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The State of Childhood Asthma, United States, 1980–2005

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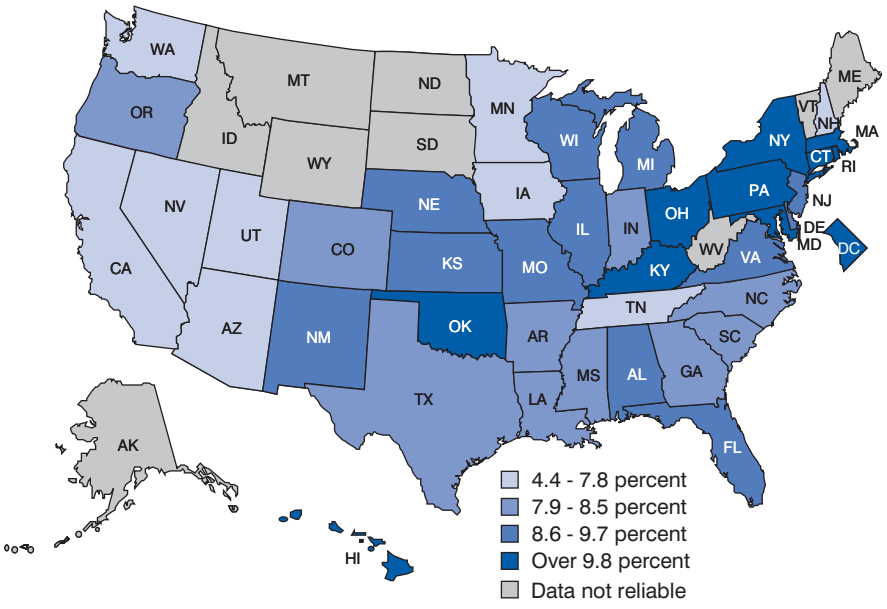
Introduction

Millions of children in the United States are affected by asthma, a chronic respiratory disease characterized by attacks of difficulty breathing. An asthma attack is a distressing and potentially life-threatening experience. Scientific advances have greatly improved the understanding of the mechanisms that cause asthma attacks and have led to effective medical interventions to prevent morbidity and improve quality of life (1). Yet, the burden in prevalence, health care use, and mortality remains high. Asthma remains a significant public health problem in the United States.

Keywords: childhood asthma • prevalence • health care use • mortality

Trend

- Asthma prevalence rates among children remain at historically high levels following dramatic increases from 1980 until the late 1990s.
- Despite the plateau in asthma prevalence, ambulatory care for asthma use has continued to grow since 2000.
- Since 1992, when data first became available, the rate of emergency department visits for asthma has remained relatively stable.



NOTES: Ranges are based on approximate quartiles among states with available estimates. Differences portrayed in this map should be interpreted with caution. The 95 percent confidence intervals for many states overlap. Current asthma prevalence estimates are based on the questions "Has a doctor or other health professional ever told you that {child's name} had asthma?" and "Does {child's name} still have asthma?" Estimates for Delaware, the District of Columbia, Mississippi, Nebraska, Nevada, and New Hampshire have a relative standard error greater than 30 percent and less than or equal to 50 percent and should be interpreted with caution as they do not meet the standard of reliability or precision. The estimates for Alaska, Idaho, Maine, Montana, North Dakota, South Dakota, Vermont, West Virginia, and Wyoming have a relative standard error greater than 50 percent and therefore are not represented in this figure.
SOURCE: CDC/NCHS, National Health Interview Survey.

Figure 1. Current asthma prevalence among children 0–17 years of age, by state, annual average for the period 2001–2005

Current asthma prevalence rates are generally higher in the Northeast region (Figure 1). While it is tempting to attribute prevalence patterns to climate or air quality, many factors affect prevalence and may also vary by region. Some examples include the likelihood that symptomatic children are diagnosed accurately with asthma (2), and population composition. For example, the Puerto Rican population, in which asthma prevalence is highest, tends to be concentrated in the Northeast region of the country (3).

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- Hospitalization rates for asthma have followed a trend similar to those in asthma prevalence rates since 1980 and also remain at historically high levels.
- Asthma death rates appear to have declined recently following a rising trend from 1980 through the mid-1990s.

Recent patterns by age and race/ethnicity

- Asthma prevalence increases with age, but health care use is highest among the youngest children. Boys have higher prevalence and death rates compared with girls throughout childhood.
- Non-Hispanic black and Puerto Rican children have higher prevalence rates compared to non-Hispanic white children. Moreover, rates in adverse outcomes such as emergency department visits, hospitalizations, and death are substantially higher for black children. The disparity in asthma mortality between black and white children has increased in recent years.

The national picture of childhood asthma

A major frustration in fighting asthma is the mystery of its development. It remains unknown why some people get the disease and others do not. Research has identified several factors associated with the development of asthma, but none have proven to be the causative agent. Asthma is characterized by episodes or attacks of inflammation and narrowing of small airways. Symptoms can include shortness of breath, cough, wheezing, and chest pain or tightness, and are triggered by a variety of things such as allergens (e.g., pollen, dust mites, animal dander, etc.), infections, exercise, changes in the weather, and exposure to airway irritants (e.g., tobacco smoke). Some people have mild asthma; others have severe and life-threatening attacks; and some people may have attacks ranging from mild to severe (4). People develop asthma at different stages of their lives, and many subsequently cease to have any symptoms (5). Most likely, the disease known as asthma is a spectrum of conditions, and likewise, the causes of asthma are a complex interaction of different factors. A constellation of causes is likely to gradually emerge.

Asthma is a priority for the research, medical, environmental, and public health communities because:

- Asthma is one of the leading chronic childhood diseases in the United States (6) and a major cause of childhood disability (7).
- Asthma places a huge burden on affected children and their families: asthma may limit a child's ability to play, learn, and sleep; necessitates potentially complex and expensive interventions (8); and results in both direct medical costs and indirect costs (e.g., missed school days and work days).
- Childhood asthma prevalence more than doubled from 1980 to the mid-1990s (9;10) and remains at historically high levels. The factors driving this pattern are still not fully understood.
- The causes of asthma remain unclear and current research paints a complex picture (5).
- Although there are means to prevent attacks or exacerbations among children with asthma (1), the majority of children with asthma still suffer from attacks (11).
- The burden of avoidable emergency department visits and hospitalizations for asthma is high and has remained relatively resistant to intervention efforts (9,11).
- Evidence of the impact of the environment on asthma incidence and morbidity—especially allergens and irritants such as cigarette smoke and outdoor pollutants—has been mounting (12).

This brief report presents overall trends in childhood asthma over the past two decades and examines the burden of asthma through each stage of childhood and among children of different race and ethnic groups. While data for prevalence, health care use, and mortality are major indicators of the impact of asthma on children, asthma symptoms that are unrecognized or not severe enough to warrant emergency care or hospitalization can still lower quality of life. Part of recent efforts to address the burden of asthma involves developing methods to track symptoms and disease management. When available, these new sources of data will provide greater insight into the burden of asthma and the impact of intervention efforts.

Asthma prevalence rates among children remain at historically high levels following dramatic increases from 1980 until the late 1990s

Currently, there are no national measures of asthma incidence, or the rate at which people develop asthma over a period of time. Instead, we focus on asthma prevalence, the percentage of the population that has asthma at a given point in time, and thus face the risk of suffering symptoms and adverse effects of the disease. Prevalence is important as it identifies the population in need of effective measures to control asthma symptoms. Figure 2 shows the trend in asthma prevalence since 1980. The major tracking system for asthma prevalence is the National Health Interview Survey (NHIS), which is used to produce annual health estimates based on self report of a nationally representative sample. From 1980 to 1996, the NHIS measured asthma period prevalence, that is, the percentage of people with asthma in the past 12 months. In 1997, the NHIS questionnaire was redesigned. Starting in 1997, asthma prevalence estimates are based on receiving an asthma diagnosis, currently having the disease at the time of the interview, and experiencing an attack in the past year. The new measure that is most similar to the previous measure of asthma period prevalence is current asthma prevalence—the percentage of children with asthma at the time of the health interview. An analysis of NHIS data before and after the 1997 redesign indicates that if the redesign had not been undertaken, the period prevalence measurements would show a plateau in the late 1990s (13). That is, most of the apparent jump between the 1996 asthma period prevalence estimate from the old NHIS and the 2001 current asthma prevalence estimate is likely attributable to the change in the NHIS questionnaire, and not a substantial change in prevalence.

