

# Epidemiology and economic burden of asthma

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**Background:** The “asthma epidemic” is on the rise, with the Center for Disease Control (CDC) epidemiological studies reporting a 3.0% asthma prevalence in the United States in 1970, 5.5% in 1996, and 7.8% in 2006 to 2008. This results in an immense economic burden, with asthma costing an estimated \$56 billion in the United States in 2007, which is a 6% increase from the \$53 billion that was spent in 2002.

**Methods:** A review of the current literature and CDC reports were used to thoroughly examine and summarize the epidemiology and economic burden of asthma domestically and globally.

**Results:** Asthma shows a male predominance before puberty, and a female predominance in adulthood. Studies show Puerto Ricans to be the most commonly affected ethnicity, and a higher prevalence of asthma is found in lower income populations. Asthma is related to some of the more common otolaryngologic diseases such as allergy and obstructive sleep apnea. The condition results in significant morbidity, such as an increase in emergency department

visits and a decrease in productivity due to missed school and works days.

**Conclusion:** Epidemiological statistics report an undisputable increase of asthma both domestically and worldwide, which means the economic burden of this disease is also on the rise. Better access to healthcare, improved asthma education, and bridging the gap between ethnic and racial disparities in the treatment and management of asthma may help to control this epidemic, promote better outcomes, and prevent continued rising costs related to the management of this widespread disease. © 2015 ARS-AAAA, LLC.

**Key Words:**

asthma; epidemiology; economic burden; pediatrics; allergy

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The “asthma epidemic” refers to the increasing prevalence of this medical condition domestically and globally over the last few decades. Although a consensus is not yet reached regarding the cause of this rising epidemic, we do know that it is strongly correlated to the increase in allergy that has occurred over the same time period.<sup>1</sup> The epidemiology of asthma, as well as the significant economic burden that comes with its prevention, management, and treatment are discussed in this article.

## Epidemiology

The Centers for Disease Control and Prevention (CDC) reported that 3.0% of the U.S. population had asthma in 1970 (Moorman et al.<sup>2</sup>), 5.5% in 1996 (Mannino et al.<sup>3</sup>), and 7.8% in 2006 to 2008 (Moorman et al.<sup>4</sup>). Correspondingly, the incidence of allergy (described as “hay fever” in most national health surveys) was reported as 7.5% in the adult U.S. population in 2012 (Blackwell et al.<sup>5</sup>), similar to the rates of asthma in the same population during the same time period.

It is difficult to definitively determine the global prevalence of asthma. Since asthma is a non-reportable disease, epidemiologists have long attempted to reduce any confounding factors that exist between countries with respect to differences in diagnostic protocols, surveillance questionnaires, and access to healthcare.<sup>1</sup> In 2002 and 2003, the World Health Survey (WHS) implemented by the World Health Organization (WHO) surveyed almost 200,000 adults over 18 years of age on the topic of asthma diagnosis and asthma symptoms. The global prevalence

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of doctor-diagnosed asthma was 4.3%, but varied widely among the 70 countries included in the survey. For example, Australia reported a 21.0% rate of doctor-diagnosed asthma, much higher than the average of 4.3%.<sup>6</sup> Asthma rates have previously been higher in more developed countries, such as Australia, but this has changed with the recent increase in asthma prevalence in low-class and middle-class societies. Best estimates report that approximately 300 million people worldwide suffer from asthma,<sup>1</sup> or about 4.3% of the population. Based upon current statistics, the WHO estimates a 100 million-person increase in the global prevalence of asthma in the next decade.<sup>7</sup>

The prevalence of asthma is higher in the United States than in other countries. A study from 2014 by Iqbal et al.<sup>8</sup> found a statistically significant higher prevalence of asthma among children and adults born in the United States than in those born elsewhere. Interestingly, children and adults currently living in the United States but who were *not* born there had a higher prevalence of asthma in relation to the amount of years they had lived in the United States. Higher asthma rates were noted in those people who have lived in the United States for 10 years or more compared to those who have lived there for less than 10 years.<sup>8</sup>

