

Current Trends of the Prevalence of Childhood Asthma in Three Chinese Cities : A Multicenter Epidemiological Survey¹

JUAN BAI^{*}, JING ZHAO^{*2}, KUN-LING SHEN[#], LI XIANG[#], AI-HUAN CHEN[&], SUI HUANG[&],
YING HUANG[§], JIAN-SHENG WANG[§], AND RONG-WEI YE[@]

^{*}Capital Institute of Pediatrics, Beijing 100020, China; [#]Beijing Children's Hospital attached to Capital Medical University, Beijing 100045, China; [&]GuangZhou Institute of Respiratory Diseases, Guangzhou 510120, Guangdong, China; [§]Children's Hospital of Chongqing Medical University, Chongqing 400014, China; [@]Chinese Centre for Disease Control and Prevention, Beijing 100050, China

Objective To analyze the prevalence of asthma and asthma related symptoms among children aged 0-14 years in three Chinese cities and to obtain a crude estimation of the trend of childhood asthma prevalence in China. **Methods** A cross-sectional, population-based survey of prevalence of asthma was conducted in children aged from 0 to 14 years in 3 major cities of China (Beijing, Chongqing, and Guangzhou) with different geographic locations. All the subjects were randomly selected by a multi-stage sampling method. Three to five schools and kindergartens in 2 urban districts in each city were randomly selected for the survey, and a validated questionnaire that included the core questions of the International Study of Asthma and Allergies in Childhood, Phase III questionnaire and several additional questions were used. All questionnaires were completed by parents or guardians of the selected children. Children whose parents responded affirmatively to the question "Has your child ever been diagnosed as asthma by a doctor" were recognized as victims of asthma. **Results** The prevalence of asthma in Beijing, Chongqing, and Guangzhou was 3.15%, 7.45%, and 2.09%, respectively. These values were significantly higher than those obtained 10 years ago in the national epidemiological survey in 2000 which used the same method of investigation and the same diagnostic criteria ($\chi^2=3.938$, $P=0.047$; $\chi^2=73.506$, $P\leq 0.001$; $\chi^2=11.956$, $P=0.001$, in each city). Of the asthmatic children 57.21%, 69.91%, and 60.00% had their first attack before the age of 3 in Beijing, Chongqing, and Guangzhou, respectively. Wheezing was the primary clinical manifestation for all asthmatic children, followed by persistent cough and repeated respiratory infections. Both the prevalence of asthma and asthma-related symptoms were statistically higher in males than in females. **Conclusion** The prevalence of childhood asthma is statistically higher than that 10 years ago in the three Chinese cities.

Key words: Children; Asthma; Prevalence; China

INTRODUCTION

Asthma is one of the most common chronic disorders in children, causing substantial morbidity^[1-2]. It increases the cost of healthcare, impairs the quality of life, and decreases school attendance^[3]. It can also be fatal, if not controlled^[4-5]. Based on the standardized methods applied to measure the prevalence of asthma and wheezing illness in children, it appears that the global prevalence of asthma ranges from 1% to 18% among the population in different countries^[6-8]. It is reported that globally there are nearly 300 million people suffering from asthma and there would be over 100 million asthmatic patients by 2025^[8]. In the 1990s, many studies revealed that the prevalence of asthma

was increasing at an alarming rate^[9-12]. However, some Western countries have recently witnessed a trend toward stabilization, or even reduction in the prevalence of childhood asthma^[13-15].

The prevalence of asthma in China seems to be lower than that in Western countries, and as China is vast geographically, the prevalence varies between different regions in the country^[16]. Two national epidemiological surveys were conducted among children aged 0-14 years in 1990 and 2000 by the Childhood Asthma Collaborative Group of China. The results of the surveys suggested that the prevalence of childhood asthma in this country increased from 0.91% to 1.54% in the period of 1990-2000^[17]. Over the past 10 years, however, the environment and lifestyle in China have been

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²Correspondence should be addressed to Jing ZHAO, Capital Institute of Pediatrics in Beijing. The authors made equal contributions to the article. E-mail: Janezhao0607@yahoo.com, Fax: 86-10-85625323.