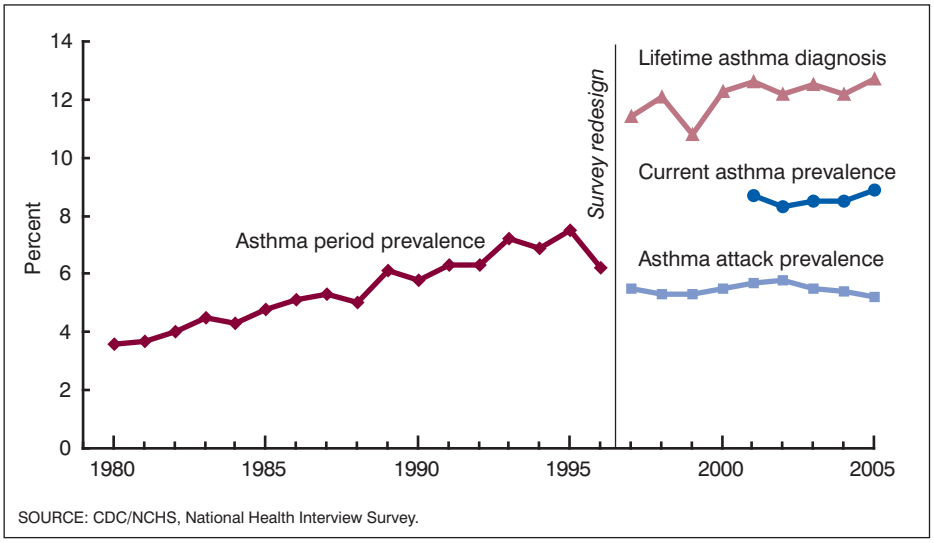


Figure 2. Asthma prevalence among children 0–17 years of age for measures of asthma prevalence available in each year, United States, 1980–2005

- From 1980 to 1996, asthma period prevalence among children 0–17 years of age more than doubled, from 3.6% in 1980 to 7.5% at the peak of the trend in 1995.
- Although not strictly comparable, the most similar post-1997 measure is current asthma prevalence that has been measured since 2001 and has remained relatively stable since then. Because current asthma prevalence estimates are higher than pre-1997 asthma period prevalence estimates, it may be tempting to conclude that asthma prevalence continued to increase after 1996. However, the difference between asthma period prevalence estimates and current asthma prevalence estimates is likely due to NHIS questionnaire changes (13). Nonetheless, prevalence remains at historically high levels. In 2005, 8.9% of children currently had asthma (6.5 million children).
- Asthma attack prevalence measures the percentage of children who had at least one attack over the past 12 months. It is a crude estimate of the percentage of symptomatic children who may have poorly controlled asthma, and thus are at risk of adverse outcomes such as emergency department visits or hospitalization. In 2005, 5.2% of children had at least one asthma attack in the previous year (3.8 million children). Nearly two of every three children who currently have asthma had at least one attack in the past 12 months.
- Lifetime asthma diagnosis measures the percentage of children who have ever received a diagnosis of asthma. It is a more general measure of the impact of asthma among children. Many of these children do not currently have asthma. In 2005, 12.7% of children had been diagnosed with asthma at some point in their lifetime (9 million children), of whom 70% were reported to currently have asthma (6.5 million).
- Measures of asthma morbidity and control are available periodically from the NHIS. In 2003:
  – Children with at least one asthma attack (4 million) in the previous year missed an estimated 12.8 million school days due to asthma.
  – Among children with asthma, 39% reported receiving an asthma management plan from their health care provider, 57% reported being taught how to monitor peak flow, and 52% reported being advised to change things at home or in school to improve asthma management.

Despite the plateau in asthma prevalence, ambulatory care use has continued to grow since 2000

Increasing rates of visits to physician offices and hospital outpatient departments for asthma may indicate increasing prevalence or severity, or reflect progress in addressing the burden of asthma. Clinical practice guidelines from the National Asthma Education and Prevention Program (1) recommend that asthma symptoms be treated early and aggressively. These guidelines also recommend that patients be evaluated for asthma severity, initial treatment be tailored to severity level, and close monitoring of symptoms and adjustment of therapy be continued over time. Poor asthma outcomes such as hospitalizations and deaths are at least partially sensitive to the quality of ambulatory health care (14). An appropriate frequency of outpatient visits is one component of quality ambulatory care. Managing asthma involves close monitoring by health care professionals both when asthma symptoms flare and when the disease is quiescent. Thus, trends in visits for asthma in outpatient settings reflect a spectrum of reasons for making visits to the doctor for asthma (Figure 3).

Visits to physician offices are measured by the National Ambulatory Medical Care Survey (NAMCS), administered in 1980–1981, 1985, and continuously since 1989. In 1992, the National Hospital Ambulatory Medical Care Survey (NHAMCS) began to provide data on visits to hospital outpatient departments. Information is obtained on visit events rather than the number of people who went to see physicians.

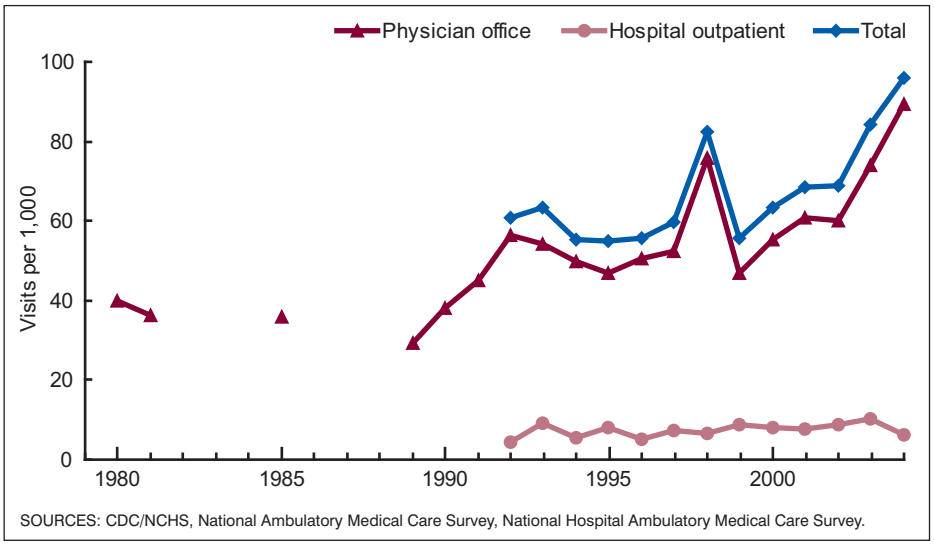


Figure 3. Number of ambulatory visits for asthma per 1,000 children 0–17 years of age, by site, United States, 1980–2004

- The periodic data available from 1980 to 1990 show a relatively stable rate of visits for asthma to physician offices. Since the early 1990s, there has been an increase in visit rates. The temporary increase in 1998 appears to be due to random variation.
- The majority of nonurgent ambulatory visits for asthma occur in physician offices. In 2004, there were 89 visits to physician offices per 1,000 children (6.5 million visits) and 6 per 1,000 children (0.5 million visits) to hospital outpatient departments, a total of 95 visits per 1,000 children, or 7 million ambulatory visits for asthma. Just over 2.5% of all ambulatory visits among children 0–17 years of age made in 2004 were for asthma.
- Ambulatory care use has continued to increase after 2000 despite a plateau in prevalence trends. Factors driving this upward trend may include increasing disease severity, and increased health care use to improve asthma control due to increased public and provider awareness. Increased ambulatory care use for asthma has continued during an era when overall rate of ambulatory care use for children did not increase (15).

Since 1992, when data first became available, the rate of emergency department visits for asthma has remained relatively stable

Asthma attacks or exacerbations are frequently managed in emergency departments (EDs). Having an asthma attack that warrants a visit to the ED may be a sign of severe asthma or uncontrolled disease, inadequate access to specialist health care, or inappropriate use of emergency services (16,17). Recurrent ED visits and hospitalizations are risk factors for fatal asthma attacks (18). In theory, asthma symptoms and poor outcomes are avoidable with implementation of environmental control measures to minimize exposure to allergens and irritants, appropriate medication use, and patient and health care provider education (1). However, recognizing the early signs and symptoms of the disease, avoiding asthma triggers, arranging appropriate health care, and managing the schedule of medication administration can be complex for children and their families. Indeed, evidence shows that children who visit the ED for asthma continue to suffer from symptoms and activity limitations despite having the health encounter in the ED (19). Trends in ED visits (Figure 4) are a crude indicator of the burden of severe and uncontrolled disease on families and the health care system, the impact of public health interventions, the degree of uptake of asthma guidelines in disease management, and the successful translation of research into medical practice.

