



## Burden of pediatric asthma in Kurdistan Province, West of Iran

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### Original Article

#### Abstract

**BACKGROUND:** Asthma is the most common chronic respiratory disease (CRD) and one of the most serious and important pediatric diseases in developing countries. The present study aims to estimate the burden of asthma among children in Kurdistan Province, Iran.

**METHODS:** Disability-adjusted life year (DALY) was used in order to estimate the burden of asthma. In a cross-sectional study, with a sample size of 4000, and using the multi-stage sampling method and Asthma and Allergies in Childhood (ISAAC) questionnaire, the prevalence of asthma was estimated for two 6-7 and 13-14 age groups in Kurdistan Province in 2013. In addition, some necessary data were extracted from the death registration system in Kurdistan Provincial Health Center and Statistical Center of Iran (SCI).

**RESULTS:** Burden of asthma for 6-7 age group was 71.6 DALYs in boys (2.77 DALYs per 1000 population) and 48 in girls (2.22 DALYs per 1000 population) with a total burden of 119.6 DALYs (2.52 DALYs per 1000 population). Moreover, its burden for 13-14 age group was 121.1 DALYs in boys (4.86 DALYs per 1000 population) and 82.3 in girls (3.98 DALYs per 1000 population) with a total burden of 203.4 DALYs (4.46 DALYs per 1000 population).

**CONCLUSION:** Considering the significant prevalence of asthma and its burden among children in Kurdistan Province, it is suggested that prevention and management of this disease be considered as a priority by policy makers and in health programs, in addition to attempting to prevent and reduce its burden by setting out effective interventions.

**KEYWORDS:** Asthma; Pediatrics; Children; Burden of Illness; Iran

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### Introduction

Asthma is the most common non-communicable disease (NCD) and one of the most important diseases among children in developing countries. Its prevalence and mortality are increasing around the world.

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Between 1990-2015, the prevalence of asthma had a 12.6% increase worldwide.<sup>1</sup> In 2015, 358.2 million people had asthma and it was responsible for nearly 397,000 deaths in the same year. More than 80% of these death cases occurred in low and middle-income countries.<sup>2</sup>

Asthma imposes a high economic burden on health systems and households. In 2013, its economic burden was 81.9 billion dollars in the United States.<sup>3</sup> In Iran, according to the previously published studies, the prevalence of

asthma among children was reported to be 2.1% to 35.4% in various regions of the country,<sup>4,9</sup> and it has imposed a significant economic burden on Iranian health system and households.<sup>10,11</sup>

Although the mortality rate of asthma is relatively low in comparison to other chronic diseases, if not managed properly, it can impose a significant burden of disease. Asthma is usually under-diagnosed and under-treated; this can impose a high burden on individuals and families and can limit the daily activities of individuals.<sup>12</sup>

Appropriate policies and responses to prevent and control asthma require appropriate epidemiological information; one of these relevant information sources is burden of diseases.<sup>2</sup> Disability-adjusted life years (DALYs) is a measure for estimating burden of diseases. It shows the mortality and morbidity rates of diseases and injuries in the form of a number, and each DALY represents one year of life lost (YLL) due to premature death or year lived with disability (YLD).<sup>13</sup>

Chronic respiratory diseases (CRD) are responsible for 4.7% of total DALYs in the world and asthma is alone responsible for one-fifth of this rate. In 2015, the burden of asthma was about 26.2 million DALYs in the world, equivalent to 1.1% of the entire global burden of diseases worldwide. Among children aged 5-14, asthma is one of the first 10 diseases with the highest burden of disease.<sup>2</sup>

The ultimate goal of estimating burden of diseases is to provide evidence needed for policymaking and to design and manage health programs. Estimating burden of diseases can be helpful in resource allocation, targeting high priority areas, and assessing the effectiveness of health interventions.<sup>14</sup> Studying the prevalence of asthma and its burden in a cross-sectional form and over time is important because this disease can be prevented or treated with appropriate and cost-effective interventions. Regardless of the importance of the subject, reviewing the related literature shows that no

study has ever been performed to estimate the burden of asthma in Kurdistan Province. Therefore, the aim of this study is to estimate the burden of asthma in children aged 6 to 7 and 13 to 14 years in this province in 2013.

## Materials and Methods

DALYs and the method of global burden of disease study (GBD) in 2010, which is extensively reported in studies, were used for estimating burden of asthma.<sup>15</sup> DALYs equal YLL plus YLD.<sup>16</sup>

$$\text{DALYs} = \text{YLL} + \text{YLD}$$

In this study, YLD was calculated using the following formula:

$$\text{YLD} = \text{Prevalence of asthma} \times \text{Disability weight}$$

In these calculations, the prevalence of asthma for the two age groups of first and second grades of primary school (6-7 years) and middle school (13-14 years) in 2013 was obtained in the following stages:

At first, a cross-sectional study with a sample size of 4000 people was performed (Prevalence = 12%; Confidence interval = 95%; Accuracy = 1%). 4000 questionnaires were distributed among children aged 6 to 7 years in elementary schools and 13 to 14 years in middle schools of Kurdistan Province proportionate to students' population, gender, and grade. A city (cluster) was randomly selected from each county and a number of schools were randomly selected from each city. Sampling was performed using randomized multistage stratified cluster sampling method. The Asthma and Allergies in Childhood (ISAAC) questionnaire (which is a simple and standard questionnaire) was used in this study. This questionnaire has been translated into Persian in previous studies and its validity and reliability have been verified.<sup>7</sup> The questionnaire was completed by parents for children aged 6 to 7 and by children themselves for those aged 13 to 14 years.