Biographical note of the first author: Juan BAI, female, born in 1985, master of medicine, majoring in pediatrics.

changing dramatically along with its economic development. No recent official statistics have been made available on the current status of childhood asthma in China. To further understand the trends of asthma in Chinese urban children in the past 10 years, a cross-sectional survey was performed in 24 290 children aged 0-14 years in 3 Chinese major cities (Beijing, Chongqing and Guangzhou) from October 2008 till March 2009.

SUBJECTS AND METHODS

Study Sites and Population

Our study was conducted in three major cities (Beijing, Chongqing, and Guangzhou) in different geographic regions of China. Beijing is located in the northern part of this country with a relatively low humidity, Chongqing is a low-lying region in the Sichuan Basin of Southwest China, with high humidity, and Guangzhou is located in the southern part of the country, with a subtropical climate.

Two urban districts were randomly selected in Beijing, Chongqing, and Guangzhou, and 3-5 schools and kindergartens were randomly selected in each selected district. All children aged 0-14 years in the selected schools and kindergartens were enrolled in the survey. Two community health service centers were randomly selected and were surveyed for children who did not go to school or kindergarten, and received immunization service there. A total of 10 372, 9 846, and 4 072 children aged 0-14 years were randomly selected in Beijing, Chongqing, and Guangzhou, respectively. A validated questionnaire which was the same as that used in the 2000 National Epidemiological Survey on Childhood Asthma was administered in the survey. The questionnaire included the core questions of the International Study of Asthma and Allergies in Childhood, Phase III questionnaire, and several additional questions on asthma and its related symptoms. In order to ensure the credibility of the survey, reliability test was done to the questionnaire and the Cronbach's α and Kappa statistic of the questionnaire were 0.82 and 0.81, respectively.

The schoolchildren in our survey were informed of the objective of the survey and were asked to request their parents to complete the questionnaire, and to return them to schools. For the children who were not old enough to attend school, investigators conducted a face-to-face interview with their parents in the kindergartens or in the community health service centers where the children received immunization service.

Statistical Analysis

The data obtained were input using EpiData version 3.1 by two people (double data entry). All statistical analyses were performed using SPSS 13.0. Measurement data was described by means and standard deviations, categorical data was described by the rate or ratio. The chi-square test (χ^2) was used to compare differences in the prevalence of asthma, and asthma related symptoms among the different cities. For all analyses, P values <0.05 were regarded as statistically significant.

Ethics

The study was approved by the Ethics Committee of the Capital Institute of Pediatrics in Beijing in March 15, 2008. Parents or legal guardians of the enrolled children were informed and were requested to complete a written consent form before the survey. All patients with evidence suggestive of asthma were investigated further, and those found to have asthma were offered treatment.

RESULTS

Prevalence of Asthma

Overall, 24 290 children took part in the survey, of whom 10 372 were from Beijing, 9 846 from Chongqing, and 4 072 from Guangzhou. Of these children, 12 908 were male, and 11 382 were female. The ratio of male to female in Beijing, Chongqing and Guangzhou was 1.11:1, 1.15:1, and 1.13:1, respectively. The average age of the children in the three cities was 7.63 ± 4.04 , 8.74 ± 2.72 , 8.39 ± 3.53 years ($\bar{x} \pm s$).