Data on ED visits are collected by the National Hospital Ambulatory Medical Care Survey (NHAMCS), administered since 1992. Information is available for visit events rather than the number of people who visited EDs.

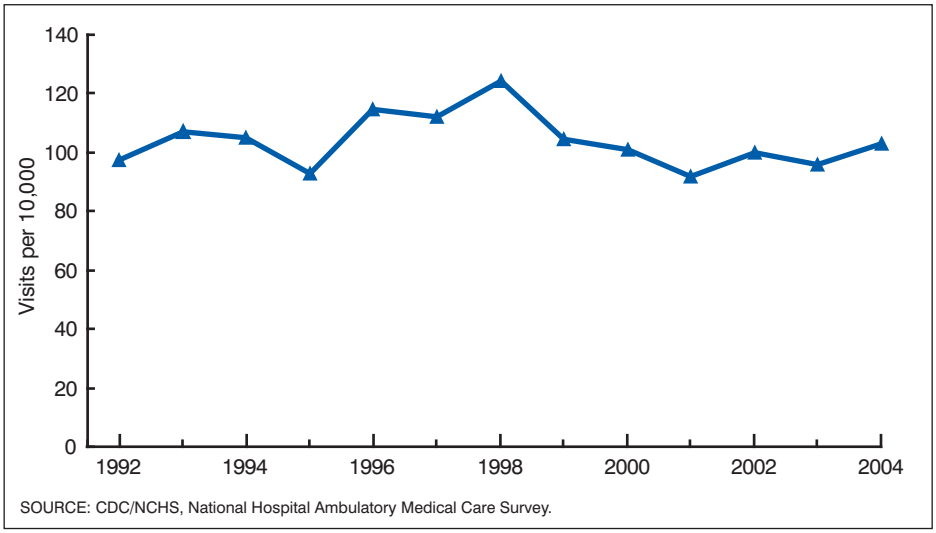


Figure 4. Number of visits to emergency departments for asthma per 10,000 children 0–17 years of age, United States, 1992–2004

- From 1992 to 2004, there is no consistent trend in the rate of ED visits for children. There appears to be an increase in rates until the late 1990s followed by a plateau after 1999.
- In 2004, there were 103 visits per 10,000 children, for a total of 750,000 visits to EDs for asthma. Asthma ED visits represented about 2.8% of all ED visits among children 0–17 years of age in 2004.

Hospitalization rates for asthma have followed a trend similar to those in asthma prevalence rates since 1980 and also remain at historically high levels

An asthma hospitalization represents a severe exacerbation that requires an increased level of monitoring and care. It also represents significant costs to the health care system and to affected families. Risks for hospitalization for asthma include previous asthma admissions, previous intubation for asthma, and severe symptoms (20). In theory, hospitalizations for asthma should be largely preventable if patients and their families are adequately educated about the disease and have access to high quality health care (14). Although some hospitalizations may not be avoidable, especially in very young children suffering from respiratory infections, trends in hospitalization over time (Figure 5) can help determine if intervention and management strategies are having an impact on the burden of disease.

The National Hospital Discharge Survey (NHDS) collects information on hospitalizations. The NHDS counts events (hospitalizations) rather than the number of people who are admitted to hospitals. Although some of the hospitalizations for asthma may be re-admissions, research suggests that re-admissions are not driving the overall pattern for asthma (21).

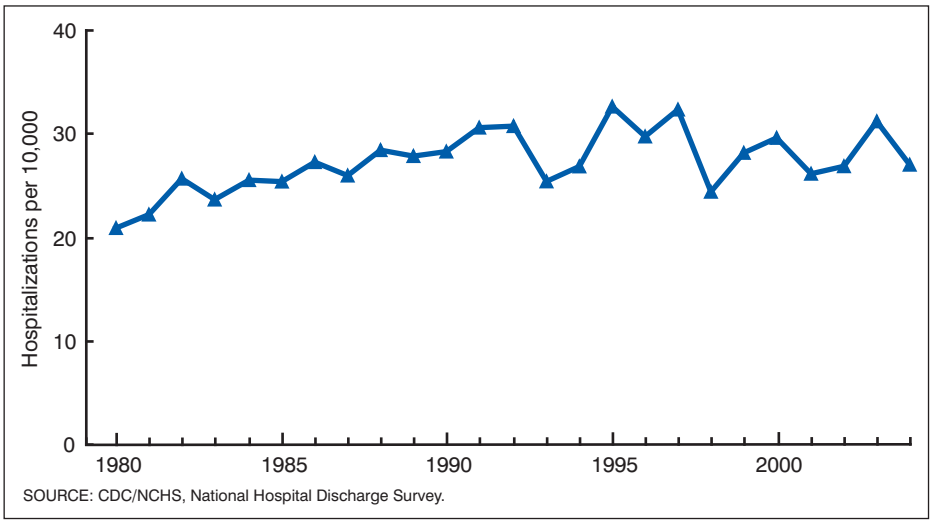


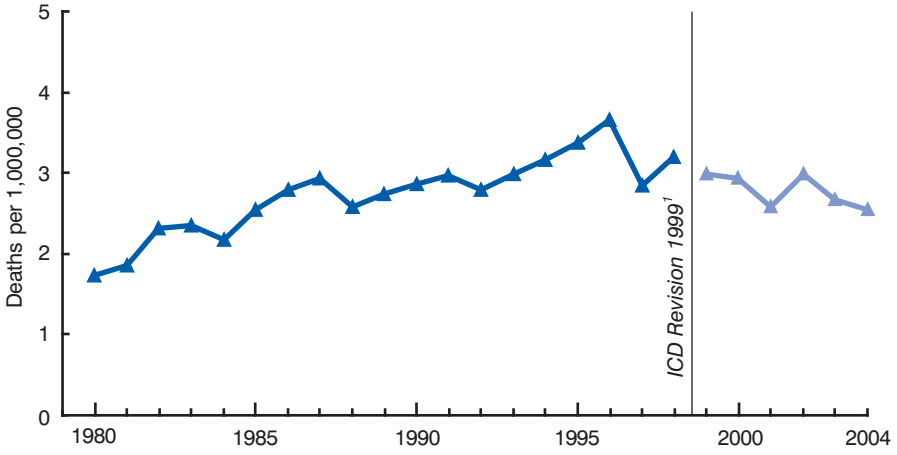
Figure 5. Number of hospitalizations for asthma per 10,000 children 0–17 years of age, United States, 1980–2004

- From 1980 through the mid-1990s, asthma hospitalization rates increased for children 0–17 years of age. This pattern follows that for prevalence, although there is evidence that improved diagnosis of asthma also contributed to the increase in hospitalizations attributed to asthma (9). Since the late 1990s, it appears that the asthma hospitalization rate among children plateaued at historically high levels.
- In 2004, there were 27 hospitalizations for asthma per 10,000 children for a total of 198,000 hospitalizations. Asthma hospitalizations represented about 3% of all hospitalizations among children.
- Many factors drive hospitalization rates among children. Overall hospitalization use among children has decreased over the time period when asthma hospitalization rates remained level (22). The threshold of attack severity for a hospital admission has likely increased. That is, asthma hospitalizations in recent years may represent more severe exacerbations compared with earlier years.

Asthma death rates appear to have declined recently following a rising trend from 1980 through the mid-1990s

Asthma deaths among children are rare but potentially avoidable. Children most at risk of dying from asthma are those with severe, uncontrolled disease, a near-fatal attack of asthma, a history of recurrent hospitalization or intubation for asthma (18). Trends in asthma deaths (Figure 6) are a stark indicator of how well the disease is diagnosed and controlled.

Information on deaths occurring in the U.S. is collected by the Mortality Component of the National Vital Statistics System. The National Center for Health Statistics compiles information abstracted by each state from death records.



