularly in developing countries (3).

Allergic asthma, a chronic complex inflammatory syndrome, involves airway hyper-responsiveness. This condi-

tion leads to repeated episodes of wheezing, coughing, and breathlessness, affecting approximately 300 million persons worldwide (4).

Another manifestation of allergic disorders is AR, a chronic inflammatory condition of the upper respiratory tract, nasal mucosa, and eyes. Daily personal and social activities of affected people are frequently impressed by this disease; therefore, their quality of life undergoes undesirable changes. Research indicates that AR affects up to 40% of the world's population (5).

Atopic dermatitis, as the most common chronic dermatitis in children, is a relapsing inflammatory disease of

the skin. It affects approximately 15% - 20% of children throughout the world (6).

In recent years, numerous evidence has been found indicating a potential association between early exposure to antipyretic drugs (7) or antibiotics (8) and the development of common allergic diseases. Moreover, several epidemiological and experimental evaluations have determined the effects of respiratory infections in early childhood on asthma occurrence (9-11). These studies, however, are inconsistent and show conflicting results, possibly owing to differences in study designs, study population, or geographic regions.

Considering the growing trend of urbanization over recent years and the importance of the accessibility to updated statistics in healthcare planning for subsequent diagnostic/therapeutic measures, the aim of this survey was to evaluate the prevalence of the major symptoms of three important allergic diseases in elementary school children in Tehran in order to update current information. Additionally, the present research attempted to find an association between allergic symptoms and acetaminophen or antibiotic use as well as hospitalization due to respiratory infections during the first year of life.

## 2. Methods

This study was conducted in Tehran, the capital of the Islamic Republic of Iran, located at the foot of the Tochal mountain range in Western Asia. This populated city faced a large number of immigration from all over the country during the 20th century and has an approximate population of 8 million citizens. From these, about 7% of the population is categorized in children in early primary school age (12).

This cross-sectional study was conducted on primary school children aged 6 to 7 years from May to July 2012 in Tehran. The protocol of this research was approved by the Medical ethics committee of academic center for education, culture and research (ACECR) and the 41th ethics committee of immunology, asthma and allergy research institute (Tehran University of Medical Sciences). Considering the fact that the prevalence of allergic symptoms was reported to be about 10% according to previous studies, the sample size was estimated as mentioned below.

$$n = Z(1-\alpha/2) 2 pq/d^2$$

$$n = 4 \times 0.1 \times 0.9 / (0.03)^2 = 400$$

Considering the design effect, 10% should be added to the calculated sample size mentioned above:  $n = 400 + 40 = 440$

Having in mind the two gender groups (male and female) and the 5 available educational regions, the total ex-

pected sample size is about 4400 children:  $n = 440 \times 10 = 4400$

5 educational districts in Tehran were randomly selected. Then, a list of all primary school children (boys and girls) and the number of students in each school among the selected districts were used for random sampling. Finally, the current survey was conducted in 41 randomly selected primary schools.

### 2.1. Questionnaire and Data Collection

The first-phase questionnaire of the international study of asthma and allergies in childhood (ISAAC) was modified to be used for identification of the allergic symptoms prevalence as well as physician-diagnosed allergic diseases.

Questions relevant to acetaminophen and antibiotic consumption or hospitalization for respiratory infection were as follows: "Did your child use acetaminophen in the first year of his/her life?", "Did your child use antibiotics in the first year of his/her life?", and "Was your child hospitalized due to respiratory infection in the first year of his/her life?"

When the agreement of school authorities was obtained, the questionnaires were completed by the parents of 6 - 7-year-old students in an interview administered by well-trained health providers. Those children with chronic heart and respiratory diseases such as cystic fibrosis and congenital heart disease and primary immunodeficiency disorders were excluded from the study.

### 2.2. Statistical Analysis

In order to adjust the effect of frequency distribution of clusters, the analysis was made by Cluster analysis methods in Stata software (version 10). An  $\alpha$  error less than 0.05 was considered as significance level. Univariate logistic regression analysis was used to identify significant risk factors of allergic diseases such as asthma, allergic rhinitis, and atopic dermatitis. The relation of presented eight symptoms with acetaminophen consumption, antibiotic use, and hospitalization due to respiratory infection was studied by univariate and multivariate logistic regression analysis.