Asthma was defined as a "yes" response to the question "Has your child ever been diagnosed as asthma by a doctor". The prevalence of asthma in Beijing, Chongqing, and Guangzhou was 3.15%, 7.45%, 2.09%, respectively. These values were significantly higher than those ten years ago (the respective prevalence of asthma in Beijing, Chongqing and Guangzhou was 2.69%, 4.63%, and 1.33% according to the 2000 National Epidemiological Survey in which the same method of survey was employed)^[18]. In these cities, the prevalence of wheezing in the last 12 month was 5.54%, 3.48%, and 3.93%, respectively; the prevalence of dry cough at night was 8.71%, 8.65%, and 8.79%, respectively. The prevalence of cough induced by exercise was 6.80%, 7.14%, and 8.45%, respectively. Overall, 68.50%, 56.54%, and 68.24% of asthmatic children in the three cities had asthma-

TABLE 1
Prevalence of Asthma and Asthma-Related Symptoms in the Last 12 Months

City	Beijing	Chongqing	Guangzhou	Total
Asthma				
Male	223 (4.09)	432 (8.22)	55 (2.55)	710 (5.50)
Female	101 (2.05)	278 (6.06)	30 (1.60)	409 (3.59)
Total	324 (3.15)	710 (7.45)	85 (7.09)	1119 (4.16)
χ^2	33.599	17.033	4.388	45.704
<i>P</i>	<0.001	<0.001	0.036	<0.001
Asthma Related Symptoms				
Wheezing	575 (5.54)	343 (3.48)	160 (3.93)	1078 (4.44)
Coughing at Night	903 (8.71)	852 (8.65)	358 (8.79)	2113 (8.70)
Exercise-induced Cough	705 (6.80)	703 (7.14)	344 (8.45)	1752 (7.21)

Note. χ^2 test was done to compare the prevalence of asthma between the male and female in each city.

TABLE 2
Statistical Comparisons of the Prevalence of Asthma between the Present Study and That Conducted 10 Years Ago

City	2000	2008	Chi-square Test	
	<i>n</i> (%)	<i>n</i> (%)	χ^2	<i>P</i>
Beijing	10163 (2.69)	10372 (3.15)	3.938	0.047
Chongqing	11200 (4.63)	9846 (7.45)	73.506	<0.001
Guangzhou	8752 (1.33)	4072 (2.09)	11.956	0.001

Note. χ^2 test was done to compare the prevalence of asthma in 2008 and 2000 in each city.

TABLE 3
The Characteristics of Children with Asthma in Beijing, Chongqing, and Guangzhou

Characteristics	Beijing	Chongqing	Guangzhou	Total
Main Symptoms	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)	<i>n</i> (%)
Wheezing	167 (51.07)	302 (41.14)	37 (43.53)	12908 (53.14)
Cough	4917 (47.41)	187 (25.48)	27 (31.76)	11382 (46.86)
Infection	167 (51.07)	178 (24.25)	26 (30.59)	24290
Age of the First Attack	7.63±4.04	8.74±2.72	8.39±3.53	8.20±3.51
<3 y	131 (57.21)	388 (69.91)	36 (60.00)	555 (65.76)
4-6 y	68 (29.69)	110 (19.82)	14 (23.33)	192 (22.75)
7-14 y	30 (13.10)	57 (10.27)	10 (16.67)	97 (11.49)
Age of Initially Diagnosed as Asthma				
<3 y	113 (46.50)	358 (63.36)	29 (53.70)	500 (58.00)
4-6 y	93 (38.27)	145 (25.67)	16 (29.63)	254 (29.47)
7-14 y	37 (15.23)	62 (10.97)	9 (16.67)	108 (12.53)

related symptoms in the last 12 months. The general characteristics of the children and the prevalence of asthma and asthma-related symptoms in the last 12 months are shown in Table 1. Statistical comparisons of the prevalence of asthma in children aged 0-14 years in the three cities between the current study and that conducted 10 years ago are shown in Table 2.

Main Clinical Manifestations of Children with Asthma

The most prevalent symptoms among children with asthma were wheezing, persistent dry cough,

and recurrent respiratory tract infection (shown in Table 3). Among the asthmatic children in Beijing, Chongqing, and Guangzhou, 57.2%, 69.91%, and 60.00% of children, had their first attack before the age of three, respectively. Among the children diagnosed as asthma by doctors, 46.50%, 63.36%, and 53.70% were diagnosed respectively in these three cities before the age of three (Table 3).