[1] Beginning with data year 1999, cause-of-death statistics published by NCHS are classified according to the Tenth Revision of the International Classification of Diseases (ICD-10).
SOURCE: CDC/NCHS, Mortality Component of the National Vital Statistics System.

Figure 6. Number of deaths due to asthma per 1,000,000 children 0–17 years of age, United States, 1980–2004

The impact of asthma varies through the stages of childhood; prevalence increases with age, but health care use is highest among the youngest children

The profile of asthma changes as children get older, as shown in Table A. In general, when asthma burden is examined over the stages of childhood, trends in levels of health care with age are inversely related to trends in prevalence rates. Understanding the characteristics of asthma in each stage of childhood helps to explain this pattern.

Wheezing is common among infants and toddlers because their small airways are more susceptible to any mechanism that impedes airflow, and they have a high incidence of respiratory infections. Definitively diagnosing asthma in infants and toddlers can be difficult given the many etiologies that cause wheezing in very young children. Furthermore, young children who wheeze only during respiratory infections are likely to have transient symptoms (5,23–25). This pattern may make clinicians reluctant to label wheezing as a chronic disease among young children. However, respiratory distress in young children can rapidly become life threatening and warrants prompt attention. For this reason,

- From 1980 to 1998, death rates for asthma climbed steadily. In 1999, the change from the *International Classification of Diseases Ninth Revision* (ICD-9) to the *International Classification of Diseases Tenth Revision* (ICD-10) codes for cause of death resulted in an overall 11 percent decline in deaths attributed to asthma. The coding change therefore accounts for much of the decrease in rates from 1998 to 1999. From 1999 onward, however, the rate of asthma deaths among children has apparently declined.
- In 2004, the rate of asthma deaths was 2.5 asthma deaths per 1 million children, a total of 186 asthma deaths.

Table A. Asthma prevalence, health care use, and mortality among children 0–17 years of age, by age group and sex, United States, 2003–2005

Age and sex	Current asthma prevalence,[1] percent (2004–2005)	Ambulatory visits[2] per 1,000 (2003–2004)	Emergency department visits per 10,000 (2003–2004)	Hospital discharges per 10,000 (2003–2004)	Deaths per 1,000,000 (2003–2004)
0–4 years	6.2	121.1	163.7	61.3	2.0
Male	7.4	160.3	199.6	77.0	2.9
Female	5.0	80.0	126.2	44.9	1.1
5–10 years	9.3	80.2	82.6	23.6	2.3
Male	11.1	86.5	91.8	31.3	2.9
Female	7.4	73.7	72.8	15.6	1.6
11–17 years	10.0	76.9	69.0	11.8	3.3
Male	11.1	71.8	63.5	13.3	4.0
Female	8.8	82.2	74.8	10.2	2.5
Total	8.7	90.0	99.2	29.1	2.6

[1]Current asthma prevalence estimates are based on the questions "Has a doctor or other health professional ever told you that {child's name} had asthma?" and "Does {child's name} still have asthma?"
[2]Includes visits to physician offices and hospital outpatient departments.

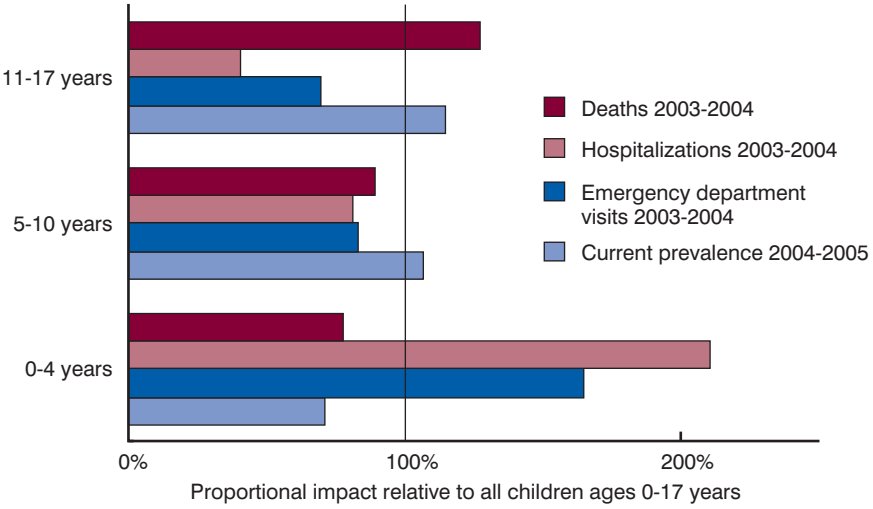
DATA SOURCES: CDC/NCHS: National Health Interview Survey, National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, National Hospital Discharge Survey, and the Mortality Component of the National Vital Statistics System.

utilization of emergency department (ED) and hospital services for asthma is high among this group.

Among school-age children, allergies/atopic sensitization starts to become a more prominent cause of wheezing, and displaces respiratory infections as a main trigger of attacks (5,24). The emergence of more clearly identifiable and predictable symptoms in school-age children allows easier identification and management of asthma compared with younger children. Families, health care professionals, and schools who work well together can successfully control symptoms. However, families coping with other factors that can interfere with good asthma management may be less successful.

Adolescents with asthma need to learn to recognize and treat symptoms independently. Issues with emerging autonomy may accentuate good management strategies, or exacerbate problems with asthma control. The relatively low level of health care use for asthma among adolescents may indicate a combination of patterns among this group: changes in disease severity, higher success in controlling a chronic disease, or lack of medical attention and poor use of medication to relieve symptoms. Of particular concern for adolescents is the higher rate of asthma deaths in this group compared with younger children.

The pattern over childhood differs for boys and girls. Boys experience a higher current asthma prevalence rate throughout most of childhood. By ages 15–17 years, however, the current prevalence rate in girls, 10.5%, has surpassed that among boys, 10.1%. Higher prevalence among females persists among adults. Use of ambulatory and hospital health care services through age 10 years is higher among boys. During adolescence, however, ambulatory care use is greater among 11–17 year old girls compared with boys. Hospitalization rates among adolescent boys, however, remain slightly higher. Asthma death rates among boys remain higher throughout childhood. Death rates rise between school-age and adolescent groups among both genders.



SOURCES: CDC/NCHS, National Health Interview Survey, National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, and the Mortality Component of the National Vital Statistic System.

Figure 7. The proportional impact of asthma prevalence, health care use, and mortality among children 0–17 years of age, by age group, United States, 2003–2005

To better illustrate the impact of asthma across age groups, the prevalence, health care use, and death rates for each group are compared with the rates for all children in Figure 7 to show all outcomes on the same scale. The 100 percent level represents the overall rate for children 0–17 years for each measure, and is shown by the vertical line. Each bar on the chart represents the proportional impact of each outcome for each age group relative to the total for all children ages 0–17 years (e.g., the proportional impact of current asthma prevalence rates among children 0–4 years is 6.2% over the total prevalence for all children, 8.7%, for a proportional impact of 71%). Children 0–4 years have the lowest proportional impact of prevalence. However, the proportional impact of ED visit and hospitalization rates for asthma among the youngest children overshadows that among older age groups. Unlike younger children, the proportional impact of mortality from asthma among adolescents is higher than that for health care use.

Racial disparities in childhood asthma are extensive; black and Puerto Rican children have high prevalence rates, and black children have dramatically higher mortality rates compared with white children

The higher rates of asthma prevalence, ED visits, hospitalizations and deaths among minority children have been well documented (9,26–28). Racial disparities remained evident in asthma prevalence through 2005 (Table B). Children of American Indian or Alaska Native decent have current asthma prevalence rates 25% higher and black children 60% higher than white children. Asian children have the lowest prevalence rates. When race and ethnicity are considered, Puerto Rican children have the highest prevalence of all groups, 140% higher than non-Hispanic white children, whereas Mexican children have low reported rates. In light of these differing prevalence rates, the lower rate for ambulatory care visits among black children compared with white children suggests that black children may be underutilizing ambulatory care. Considering the evidence that minority children do not receive the same level and quality of ambulatory health care

Table B. Asthma prevalence, health care use, and mortality among children 0–17 years of age, by race and ethnicity, United States, 2003–2005

Race and ethnicity	Current prevalence[1], percent (2004–2005)	Ambulatory visits[2] per 1,000 (2003–2004)	Emergency department visits per 10,000 (2003–2004)	Hospital discharges per 10,000 (2003–2004)	Deaths per 1,000,000 (2003–2004)
Race only					
White	7.9	94.8	73.0	16.9	1.5
Black	12.8	76.4	263.7	59.2	9.0
American Indian or Alaska Native	9.9	*	*	*	*
Asian	4.9	*	*	*	*
Race/ethnicity					
Hispanic	7.8	83.3	108.1	**	1.8
Puerto Rican	19.2	**	**	**	*
Mexican	6.4	**	**	**	1.7
Non-Hispanic white	8.0	100.2	65.8	**	1.3
Non-Hispanic black	12.7	71.5	251.6	**	9.2
Total	8.7	90.0	99.2	29.1	2.6

* Estimates are considered unreliable. For ambulatory visit rates, emergency department visit rates and hospital discharge rates, the relative standard error of the estimate is greater than 30%. For death rates, rates based on a number of deaths fewer than 20 are not shown.