## 3. Results

Of the 5030 questionnaires distributed among students, 37 were incomplete, giving a response rate of 99.26%. The missing data of the other included participants were not high enough to exclude an individual from the study. There were 2899 (58.06%) girls and 2094 (41.93%) boys. The reported prevalence of asthma, AR, and eczema symptoms

is summarized in Table 1. Ever wheezing was positive in 27.49% of cases (25.09% of girls and 30.82% of boys ( $P = 0.002$ )). Analysis of data showed that 971 (19.64%) of 6 - 7 year old children (22.59% of boys and 17.51% of girls ( $P = 0.016$ )) experienced wheezing in the last 12 months. According to parents' reports, 1061 (21.41%) of the studied school children had suffered from dry night cough in the previous 12 months, with a significant difference ( $P < 0.001$ ) between boys and girls (24.78% versus 18.98%). The prevalence of exercise wheeze in the last 12 months was significantly higher ( $P = 0.005$ ) in boys than girls (14.38% versus 8.14%). Although positive responses to the question about waking up due to cough or wheeze were higher in boys (25.88%) than girls (24.71%), this difference was not statistically significant ( $P = 0.635$ ). The prevalence of AR symptoms was significantly higher ( $P = 0.018$ ) in boys (25.41%) than girls (19.32%). No significant difference was observed between the genders in the prevalence of eczema symptoms (Table 1).

Table 2 shows the frequency of positive and negative responses to questions about study risk factors among children having allergic symptoms or diseases. Table 3 shows the results of univariate logistic regression analysis for the association of three dependent physician-diagnosed allergic diseases (asthma, allergic rhinitis, and atopic dermatitis) with the evaluated risk factors including acetaminophen/antibiotic use and hospitalization due to respiratory infection, separately. As indicated, hospitalization for respiratory infection in the first year of life was a significant ( $P < 0.05$ ) risk factor for both physician-diagnosed asthma (OR = 4.23, 95% CI 2.36 - 7.57) and atopic dermatitis (OR = 2.16, 95% CI 1.38 - 3.40). Antibiotic consumption in the first year of life was also significantly associated ( $P = 0.001$ ) with the diagnosis of AR (OR = 1.60, 95% CI 1.37 - 1.88).

In order to test the hypothesis of correlation of three risk factors (acetaminophen use, antibiotic use, and hospitalization due to respiratory infection) with eight allergic symptoms, univariate and multivariate logistic regression analyses were employed. Tables 4 and 5 demonstrate the relation of those three risk factors with each symptom separately as dependent variables. Although acetaminophen use and antibiotic consumption during the child's first year of life were significantly associated ( $P < 0.05$ ) with the studied symptoms of allergic diseases by univariate analysis (Table 4), their significance lost out in some cases of asthma or atopic dermatitis symptoms when evaluated by multivariate analysis (Table 5). In this regard, the association between antibiotic use and current wheeze ( $P = 0.063$ , OR = 1.48, 95% CI 0.96 - 2.27), exercise-induced wheeze in the past year ( $P = 0.098$ , OR = 1.42, 95% CI 1.15 - 1.75), and itchy rash ever ( $P = 0.071$ , OR = 1.48, 95% CI 0.94 - 2.31) was not

significant after multivariate analysis. Similarly, no significant association was found between acetaminophen consumption and itchy rash ever ( $P = 0.169$ , OR = 1.36, 95% CI 0.81 - 2.30), and current itchy rash ( $P = 0.076$ , OR = 1.41, 95% CI 0.94 - 2.11) after multivariate analysis. However, hospitalization for respiratory infection in the first year of life had a significant ( $P < 0.05$ ) association with all studied symptoms of allergic diseases in both univariate and multivariate analyses (Tables 4 and 5).