**Table 1. Disability weight of asthma symptoms**

Variable	Disability weight
Controlled asthma Having wheezing and cough once a month, which does not cause difficulty with daily activities.	0.009 (0.004-0.018)
Partially controlled asthma Having wheezing and cough once a week, which causes some difficulty with daily activities.	0.027 (0.015-0.045)
Uncontrolled asthma Having wheezing, cough, and shortness of breath more than twice a week, which causes difficulty with daily activities and sometimes wakes the person up at night.	0.132 (0.087-0.190)

Moreover, YLL was calculated using the formula below:

YLL = Number of deaths × Life expectancy at the age of death

Then, in the study population, the prevalence of asthma was calculated in three classes of controlled asthma, partially controlled asthma, and non-controlled asthma for the two age groups of 6-7 and 13-14 years (Table 1).

Finally, in order to obtain the number of people with asthma in both age groups, the prevalence of each class was multiplied by the population of that age group. The population of both age groups was obtained from the Statistical Center of Iran (SCI). According to the data from the SCI, the population of the 6-7 and 13-14 age groups was 47424 (25814 boys and 21610 girls) and 45363 (24939 boys and 20697 girls) in 2013, respectively.<sup>17</sup>

Furthermore, in these calculations, the disability weights for three classes of controlled asthma, partially controlled asthma, and uncontrolled asthma are shown in table 1. Disability weight varied from 0 (complete health) to 1 (death) based on the severity of the disease.<sup>1</sup>

However, given that there was no record of death case due to asthma in both age groups in the death registration system in Kurdistan Provincial Health Center in 2013, the YLL would equal zero, and the total DALYs would equal YLD. Data were analyzed using Excel software (version 2010). Kurdistan Province, with Sanandaj as its center, is located in west of Iran and consists of ten counties with a population of about 1532000 in 2013.<sup>17</sup>

## Results

In this study, 3890 questionnaires were completed (1768 by 6-7 age group and 2122 by 13-14 age group) (Table 2). In the 6-7 age group, the

prevalence of the controlled asthma, partially controlled asthma, and uncontrolled asthma was 14.75, 3.13, and 0.45% among boys and 12.94, 2.75, and 0.23% among girls, respectively. Additionally, in the 13-14 age group, the prevalence of the controlled asthma, partially controlled asthma, and uncontrolled asthma was 18.98, 4.23, and 1.52% among boys and 16.24, 3.65, and 1.16% among girls, respectively (Table 2).

According to the data reported by the SCI, the population of the 6-7 and 13-14 age groups in Kurdistan Province was 47424 (25814 boys and 21610 girls) and 45363 (24939 boys and 20697 girls) in 2013, respectively.

In order to estimate the number of people with asthma in this province in both age groups, the prevalence of each class was multiplied by the population of that age group (Table 2).

Table 3 represents the burden of asthma by age group and sex. In the 6-7 age group, the burden of asthma was 71.6 DALYs for boys (2.77 DALYs per 1000 population) and 48 DALYs for girls (2.22 DALYs per 1000 population) with a total burden of 119.6 DALYs (2.52 DALYs per 1000 population). Besides, in the 13-14 age group, its burden was 121.1 among boys (4.86 DALYs per 1000 population) and 82.3 DALYs among girls (3.98 DALYs per 1000 population). In total, asthma had imposed 203.4 DALYs on population (4.46 DALYs per 1000 population).

## Discussion

Asthma is a global public health problem, and among respiratory diseases, it imposes the highest burden of disease after chronic obstructive pulmonary disease (COPD).<sup>2</sup>

**Table 2. Prevalence of asthma symptoms in study population by age group and sex in Kurdistan Province, Iran**

Variable	6-7 years old (n = 1678; Total = 47424)				13-14 years old (n = 2129; Total = 45636)			
	Male [n (%)]	Estimate in all male population*	Female [n (%)]	Estimate in all female population*	Male [n (%)]	Estimate in all male population**	Female [n (%)]	Estimate in all female population**
No asthma symptoms	731 (81.68)	21083	734 (84.08)	18168	694 (75.27)	18772	953 (78.96)	16341
Controlled asthma	132 (14.75)	3807	113 (12.94)	2796	175 (18.98)	4733	196 (16.24)	3361
Partially controlled asthma	28 (3.13)	808	24 (2.75)	596	39 (4.23)	1055	44 (3.65)	755
Uncontrolled asthma	4 (0.45)	116	2 (0.23)	50	14 (1.52)	379	14 (1.16)	240
Total	895 (100)	25814	873 (100)	21610	922 (100)	24939	1207 (100)	20697