** Data not available.

[1]Current asthma prevalence estimates are based on the questions "Has a doctor or other health professional ever told you that {child's name} had asthma?" and "Does {child's name} still have asthma?"

[2]Includes visits to physician offices and hospital outpatient departments.

DATA SOURCES: CDC/NCHS: National Health Interview Survey, National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey, National Hospital Discharge Survey, and the Mortality Component of the National Vital Statistic System.

for asthma (29,30), the disparity in ambulatory care use may contribute to the disparities in ED use, hospitalization, and death. The racial disparities in these adverse asthma outcomes are much greater than those in asthma prevalence. Compared with white children, black children have a 260% higher ED visit rate, a 250% higher hospitalization rate, and a 500% higher death rate from asthma. Unfortunately, information about race/ethnicity and income are not consistently available across the health care data systems used to measure the impact of asthma.

Figure 8 illustrates the impact of these disparities by comparing the rates for asthma prevalence, health care use, and death for each group to the total rate to show all outcomes on the same scale. The 100 percent level represents the overall rate for children 0–17 years for each measure and is shown by the vertical line. Only those groups with data available for all indicators are shown. The proportional impact of prevalence is highest among non-Hispanic black children. However, disparities in adverse asthma outcomes—ED visits and deaths—are much higher. The pattern for the Hispanic group is similar to non-Hispanic white children, although grouping all Hispanic subgroups together masks the possible varied patterns for Puerto Rican and Mexican children.

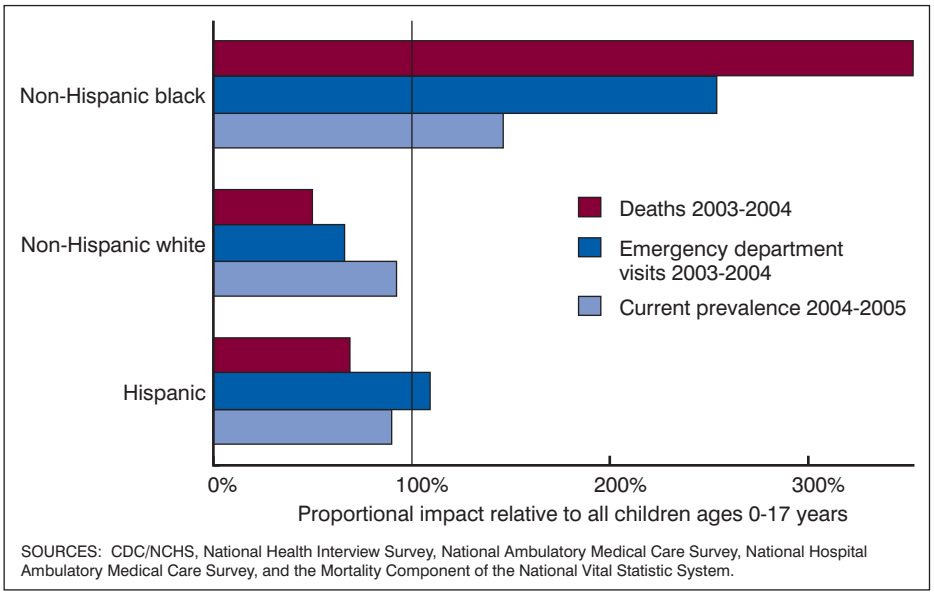


Figure 8. The proportional impact of asthma prevalence, health care use and mortality among children 0–17 years of age, by race and ethnicity, United States, 2003–2005

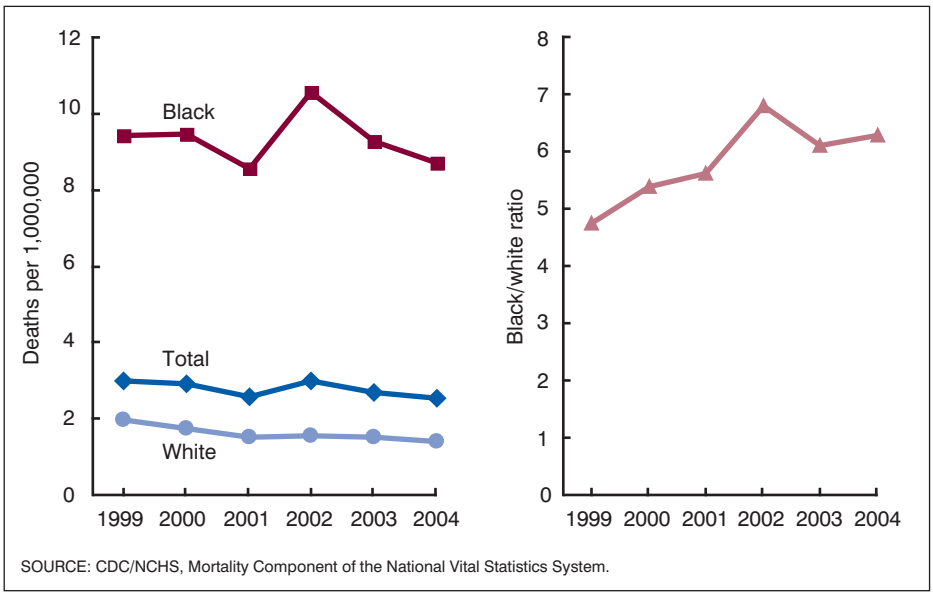


Figure 9a (left). Number of deaths due to asthma per 1,000,000 children 0–17 years of age by race, United States, 1999–2004

Figure 9b (right). Ratio of black to white asthma death rates, children 0–17 years, United States, 1999–2004

Figures 9a and 9b present recent trends in asthma death rates for black children and white children. Although overall asthma death rates have declined since 1999 (Figure 9a), this pattern is not observed for black children among whom death rates remained relatively level. As a result, the black and white disparity for asthma deaths has increased since 1999 as measured by the ratio of the black rate to the white rate (Figure 9b). The lack of progress among black children in lowering mortality from asthma may reflect a number of factors such as more severe disease, greater environmental obstacles (e.g., residence in more polluted or high poverty areas), lag in uptake of medical advances to control asthma symptoms among health care providers who treat black children, and lack of asthma education or difficulties in adopting certain asthma control methods by black families.

Summary

The large increases in the burden of childhood asthma seen in the 1980s until the late 1990s appear to have abated in recent years. Yet, the burden remains at the highest levels recorded for all measures except mortality. The decrease in asthma death rates among children since 1999 is encouraging, and may signal the accomplishments of the many diverse groups working to lighten the burden of asthma. However, asthma deaths are theoretically preventable, and black children have not experienced a decrease in asthma mortality. Furthermore, the measures presented in this report reveal only part of the burden of asthma for children and their families, especially because the measures used rely on a physician accurately diagnosing asthma and either relaying this information to the child's family (prevalence measures) or documenting the condition in medical records (health care use). The most current data show that the challenges of childhood asthma remain and that asthma persists as a significant public health problem.

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Technical Notes

Asthma prevalence data

Prevalence data were obtained from the National Health Interview Survey (NHIS), a cross-sectional household interview survey of the U.S. civilian noninstitutionalized population. Excluded are patients in long-term care facilities, Armed Forces active duty personnel (although dependents are included), and U.S. nationals living in foreign countries. NHIS interviewing is continuous throughout each year, and follows a multistage area probability design that permits the representative sampling of households. From each family in the NHIS, one sample adult and, for families with children under 18 years of age, one sample child are randomly selected to participate in the detailed health survey. A responsible adult, usually a parent, reports in proxy for the sample child.