#### 4. Discussion

The present study showed that the prevalence of wheeze ever, as a cardinal symptom of asthma, was 27.49% among 6 - 7-year-old school children in Tehran. This value is higher than the reported value (15%) found in a survey conducted in Tehran in 2004 (13). On the contrary, the results of a previous study revealed that the percentage of girls presenting this symptom was significantly higher than that of boys (13). The frequency of current wheezing as a major index of asthma (3) with less recall bias was also higher (8.6% in a previous study (13) versus 19.64% in the current study). The mean prevalence of this symptom is reported as 9.4% in the Eastern Mediterranean region (14). Although previous research (13) (with a sample size of 3015 students) indicated similarity between the two sexes in responding to the question on current wheezing, the present study (on 4993 pupils) demonstrated a significant dominance in boys which is in compliance with the current literature (15). For the two other common symptoms studied, i.e. night cough and exercise-induced wheeze, the findings of this study showed also higher rates compared to an earlier report (13) (21.41% versus 7.5% and 10.75% versus 2.4%, respectively).

Considering the expansion of urbanization and westernization in developing countries (16), a higher prevalence of allergic conditions are expected. Several studies have indicated that outdoor air pollution in terms of, for example, particulate matters or gaseous pollutants contributes to the exacerbation of pre-existing asthma or the development of new-onset cases (17, 18). The reported prevalence of the two main asthma symptoms from other Iranian cities ranges from 3.7% in Tabriz to 23.2% in Rasht for "ever wheezing" and 2.9% in Tabriz to 19.7% in Rasht for "current wheezing" (15, 19). Type of weather, air pollution level, and genetic factors may be the causes of the observed differences.

In the current study, the frequency of AR symptoms was 21.87% with a significant prevailing in boys ( $P = 0.018$ ). Large variations were previously observed in the prevalence of rhinoconjunctivitis symptoms between regions, countries, and centers (20). For children aged 6 - 7 years,

**Table 1.** Frequency of Positive Responses to Questions About Symptoms of Allergic Diseases in 6 - 7 Year-Old School Children<sup>a</sup>

Main Topic of Questions	Boys (N = 2094)	Girls (N = 2899)	Total (N = 4993)	P Value <sup>b</sup>
Wheeze ever	30.82	25.09	27.49	0.002
Current wheeze	22.59	17.51	19.64	0.016
Nocturnal cough in the past year	24.78	18.98	21.41	< 0.0001
Exercise-induced wheeze in the past year	14.38	8.14	10.75	0.005
Waking up due to cough or wheeze in the past year	25.88	24.71	25.20	0.635
Physician diagnosed asthma	5.60	3.40	4.32	0.002
Allergic rhinitis ever	25.41	19.32	21.87	0.018
Physician diagnosed-allergic rhinitis	12.41	7.59	9.61	0.002
Itchy rash ever	8.84	7.88	8.28	0.360
Current itching rash	9.48	8.57	8.95	0.389
Physician diagnosed-eczema	7.33	7.25	7.29	0.937

<sup>a</sup>Values are expressed as number percent.<sup>b</sup>P value determined by chi-square test.**Table 2.** The Percentage of Responses to Questions About Studied Risk Factors Among Children Having Allergic Symptoms or Diseases<sup>a</sup>