Considering the burden of asthma in the pediatric population, the National Health Interview Survey reported that 6.7 million or 9% of children (ages 0 to 17 years) in the United States had asthma in 2007, with a lifetime prevalence as high as 13%.<sup>9</sup> The global prevalence of pediatric asthma is reported to be approximately 14%, and as noted in the first paragraph of this article, is on the rise.<sup>10</sup> Because asthma is the most common noncommunicable disease in children, its significant impact on the health and welfare of the pediatric population cannot be neglected.

Studies show a male predominance of asthma prior to puberty. However, there is a higher prevalence of asthma in females during adulthood. Furthermore, more severe cases of asthma predominate in women over men.<sup>11</sup> These gender differences are believed to be multifactorial and include hormonal differences, environmental factors, cultural factors, and biological sex differences that impact genetics, immune function, and lung function.<sup>12</sup> The breakdown of race and ethnicity in asthma was reported by the CDC in 2002 with the following results: a 7.6% prevalence in the non-Hispanic white population, 9.3% in the black population, 2.9% in the Asian population, 1.3% in the Native Hawaiian/Pacific Islander population, 11.6% in the American Indian/Alaska Native population, 5.0% in the Hispanic population, 15.6% in the multiracial (non-Hispanic) population, and 7.2% in the other (non-Hispanic) population.<sup>13</sup> Other data show the overall highest prevalence in the Puerto Rican population (17.0%) and the lowest prevalence in the Mexican American population (3.9%).<sup>14</sup>

From 2001 to 2009, asthma prevalence was higher for groups close to or below the poverty line, which is the minimum income deemed adequate for a family: 11.2% in those with incomes less than 100% of the poverty level, 8.7% for persons with incomes 100% to 200% of the poverty level,

**TABLE 1.** Rates of asthma associated with otolaryngologic disease

AR	Pediatrics: In 2024 children, 14% had AR and 7.3% had asthma. <sup>19</sup> Adults: AR prevalence as high as 80% in asthmatics; asthma prevalence as high as 40% in AR patients. <sup>18</sup>
Obesity	Obesity increases the incidence of asthma by 2.0-fold and 2.3-fold in children and adults, respectively. <sup>20</sup>
OSA	Prevalence of asthma is 35.1% in patients with OSA. <sup>21</sup>
GERD	Asthma patients are 3× more likely to have GERD. GERD is an asthma-causing factor (defined as improved asthma symptoms with reflux treatment) in 64% of asthma patients. <sup>22</sup>
CRSwNP	Asthma was diagnosed in 65% of patients with CRSwNP. <sup>23</sup>

AR = allergic rhinitis; CRSwNP = chronic rhinosinusitis with nasal polyposis; GERD = gastroesophageal reflux disease; OSA = obstructive sleep apnea.

and 7.3% for persons with incomes at least 200% of the poverty level.<sup>15</sup> It is important to note that there are disparities in asthma diagnosis and treatment with respect to race, ethnicity, and income. Bryant-Stephens<sup>16</sup> discussed the higher prevalence of asthma morbidity and mortality that affects black and Latino children living in low socioeconomic environments as compared to white children. Factors believed to contribute to this disparity include poorer access to adequate treatment, housing environment with increased allergen exposure, and psychosocial pressures (ie, family stressors). From 2007 to 2009, black individuals had higher rates of emergency department visits for asthma and more hospitalizations per 100 persons with asthma than whites. Blacks also had a higher asthma death rate per 1000 persons with asthma than whites.<sup>15</sup> Furthermore, from 2001 through 2009, asthma rates rose 50% in black children, the highest increase of any race and age group.<sup>17</sup>

Looking at asthma from a more clinical standpoint, it is interesting to recognize the relationship between this condition and some of the more common otolaryngologic diseases such as allergy, obstructive sleep apnea, reflux, and chronic rhinosinusitis with nasal polyposis. For example, the prevalence of allergic rhinitis is as high as 80% in adult asthmatics.<sup>18</sup> A more detailed description of the association between asthma and other otolaryngologic diseases can be found in Table 1.