NHIS obtains information on illnesses, injuries, activity limitation, chronic conditions, health insurance coverage, utilization of health care, other health topics, demographic information, and risk factor data. Special modules and supplements focus on different issues each year. Additional questions about asthma were most recently included in the 2002 and 2003 NHIS.

NHIS has been conducted annually since 1957. In 1997, the questionnaire was redesigned and some basic concepts were changed and other concepts were measured in different ways. Also in 1997, the collection methodology changed from paper and pencil questionnaires to computer-assisted personal interviewing. Since 1997, the annual sample has numbered about 100,000 persons with about 30,000 persons participating in the sample adult and about 15,000 persons in the sample child questionnaires. In recent years, the total household response rate was about 90%.

National estimates from NHIS are produced by using the sample weights. Because the sample weights incorporate U.S. Census estimates of the civilian noninstitutionalized population, no denominators are necessary to compute percentages.

For More Information: See the NHIS website at: http://www.cdc.gov/nchs/nhis.htm.

Physician office visit data

Data on asthma visits to physician offices are obtained from the National Ambulatory Medical Care Survey (NAMCS), a national survey designed to provide information about the provision and use of medical care services in office-based physician practices in the U.S. The survey covers patient encounters in the offices of nonfederally employed physicians classified by the American Medical Association or American Osteopathic Association as ''office-based, patient care'' physicians. Excluded are visits to hospital-based physicians, visits to specialists in anesthesiology, pathology, and radiology, and visits to physicians who are principally engaged in teaching, research, or administration. Telephone contacts and nonoffice visits are also excluded. A multistage probability design is employed. The final stage involves systematic random samples of office visits during randomly assigned 7-day reporting periods. In 1985 the survey excluded Alaska and Hawaii.

Data are collected from medical records on type of providers seen; reason for visit; diagnoses; drugs ordered, provided, or continued; and selected procedures and tests ordered or performed during the visit. Patient data include age, sex, race, and expected source of payment.

The NAMCS, which began in 1973, was conducted annually until 1981, again in 1985, and resumed an annual schedule in 1989. In 2004, 1,961 physicians were in scope and 1,372 participated for a response rate of 65%. Data were provided for 25,286 visits.

National estimates of the number of asthma visits were calculated using survey weights. To obtain visit rates for a group, national estimates of the number of visits were divided by the civilian noninstitutionalized population for that group (see section on population estimates). For More Information: See the Ambulatory Health Care Data website at: http://www.cdc.gov/nchs/about/major/ahcd/ahcd1.htm.

Hospital outpatient and emergency department visit data

Visit data to hospital outpatient departments (OPDs) and emergency departments (EDs) were obtained from the National Hospital Ambulatory Medical Care Survey (NHAMCS) that collects data on the utilization and provision of medical care services provided in hospital OPDs and EDs. The survey is a representative sample of visits to EDs and OPDs of nonfederal, short-stay, or general hospitals. Telephone contacts are excluded. In the NHAMCS OPD survey, a clinic is defined as an administrative unit of the OPD in which ambulatory medical care is provided under the supervision of a physician. If a hospital OPD has five or fewer in-scope clinics, all are included in the sample. For hospital OPDs with more than five clinics, a systematic sample of clinics proportional to size is included in the survey. Visits to eligible EDs and OPDs are systematically sampled over the 4-week reporting period such that about 100 ED encounters and about 200 OPD encounters are selected.

Data are collected from medical records on type of providers seen; reason for visit; diagnoses; drugs ordered, provided, or continued; and selected procedures and tests performed during the visit. Patient data include age, sex, race, and expected source of payment.

Annual data collection began in 1992. In any given year, the hospital sample consists of approximately 500 hospitals, of which 80 percent have EDs and about half have eligible OPDs. Typically, about 1,000 clinics are selected from participating hospital OPDs. In 2004, the hospital response rate was 89% for EDs and 75% for OPDs.

Sample data are weighted to produce national estimates. To obtain visit rates for a group, national estimates of number of visits were divided by the

civilian population for that group (see section on population estimates).

For More Information: See the Ambulatory Health Care website at: http://www.cdc.gov/nchs/about/major/ahcd/ahcd1.htm.

Hospital discharge visit data

Data on asthma hospital discharges were obtained from the National Hospital Discharge Survey (NHDS) that collects and produces national estimates on characteristics of inpatient stays in nonfederal short-stay hospitals in the U.S. Included in the survey are hospitals with an average length of stay of less than 30 days for all inpatients, general hospitals, and children's general hospitals. Excluded are federal, military, and Department of Veterans Affairs hospitals, as well as hospital units of institutions (such as prison hospitals), and hospitals with fewer than six beds staffed for patient use. Two data collection procedures are used in the survey. One is a manual system of sample selection and medical transcription from the hospital records to abstract forms. The second is an automated system in which the National Center for Health Statistics purchases machine-readable medical record data from commercial organizations, state data systems, hospitals, or hospital associations.

Patient information collected includes demographics, length of stay, diagnoses, and procedures. Hospital characteristics collected include geographic region of the country, ownership, and bed size.

The NHDS has been conducted annually since 1965. Hospitals are selected using a modified three-stage stratified design. For 2004, the sample consisted of 501 hospitals, of which 439 responded. Data were collected for approximately 371,000 discharges.

Sample data are weighted to produce national estimates. To obtain hospitalization rates for a group, national estimates of hospitalizations were divided by the civilian population of that group (see section on population estimates). For More Information: See the National Health Care Survey website at: http://www.cdc.gov/nchs.nhcs.htm.

Mortality data

Data on deaths are obtained from the Mortality Component of the National Vital Statistics System (NVSS) that collects and publishes official national statistics on births, deaths, and fetal deaths based on U.S. Standard Certificates. Vital events occurring in the U.S. to non-U.S. residents and vital events occurring abroad to U.S. residents are excluded. By law, the registration of deaths is the responsibility of the funeral director. The funeral director obtains demographic data for the death certificate from an informant.

The physician in attendance at the death is required to certify the cause of death. The mortality file includes demographic information on age, sex, race, Hispanic origin, state of residence, and educational attainment, and medical information on cause of death.

The *International Classification of Diseases* (ICD), by which cause of death is coded and classified, is revised approximately every 10 to 15 years. Beginning with data year 1999, the cause-of-death statistics are classified according to the Tenth Revision of the ICD (ICD-10). Discontinuities between the Ninth and Tenth Revisions for selected causes of death are measured using comparability ratios. For asthma, the comparability ratio for the overall population in 1999 was 0.89. That is, the overall number of deaths attributed to asthma was 11% lower using ICD-10 compared with ICD-9.

Data obtained from the mortality file represent a complete count of deaths. To obtain asthma death rates for a group, the number of deaths was divided by the residential population of that group (see section on population estimates).

For More Information: See the Mortality Data website at: http://www.cdc.gov/nchs/about/major/dvs/mortdata.htm.

Population estimates

The census of population (decennial census) has been held in the United States every 10 years since 1790. Data on sex, race, age, and marital status are collected from 100% of the enumerated population.

Postcensal population estimates are estimates made for the years following a census before the next census has been taken, and are derived by updating counts in the decennial census using a ''components of population change'' approach (accounting for births, deaths, net international migration and net movement of U.S Armed Forces and U.S. civilians). Postcensal population estimates were used to calculate ambulatory visit rates, hospitalization rates and death rates for the years 2001–2004.

With the completion of the decennial census at the end of the decade, intercensal estimates for the preceding decade were prepared to replace the less accurate postcensal estimates. Intercensal population estimates take into account the census of population at the beginning and end of the decade. Intercensal population estimates were used to calculate ambulatory visit rates, hospitalization rates and death rates for the years 1980–1999.

A different data source was used to provide denominators to calculate death rates for Puerto Rican and Mexican children for the period 2003–2004. Population estimates for 0–17 year old children by Hispanic subgroup are not available. However, the Current Population Survey (CPS) website at: http://www.census.gov/population/www/socdemo/hispanic.html collects information on Hispanic subgroup, and so CPS population estimates were used to calculate death rates for Puerto Rican and Mexican children. Because CPS estimates are based on survey data, they are subject to sampling error. In addition, studies have shown that persons self-reported as Hispanic on census and survey records may sometimes be reported as white or non-Hispanic on the death certificate, resulting in an underestimation of deaths and death rates for Hispanic groups. The overall impact of these errors on asthma death rates for Puerto Rican and Mexican children is unknown.