Allergic Symptoms or Diseases	Risk Factors (in the First Year of Life)								
	Acetaminophen consumption			Antibiotic consumption			Hospitalization for respiratory infection		
	Yes	No	P Value <sup>b</sup>	Yes	No	P Value <sup>b</sup>	Yes	No	P Value <sup>b</sup>
Wheeze ever	30.02 (1142)	18.91 (201)	0.003	33.87 (867)	20.24 (452)	0.001	54.95 (122)	26.17 (1227)	< 0.0001
Current wheeze	21.53 (814)	13.05 (139)	0.003	23.43 (596)	15.27 (340)	0.009	34.84 (77)	18.81 (879)	0.005
Nocturnal cough in the past year	23.25 (881)	15.37 (164)	0.003	24.92 (635)	16.85 (376)	0.002	36.65 (81)	20.68 (968)	0.002
Exercise-induced wheeze in the past year	11.90 (451)	6.77 (72)	0.001	12.43 (317)	8.84 (197)	0.015	18.35 (40)	10.28 (481)	0.007
Awaking due to cough or wheeze in the past year	27.44 (1041)	17.45 (185)	0.001	30.04 (766)	19.64 (438)	< 0.0001	24.31 (95)	43.38 (1137)	0.003
Physician diagnosed asthma	4.48 (170)	3.86 (41)	0.194	5.28 (135)	3.28 (73)	0.052	14.41 (32)	3.82 (179)	0.001
Allergic rhinitis ever	23.77 (897)	15.19 (161)	0.004	26.24 (666)	16.94 (376)	0.003	35.59 (79)	21.18 (986)	0.003
Physician diagnosed-allergic rhinitis	10.04 (382)	8.08 (86)	0.070	11.41 (292)	7.41 (165)	0.001	14.48 (32)	9.40 (441)	0.156
Itchy rash ever	9.13 (347)	5.54 (59)	0.035	10.00 (256)	6.01 (134)	0.008	20.27 (45)	7.66 (359)	0.002
Current itching rash	9.85 (374)	5.92 (63)	0.010	10.71 (273)	6.50 (145)	0.002	17.04 (38)	8.48 (397)	< 0.0001
Physician diagnosed-eczema	7.66 (291)	6.03 (64)	0.220	7.88 (201)	6.38 (142)	0.311	14.00 (31)	7.00 (327)	0.008

<sup>a</sup>Values are expressed as No. (%).<sup>b</sup>P value estimated by chi-square test.**Table 3.** Univariate Analysis of Studied Risk Factors Associated with Physician-Diagnosed Allergic Diseases

Risk Factors (In the First Year of Life)	Asthma		Allergic Rhinitis		Atopic Dermatitis	
	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)
Acetaminophen consumption	0.195	1.16 (0.88 - 1.54)	0.071	1.26 (0.96 - 1.66)	0.221	1.29 (0.78 - 2.11)
Antibiotic use	0.054	1.64 (0.98 - 2.74)	0.001	1.60 (1.37 - 1.88)	0.312	1.25 (0.72 - 2.17)
Hospitalization due to respiratory infection	0.002	4.23 (2.36 - 7.57)	0.159	1.63 (0.74 - 3.58)	0.009	2.16 (1.38 - 3.40)

the lowest and the highest prevalence rates of hay fever ever were obtained in the regions of Northern and Eastern Europe (6.1%) and North America (27.8%), respectively (20). In the Eastern Mediterranean region, its average

prevalence was reported as 13.9% (20). A previous study in Tehran showed that 2.1% of 6 - 7-year-old children had rhinitis symptoms during their lives (21), indicating the rising pattern of this allergic disease in Tehran as in other devel-

**Table 4.** Univariate Analysis of Studied Risk Factors Associated with Symptoms of Allergic Diseases

Symptoms	Risk Factors (In the First Year of Life)					
	Acetaminophen consumption		Antibiotic use		Hospitalization due to respiratory infection	
	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)
Wheeze ever	0.003	1.84 (1.40 - 2.41)	0.002	2.01 (1.55 - 2.61)	< 0.0001	3.44 (2.68 - 4.41)
Current wheeze	0.003	1.82 (1.39 - 2.38)	0.010	1.69 (1.23 - 2.32)	0.006	2.30 (1.50 - 3.54)
Nocturnal cough in the past year	0.003	1.66 (1.32 - 2.09)	0.003	1.63 (1.32 - 2.02)	0.003	2.21 (1.58 - 3.10)
Exercise - induced wheeze in the past year	0.001	1.85 (1.52 - 2.26)	0.015	1.46 (1.12 - 1.90)	0.008	1.96 (1.33 - 2.87)
Waking up due to cough or wheeze in the past year	0.002	1.78 (1.44 - 2.20)	0.001	1.75 (1.46 - 2.10)	0.004	2.38 (1.60 - 3.53)
Allergic rhinitis ever	0.004	1.74 (1.34 - 2.25)	0.003	1.74 (1.36 - 2.23)	0.004	2.05 (1.48 - 2.85)
Itchy rash ever	0.037	1.71 (1.05 - 2.78)	0.009	1.73 (1.25 - 2.39)	0.003	3.06 (1.90 - 4.93)
Current itching rash	0.011	1.73 (1.23 - 2.44)	0.003	1.72 (1.37 - 2.16)	< 0.0001	2.21 (1.83 - 2.67)