\* Calculated as the prevalence of asthma symptoms in the sample multiplied by the population of 6 to 7 year-old subjects in Kurdistan Province, Iran

\*\* Calculated as the prevalence of asthma symptoms in the sample multiplied by the population of 13 to 14 year-old subjects in Kurdistan Province, Iran

**Table 3. Disability-adjusted life years (DALYs) due to asthma in the study population by severity, sex and age group in Kurdistan Province, Iran**

Variable	6-7 years old			13-14 years old		
	Estimated DALYs in boys	Estimated DALYs in girls	Total DALYs	Estimated DALYs in boys	Estimated DALYs in girls	Total DALYs
Controlled asthma	34.4	25.3	59.7	42.6	30.2	72.8
Partially controlled asthma	21.9	16.1	38.0	28.5	20.4	48.9
Uncontrolled asthma	15.3	6.6	21.9	50.0	31.7	81.7
Total	71.6	48.0	119.6	121.1	82.3	203.4

DALYs: Disability-adjusted life years

The results of the present study suggested that in the 6-7 age groups, the prevalence of controlled asthma, partially controlled asthma, and uncontrolled asthma was 14.60, 3.10, and 0.36% in 2013, respectively. In addition, in the 13-14 age group, the prevalence of controlled asthma, partially controlled, and uncontrolled asthma was 17.43, 3.90, and 1.32% in the same year, respectively. In Iran, according to the results of previous studies, the prevalence of asthma in children has been reported to be 2.1% to 35.4% in different regions of the country.<sup>4,6,7,9,18-20</sup>

The findings of the first national study in Iran showed that the prevalence of asthma in children aged 6-7 and 13-14 years was 9.4% and 12.4%, respectively.<sup>5</sup> In another study in Iran (city of Ahvaz), the prevalence of asthma among elementary school children aged 6-7 and 13-14 years was 3.7% and 6.1%, respectively.<sup>21</sup> According to the findings of the current study, the prevalence of asthma and its burden in the 13-14 age group was more than that of the 6-7 age group and it imposed a higher burden on boys compared to girls. Results of national studies on Iranian children have shown that the prevalence of asthma in 13-14 age group is more than that of the 6-7 age group; however conflicting results have been reported in relation to the gender.<sup>5,8,20-22</sup> Contrary to our findings, according to the global burden of disease report 2015, we had more asthma cases in women (190.2 million) compared to men (168 million).<sup>2</sup> This difference could be due to differences in the age groups studied.

Given the present results, no death was reported for the studied age groups in 2013. As reported by the global burden of disease study in 2015, about 358.2 million had asthma and about 397,000 died of it; number of deaths in male and female population was 6.7 and 5.6 per 100,000 populations, respectively.<sup>2</sup> In a study in Iran (Yazd Province) between 2002 and 2011, 33 men and 24 women died of asthma annually.<sup>23</sup>

In our study, burden of asthma in the 6-7 and 13-14 age groups was 119.6 DALYs (2.52 DALYs per 1,000 population) and 203.4 DALYs (4.46 DALYs per 1000 population), respectively. In both age groups, asthma imposed a higher burden on boys compared to girls. According to the global burden of disease report in 2015, asthma DALYs rate per 100,000 population was more than 12 for the countries of Afghanistan, the Central African Republic, Fiji, New Guinea, and Swaziland, between 1 to 2 for countries of Eastern and Central Europe, China, Italy, and Japan, and 3.49 (274162 DALYs) for Iran.<sup>2</sup>

As outlined in this report, the asthma DALYs rate was similar between men (3.65 per 1,000) and women (3.68 per 1,000) across the world.<sup>2</sup>

According to our findings, 100% of asthma DALYs was caused by YLD, while according to the GBD report in 2015, nearly 60.7% of the world's asthma burden (10.3 million YLL and 15.9 million YLD) was due to YLD.<sup>2</sup> The results of a study in Iran (Yazd Province) revealed that asthma-induced YLL was 251.7 and 519.1 in the 0-10 and 10-20 age groups, respectively, and it was significantly higher in women compared to men.<sup>22</sup>

## Conclusion

Regarding the significant prevalence of asthma and its burden among children in Kurdistan Province, it is suggested that prevention and management of this disease be considered as priority by policy makers and in health programs. The burden of the disease must be prevented and reduced by establishing effective and affordable interventions.

**Limitations:** One of the limitations of this study was the report of asthma symptoms by the child himself/herself or the child's parents. Lack of data on the number of people with asthma in Kurdistan Province due to the absence of asthma health surveillance system was another limitation of this study. Therefore, in order to estimate the number of asthma

cases and its burden, a sample was selected from 6-7 and 13-14 age groups in Kurdistan population. Additionally, the prevalence of asthma among the studied age groups in Kurdistan Province was examined only on students in urban areas.

### Conflict of Interests

Authors have no conflict of interests.

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