Table I. Data for Figure 1: Percentage of current asthma prevalence among children 0–17 years of age, by state, annual average for the period 2001–2005

	Current asthma prevalence	95% Confidence interval lower bound	95% Confidence interval upper bound
Massachusetts	12.1	9.7	14.5
Hawaii	10.9	4.7	17.1
Oklahoma	10.8	7.7	14.0
Maryland	10.8	8.5	13.2
Rhode Island	10.5	4.7	16.2
Kentucky	10.4	7.4	13.5
District of Columbia	*10.3	2.2	18.4
Ohio	10.2	8.4	12.0
New York	10.2	9.0	11.4
Pennsylvania	9.9	8.2	11.7
Connecticut	9.9	6.8	13.0
Michigan	9.4	7.5	11.2
Illinois	9.0	7.6	10.4
Florida	8.9	7.7	10.1
Kansas	8.8	5.2	12.5
Delaware	*8.8	2.9	14.7
New Jersey	8.8	7.1	10.5
Virginia	8.7	6.8	10.6
Nebraska	*8.7	3.1	14.3
Alabama	8.7	6.1	11.2
New Mexico	8.6	4.6	12.7
Wisconsin	8.6	6.1	11.2
Missouri	8.6	6.4	10.7
Arkansas	8.5	4.5	12.6
Colorado	8.5	5.8	11.1
Mississippi	*8.4	3.5	13.4
Indiana	8.4	6.1	10.7
Louisiana	8.3	5.9	10.7
Oregon	8.1	4.8	11.5
North Carolina	8.1	6.3	9.8
South Carolina	8.1	4.9	11.2
Georgia	7.9	6.1	9.8
Texas	7.9	6.9	8.8
Minnesota	7.8	5.7	10.0
Arizona	7.7	5.7	9.6
New Hampshire	*7.5	1.9	13.1
Washington	7.4	5.4	9.4
Tennessee	7.3	5.0	9.6
California	7.1	6.4	7.8
Iowa	7.1	3.1	11.1
Utah	4.4	2.0	6.8
Nevada	*4.4	1.4	7.4
Alaska	*	. . .	. . .
Idaho	*	. . .	. . .
Maine	*	. . .	. . .
Montana	*	. . .	. . .
North Dakota	*	. . .	. . .
South Dakota	*	. . .	. . .
Vermont	*	. . .	. . .
West Virginia	*	. . .	. . .
Wyoming	*	. . .	. . .

* Estimates are considered unreliable. Estimates preceded by an asterisk have a relative standard error greater than 30 percent and less than or equal to 50 percent and should be interpreted with caution. Estimates not shown have a relative standard error greater than 50 percent.

. . . Category not applicable.

NOTE: Current asthma prevalence estimates are based on the questions ''Has a doctor or other health professional ever told you that {child's name} had asthma?'' and ''Does {child's name} still have asthma?''

DATA SOURCE: CDC/NCHS: National Health Interview Survey.

Table II. Data for Figure 2: Percentage of children 0–17 years of age for measures of asthma prevalence by years of data availability, United States, 1980–2005

	Asthma period prevalence[1]	Lifetime asthma diagnosis[2]	Current asthma prevalence[3]	Asthma attack prevalence[4]
1980	3.6	– – –	– – –	– – –
1981	3.7	– – –	– – –	– – –
1982	4.0	– – –	– – –	– – –
1983	4.5	– – –	– – –	– – –
1984	4.3	– – –	– – –	– – –
1985	4.8	– – –	– – –	– – –
1986	5.1	– – –	– – –	– – –
1987	5.3	– – –	– – –	– – –
1988	5.0	– – –	– – –	– – –
1989	6.1	– – –	– – –	– – –
1990	5.8	– – –	– – –	– – –
1991	6.3	– – –	– – –	– – –
1992	6.3	– – –	– – –	– – –
1993	7.2	– – –	– – –	– – –
1994	6.9	– – –	– – –	– – –
1995	7.5	– – –	– – –	– – –
1996	6.2	– – –	– – –	– – –
1997[5]	– – –	11.4	– – –	5.5
1998	– – –	12.1	– – –	5.3
1999	– – –	10.8	– – –	5.3
2000	– – –	12.3	– – –	5.5
2001	– – –	12.7	8.7	5.7
2002	– – –	12.2	8.3	5.8
2003	– – –	12.5	8.5	5.5
2004	– – –	12.2	8.5	5.4
2005	– – –	12.7	8.9	5.2

– – – Data not available.

[1]Asthma period prevalence estimates are based on the question ''During the past 12 months, did anyone in the family have asthma?''

[2]Lifetime asthma diagnosis estimates are based on the question ''Has a doctor or other health professional ever told you that {child's name} had asthma?''

[3]Current asthma prevalence estimates are based on the questions ''Has a doctor or other health professional ever told you that {child's name} had asthma?'' and ''Does {child's name} still have asthma?''

[4]Asthma attack prevalence estimates are based on the questions ''Has a doctor or other health professional ever told you that {child's name} had asthma?'' and ''Has {child's name} had an episode or attack of asthma in the past 12 months?''

[5]The National Health Interview Survey was redesigned in 1997. Estimates from 1997 onward are not directly comparable to pre-1997 estimates.

DATA SOURCE: CDC/NCHS: National Health Interview Survey.

Table III. Data for Figure 3: Number of ambulatory visits for asthma per 1,000 children 0–17 years of age, by site, United States, 1980–2004

	Physician office visit rate	Hospital outpatient visit rate	Total ambulatory visit rate
1980	42.0	– – –	– – –
1981	36.3	– – –	– – –
1982	– – –	– – –	– – –
1983	– – –	– – –	– – –
1984	– – –	– – –	– – –
1985	36.1	– – –	– – –
1986	– – –	– – –	– – –
1987	– – –	– – –	– – –
1988	– – –	– – –	– – –
1989	29.2	– – –	– – –
1990	38.2	– – –	– – –
1991	45.1	– – –	– – –
1992	56.4	4.4	60.8
1993	54.2	9.0	63.3
1994	49.8	5.4	55.1
1995	46.9	8.0	55.0
1996	50.4	5.3	55.7
1997	52.5	7.3	59.8
1998	76.0	6.5	82.5
1999	46.8	8.9	55.7
2000	55.2	8.1	63.3
2001	60.7	7.9	68.6
2002	60.0	8.7	68.7
2003	74.0	10.3	84.3
2004	89.5	6.3	95.8

– – – Data not available.

DATA SOURCES: CDC/NCHS: National Ambulatory Medical Care Survey, National Hospital Ambulatory Medical Care Survey.

Table IV. Data for Figure 4: Number of visits to emergency departments for asthma per 10,000 children 0–17 years of age, United States, 1992–2004

	Emergency department visit rate
1992	96.8
1993	106.0
1994	103.7
1995	91.2
1996	112.3
1997	109.7
1998	121.4
1999	101.7
2000	100.7
2001	91.7
2002	99.9
2003	95.5
2004	102.9

DATA SOURCE: CDC/NCHS: National Hospital Ambulatory Medical Care Survey.

Table V. Data for Figure 5: Number of hospitalizations for asthma per 10,000 children 0–17 years of age, United States, 1980–2004

	Hospitalization rate
1980	21.0
1981	22.2
1982	25.7
1983	23.7
1984	25.5
1985	25.4
1986	27.3
1987	25.9
1988	28.5
1989	27.9
1990	28.4
1991	30.6
1992	30.8
1993	25.4
1994	26.8
1995	32.7
1996	29.8
1997	32.4
1998	24.4
1999	28.1
2000	29.6
2001	26.2
2002	26.9
2003	31.2
2004	27.1

DATA SOURCE: CDC/NCHS: National Hospital Discharge Survey.

Table VI. Data for Figure 6: Number of deaths due to asthma per 1,000,000 children 0–17 years of age, United States, 1980–2004

Year	Death rate, ICD-9[1]	Death rate, ICD-10[2]
1980	1.7	. . .
1981	1.9	. . .
1982	2.3	. . .
1983	2.4	. . .
1984	2.2	. . .
1985	2.5	. . .
1986	2.8	. . .
1987	2.9	. . .
1988	2.6	. . .
1989	2.7	. . .
1990	2.9	. . .
1991	3.0	. . .
1992	2.8	. . .
1993	3.0	. . .
1994	3.2	. . .
1995	3.4	. . .
1996	3.7	. . .
1997	2.9	. . .
1998	3.2	. . .
1999	. . .	3.0
2000	. . .	2.9
2001	. . .	2.6
2002	. . .	3.0
2003	. . .	2.7
2004	. . .	2.5

. . . Category not applicable.