**Table 5.** Multivariate Analysis of Studied Risk Factors Associated with Symptoms of Allergic Diseases

Symptoms	Risk Factors (In the First Year of Life)					
	Acetaminophen consumption		Antibiotic use		Hospitalization due to respiratory infections	
	P Value	OR (95% CI)	P Value	OR (95% CI)	P Value	OR (95% CI)
Wheeze ever	0.041	1.42 (1.02 - 1.99)	0.009	1.72 (1.24 - 2.38)	0.001	2.83 (2.12 - 3.77)
Current wheeze	0.050	1.47 (1.00 - 2.16)	0.063	1.48 (0.96 - 2.27)	0.024	2.05 (1.17 - 3.60)
Nocturnal cough in the past year	0.029	1.42 (1.05 - 1.90)	0.009	1.42 (1.15 - 1.75)	0.005	1.95 (1.41 - 2.69)
Exercise - induced wheeze in the past year	0.011	1.69 (1.22 - 2.35)	0.098	1.23 (0.94 - 1.61)	0.006	1.76 (1.31 - 2.38)
Waking up due to cough or wheeze in the past year	0.009	1.48 (1.17 - 1.87)	0.010	1.50 (1.17 - 1.91)	0.011	2.03 (1.31 - 3.15)
Allergic rhinitis ever	0.033	1.40 (1.04 - 1.89)	0.006	1.54 (1.22 - 1.93)	0.008	1.82 (1.29 - 2.54)
Itchy rash ever	0.169	1.36 (0.81 - 2.30)	0.071	1.48 (0.94 - 2.31)	0.008	2.64 (1.53 - 4.56)
Current itching rash	0.076	1.41 (0.94 - 2.11)	0.017	1.52 (1.13 - 2.05)	0.006	1.79 (1.32 - 2.44)

oping centers.

On the basis of this study, the prevalence rates of ever and current itchy rash were 8.28% and 8.95%, respectively. No significant difference was observed between boys and girls in these two types of symptoms. Previous studies demonstrated widely different prevalence rates for atopic dermatitis among different countries, even in different parts of a country (6). In Iran, the lowest and the highest prevalence rates of eczema in the 6 - 7-year-old group were reported in Shiraz (1.62%) and Zanjan (11.8%), respectively (22). The global prevalence of current eczema symptoms was found to be 3.2% and that of eczema ever was reported as 10.3% in Iran (6). Moreover, ISSAC studies have shown that the prevalence of current eczema symptoms in the age group of 6 - 7 years fluctuate from lower than 5% to higher than 15% in different world regions (6). In addition to ethnic and genetic background, some environmental factors such as climate and diet are potential explanations for the

observed variations.

In the present survey, the prevalence rates of all evaluated symptoms of asthma, AR, and eczema were significantly higher in children taking acetaminophen in the first year of their lives. For the first time, Shaheen et al. reported a strong positive association between acetaminophen use and asthma in adults (23). After his study, a number of cross-sectional or case-control studies in children and adults confirmed the former findings (7). The analysis of data from countries participating in ISAAC evaluations showed a strong association between acetaminophen use and symptoms of asthma, AR, and eczema in children aged 6 - 7 years. It indicates that the acetaminophen effect is not restricted to the airways (24). In agreement with these analyses, it also seems that the association between acetaminophen and asthma has a cause-effect relationship. Some potential mechanisms such as glutathione depletion and dominant T helper-2 cytokine responses are proposed

as the reasons for the effects of acetaminophen on asthma and other allergic diseases (7, 25).