DISCUSSION

Asthma is the most prevalent chronic childhood

disease and has a serious detrimental effect both physically and mentally on children. It imposes a major burden on the affected children and their families, and also represents a challenge to the public health system and health care providers^[15]. It is becoming a serious public health problem throughout the world.

Epidemiological surveys in some Western countries have revealed that the prevalence of asthma tends to stabilize or decrease in recent years. For example, Anderson documented decreases in the prevalence of wheezing, symptoms of allergic rhinitis, and eczema among adolescents between 1995 and 2002 in the United Kingdom, one of the areas in the world with the highest rates of symptoms of asthma, allergic rhinitis, and atopic eczema^[19]. Braun-Fahrlander detected no further increases in asthma, hay fever, or atopic sensitization among adolescents living in Switzerland in the late 1990s^[20]. An Italian study of schoolchildren reported no further increase in physician-diagnosed asthma after 1992^[21]. However, the present study has observed an increase in the prevalence of asthma and asthma-related symptoms in Chinese children aged 0-14 years.

Two national epidemiological surveys were conducted in 1990 and 2000 by the Collaborative Group of Childhood Asthma in China and the results showed that the respective prevalence of asthma in children aged 0-14 years in Beijing, Chongqing, and Guangzhou was 0.77%, 2.60%, and 1.39% in 1990, and it reached 2.69%, 4.63%, and 1.33% in 2000. We conducted the survey in 2008 among children aged 0-14 years in the same area of Beijing, Chongqing, and Guangzhou as the two national epidemiological surveys in 1990 and 2000. In order to ensure comparability of the survey with the two previous national surveys, the identical sampling method was employed. Moreover, the diagnostic criteria for asthma in the survey which were established by the Chinese Medical Association Study Group on Pediatric Respiratory Disorder were identical with those used in the two previous national epidemiological surveys. In the present survey, it was found that the prevalence of asthma in the three cities was up to 3.15%, 7.45%, and 2.09% respectively, which was significantly higher than that observed 10 years ago. The factors driving the prevalence to increase to the current levels are poorly understood, nevertheless the increase in the prevalence may be associated partially with the change in lifestyle and urbanization process, as many previous studies have suggested^[22]. A population-based study in Mongolia demonstrated that the prevalence of allergic sensitization increased significantly with accelerating urbanization: 13.6% in villages, 25.3% in rural towns and 31.0% in the city^[23]. Over the past decade, with

China's urbanization and industrialization, the living environment and lifestyle in this country has been changing dramatically, which has been accompanied by an increase in the prevalence of asthma.

Among the three cities, the prevalence of asthma in Chongqing was higher than that in Beijing and Guangzhou. This geographic variations may be partly due to the environmental and climate factors^[24]. The geographic, climatic and air pollution characteristics of these cities are different. Chongqing is in the southwest of China with a relatively high humidity and lower elevation, providing favorable conditions for the growth of mites that can cause allergic diseases including asthma. Much more researches are needed to find out the exact causes. In our survey, the prevalence of asthma in males is significantly higher than that in females in each respective city and this observation is concordant with previous studies.

For most of asthmatic children in the survey, wheezing is the first main clinical manifestation, followed by persistent cough and recurrent respiratory infections. In all asthmatic children, over half of them developed asthma-related symptoms, such as wheezing, cough at night, and exercise-induced cough in the past 12 months (68.50%, 56.54%, and 68.24% in Beijing, Chongqing, and Guangzhou, respectively). This phenomenon has indicated that asthma is a chronic airway inflammatory disease with a long course, and is prone to recur when some stimuli are encountered.

In the survey, 57.2%, 69.9%, and 60.0% of children who were diagnosed as asthma had their first attack before the age of three in Beijing, Chongqing, and Guangzhou, respectively. Among these children, 46.50%, 63.36%, and 53.70% had been diagnosed as asthma before the age of three respectively. It is inferred indirectly that most of the children with asthma can get accurate diagnosis at the initial stages of the disease, owing to the dissemination and extensive implementation of the Global Initiative for Asthma (GINA) in China.

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