## Economic burden

The economic burden of asthma is immense, with asthma costing an estimated \$56 billion in the United States in 2007, which is a 6% increase from the \$53 billion that was spent in 2002.<sup>17</sup> Every year from 2002 to 2007, each person with asthma in the United States costs approximately \$3300 in medical expenses, lost productivity, and early deaths.<sup>17</sup>

The morbidity and diminished quality of life for people suffering from asthma can be striking. More than one-half of people with asthma had an asthma attack in 2008, with more children (57%) than adults (53%) affected.<sup>17</sup> In 2007, there were 1.75 million emergency department visits for asthma exacerbations and 456,000 asthma-related hospitalizations.<sup>24</sup> The average length of stay for an asthma hospitalization was 4.3 days.<sup>25</sup> In 2008, 10.5 million school days and 14.2 million work days were missed because of asthma, with an average of 4 missed school days for children and 5 missed work days for adults.<sup>17,24</sup>

Asthma exacerbations consume substantial resources and result in a large number of emergency department visits. Patients with uncontrolled asthma were found to have a 1.8-fold increase in emergency department visits versus patients without asthma. Furthermore, people with uncontrolled asthma were more likely to be unemployed, miss more days of work, and have more limitations in the types of work and activities they were able to perform.<sup>26</sup> Medical Expenditure Panel Surveys in 2003 and 2005 demonstrated similar findings, with results showing that people with asthma spent 1.4 more days sick in bed annually and were significantly more likely to have activity limitations or to be unable to work. Adults with asthma experienced higher healthcare use and comorbidity, and were more likely to be covered by Medicaid (30%) than the general population (10%). In this study, the largest contributors to medical expenditures for adults were prescription drugs, inpatient hospitalizations, and home health care.<sup>27</sup>

The pediatric population makes up nearly one-half (44%) of all asthma hospitalizations, and asthma is the third highest-ranking cause of pediatric hospitalizations.<sup>25</sup> Fortunately, data collected between 2000 and 2009 showed that the rate of asthma hospitalizations in U.S. children had decreased from 21.1 to 18.4 per 10000 person-years (−13%). Mortality also showed significant decline.

However, there was an increase in the use of mechanical ventilation (28% increase) and nationwide hospital charges (26% increase), driven by a rise in the geometric mean of hospital charges per discharge (42% increase).<sup>28</sup>

A total of 185 children and 3262 adults died from asthma in 2007. The overall number of deaths due to asthma in 2010 was 3404,<sup>17,29</sup> which means that approximately 9 to 10 Americans die from asthma each day. Asthma has also been identified as a “contributing factor” for nearly 7000 other deaths per year, many of which were deemed to have been avoidable with proper management and care.<sup>30</sup>

The senior citizen population (65 years of age and older) accounts for approximately 60% of asthma-related deaths.<sup>30</sup> More females than males die of asthma, with females accounting for 65% of mortalities and males accounting for 35%.<sup>30</sup> Black women have been found to have the highest mortality rate of all groups, a rate that is nearly 2.5 times higher than the mortality rate for white women.<sup>31</sup>

## Conclusion

Asthma remains a prevalent and challenging global health issue, with a tendency to consume valuable health care resources and to reach all areas of the globe. In the United States, asthma has a significant impact on those affected, particularly when taking into account missed work days and the need for extended hospital stays. Furthermore, lost productivity has a considerable financial impact on asthma sufferers. This financial impact is also recognized on a countrywide level, because asthma has indeed become an economic burden in terms of national medical expenditure related its treatment and control. The economic impact of this disease is especially concerning as it has indisputably been on the rise throughout the past few decades, and statistical analyses project a continued rise throughout the upcoming decades. 

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