This study detected a significant association between the reported use of antibiotics in the first year of life and studied symptoms of asthma (ever and current wheeze), AR, and atopic dermatitis. There is conflicting evidence regarding the association between exposure to antibiotics and the development of asthma symptoms or other related allergic disorders. Foliaki et al. concluded that there is a significant positive association between antibiotic use in the first year of life and current asthma, AR, and eczema symptoms in children aged 6 - 7 years (8). Furthermore, Hoskin-Parr et al. found a strong and dose-dependent association between antibiotic exposure in the first two years of life and allergic diseases, especially asthma (26). The results of another study in Iran (Urmia city) on children aged 2 - 8 years also showed that the consumption of antibiotics was associated with an increased risk of asthma symptoms (27). On the basis of earlier findings, antibiotic use early in life may alter the normal immune system development in a critical window during which specific subsets of the infant gut microbiota can differentially regulate immune function, leading to an influence on the likelihood of developing atopic disorders (28, 29). On the other hand, in contrast with the current survey, a meta-analysis conducted by Pander et al. on longitudinal studies indicated that a weak association could exist between antibiotic use and subsequent development of wheeze/asthma over 5 - 6 years of age (30). Moreover, the findings of Celeidon et al. did not support the hypothesis that exposure to antibiotics in the first year of life is related to the later development of asthma, AR, and eczema symptoms or diseases at the age of 5 (31). These inconsistencies may be partially attributed to different methodological designs, heterogeneity in the number of studied population, and two forms of bias known as reverse causation (antibiotic prescription for early symptoms of allergic diseases) and confounding by indication (presence of other actual allergic disease risk factors that lead to antibiotic consumption).

In the current study, it was found that the most important predisposing factor for developing allergic symptoms was hospitalization due to respiratory infection in the first year of life. Previous studies revealed similar results in which hospitalization for severe respiratory syncytial virus (RSV)- or rhinovirus (RV)-induced bronchitis during the first year of life was highly associated with the development of asthma and allergic sensitization at the age of 6 or 7 (9, 10, 32, 33). The researchers did suggest, however, that other factors including genetic, environmental, and developmental conditions or the type of virus causing the respiratory infection may also be involved. A systematic review conducted by Szabo et al. demonstrated

that hospitalization for RSV disease during infancy significantly elevated the prevalence of asthma in comparison with the non-hospitalized group, as well (34). In contrast to the above-mentioned findings, the hygiene hypothesis suggests that infections in early life are protective against the development of allergic diseases.

Considering the fact that some controversies still exist regarding acetaminophen consumption as a potential risk factor of increased asthma prevalence, the current study may support the results of previous studies. However, the current study had some limitations. Unfortunately, the frequency, duration, or doses of acetaminophen consumption were not specified. No information was gained in our research concerning the types of antibiotics and their broad and narrow spectrum. Data in this study were obtained retrospectively from the parents of children aged 6 and 7 years old, and this might lead to recall bias. Further studies are under evaluation for reporting current data on the prevalence of allergic symptoms among Iranian children.

In this study, the number of children who had allergic symptoms, especially those of asthma or rhinitis, was noticeably higher than the number of children diagnosed with allergic diseases. The probable explanation for this condition may be the parents' unawareness of the importance of these symptoms and failure to seek timely medical advice, as well as a reluctance to label children as allergic patients, especially in asthma cases. This underestimation may interfere with accurate recognition of risk factors as well as assessment of their effects, therefore, it should be considered in the insignificance association of physician-diagnosed allergies with evaluated risk factors.

#### 4.1. Conclusion

In summary, our findings demonstrated that the prevalence of symptoms of allergic diseases is rising in 6 - 7-year-old children in Tehran. Moreover, this study ascertained that acetaminophen and antibiotic use as well as hospitalization due to respiratory infection during the first year of life are significant risk factors for the appearance of allergic symptoms in childhood.

#### Acknowledgments

We highly acknowledge all the health care providers who kindly helped us with training parents in fulfilling the questionnaires.

#### Footnotes

**Conflict of Interests:** The author does not have any conflict of interest, and will sign the disclosing form.

**Funding/Support:** Academic center for education, culture and research (ACECR) funded the current study.

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