[1]*International Classification of Diseases, Ninth Revision* (ICD-9).

[2]Beginning with data year 1999, the cause-of-death statistics published by NCHS are classified according to the *International Classification of Diseases, Tenth Revision* (ICD-10). Discontinuities between the Ninth and Tenth Revisions of the ICD for selected causes of death are measured using comparability ratios. For asthma, the comparability ratio for the overall population was 0.89. That is, the overall number of deaths attributed to asthma in 1999 was 11 percent lower using ICD-10 compared with ICD-9.

DATA SOURCE: CDC/NCHS: Mortality Component of the National Vital Statistics System.

Table VII. Data for Figure 7: Proportional impact of asthma prevalence, health care use, and mortality among children 0–17 years of age, by age group, United States, 2003–2005

Age group	Current prevalence 2004–2005	Emergency department visit rate 2003–2004	Hospitalization rate 2003–2004	Death rate 2003–2004
0–4 years	71%	165%	211%	77%
5–10 years	107%	83%	81%	88%
11–17 years	115%	70%	40%	127%

NOTE: Proportional impact is calculated by dividing the outcome for each age group by the outcome for all children 0–17 years of age. For example, the proportional impact of current asthma prevalence rates among children 0–4 years is 6.2 percent over the total prevalence, 8.7 percent, for a proportional impact of 71 percent.

DATA SOURCES: CDC/NCHS: National Health Interview Survey, National Hospital Ambulatory Medical Care Survey, National Hospital Discharge Survey, and the Mortality Component of the National Vital Statistic System.

Table VIII. Data for Figure 8: The proportional impact of asthma prevalence, health care use and mortality among children 0–17 years of age, by race and ethnicity, United States, 2003–2005

Race/ethnicity	Current prevalence 2004–2005	Emergency department visit rate 2003–2004	Death rate 2003–2004
Hispanic	90%	109%	69%
Non-Hispanic white	92%	66%	50%
Non-Hispanic black	146%	254%	354%

NOTE: Proportional impact is calculated by dividing the outcome among each race/ethnicity by the outcome for all children 0–17 years of age. For example, the proportional impact of current asthma prevalence rates among non-Hispanic black children is 12.7 percent over the total prevalence, 8.7 percent, for a proportional impact of 146 percent.

DATA SOURCES: CDC/NCHS: National Health Interview Survey, National Hospital Ambulatory Medical Care Survey, and the Mortality Component of the National Vital Statistic System.

Table IX. Data for Figure 9a: Number of asthma deaths per 1,000,000 children 0–17 years of age, by race, 1999–2004

	White	Black	Total
1999	2.0	9.4	3.0
2000	1.8	9.5	2.9
2001	1.5	8.6	2.6
2002	1.6	10.6	3.0
2003	1.5	9.3	2.7
2004	1.4	8.7	2.5

DATA SOURCE: CDC/NCHS: Mortality Component of the National Vital Statistics System.

Table X. Data for Figure 9b: Ratio of black to white asthma death rates, children 0–17 years, 1999–2004

	Ratio
1999	4.7
2000	5.4
2001	5.6
2002	6.8
2003	6.1
2004	6.3

DATA SOURCE: CDC/NCHS: Mortality Component of the National Vital Statistics System.

Selected federal data sets with asthma content

Data source	Purpose/Scope	Design/Sample/Geographic coverage	Selected asthma content
National Health Interview Survey (NHIS) http://www.cdc.gov/nchs/nhis.htm • Questionnaires, data files and documentation: http://www.cdc.gov/nchs/about/major/nhis/quest_data_related_doc.htm Centers for Disease Control and Prevention (CDC)	The main objective of the NHIS is to monitor the health of the U.S. population through the collection and analysis of data on a broad range of health topics. A major strength of this survey lies in the ability to display these health characteristics by many demographic and socioeconomic characteristics.	• Continuous survey; annual data release • Household face-to-face interview • Nationally representative • Multistage probability sample of the civilian noninstitutionalized population • Geography: National, 4 regions (Northeast, South, Midwest, West), some states Administered by National Center for Health Statistics, CDC	Asthma prevalence: • Lifetime asthma diagnosis • Current asthma prevalence • Asthma attack prevalence Periodic supplements on asthma symptoms, medication use, health care use, and disease control measures (1999, 2002, 2003)
Behavioral Risk Factor Surveillance System (BRFSS) http://www.cdc.gov/brfss/ • Questionnaires: http://www.cdc.gov/brfss/questionnaires/questionnaires.htm • Data files: http://www.cdc.gov/brfss/technical_infodata/surveydata.htm Centers for Disease Control and Prevention (CDC)	The BRFSS is a state-based system of health surveys that collects information on health risk behaviors, preventive health practices, and health care access primarily related to chronic disease and injury. For many states, the BRFSS is the only available source of timely, accurate data on health-related behaviors about issues such as asthma, diabetes, health care access, alcohol use, hypertension, obesity, cancer screening, nutrition and physical activity, tobacco use, and more. Federal, state, and local health officials and researchers use this information to track health risks, identify emerging problems, prevent disease, and improve treatment.	• Continuous survey; annual data release • Telephone interview • Nationally representative • Stratified probability sample, households with telephones among the adult civilian noninstitutionalized population • Geography: National, 50 states, District of Columbia, U.S. Territories. Data available for large metropolitan areas (see Selected Metropolitan/Micropolitan Area Risk Trends: http://apps.nccd.cdc.gov/brfss-smart/SelMMSAPrevData.asp) Administered by National Center for Chronic Disease Prevention and Health Promotion, CDC, conducted by States	Asthma prevalence, adults 18 years of age and over: • Lifetime asthma diagnosis • Current asthma prevalence Periodic supplements on asthma symptoms, medication use, health care use, severity and control Supplement on childhood asthma (2001)
National Asthma Survey and Asthma call-back survey http://www.cdc.gov/nchs/about/major/slaits/nas.htm • Questionnaires and data files for 2002–2003: http://www.cdc.gov/nchs/about/major/slaits/nas.htm Centers for Disease Control and Prevention (CDC)	This survey examines the health, socioeconomic, behavioral, and environmental predictors that relate to better control of asthma. This survey also explores the content of care and health care experiences of persons with asthma. Data for the initial survey, which included a national sample and 4 states, were collected in 2003 and released in the fall of 2005. The survey is now conducted as a call-back interview subsequent to identifying respondents with asthma during the BRFSS interview (above).	• Periodic data collection • Telephone interview • Initial survey (2003–2004) nationally representative • Geography: Initial survey 2003–2004: National and 4 pilot states (AL, CA, IL, TX) Call-back survey: 2005: 3 states, 2006: 25 states, and 2007: 35 states Sponsored by the National Center for Environmental Health, CDC	Asthma experiences: • Time since diagnosis • Medication use • Health care use • Symptoms • Risk factors • Disease management
National Health and Nutrition Examination Survey (NHANES) http://www.cdc.gov/nchs/nhanes.htm • Questionnaires and data files: http://www.cdc.gov/nchs/about/major/nhanes/datalink.htm Centers for Disease Control and Prevention (CDC)	The NHANES combines interviews and physical examinations to assess the health and nutritional status of adults and children in the U.S. The interview includes demographic, socioeconomic, dietary, and health-related questions. The examination component consists of medical and dental examinations, physiological measurements, and laboratory tests. Data from this survey are used in epidemiological studies and health sciences research, which help develop sound public health policy, direct and design health programs and services, and expand health knowledge.	• Continuous since 1999 with data release every 2 years; periodic from 1971–1994 • Household face-to-face interview, physical exam in mobile examination center • Nationally representative • Multistage probability sample of the civilian noninstitutionalized population • Geography: National Administered by National Center for Health Statistics, CDC	Asthma prevalence: • Lifetime asthma diagnosis • Current asthma prevalence • Asthma attack prevalence Spirometry/pulmonary function testing, 1988–1994 Household dust analysis and allergen sensitization data, 2005–2006 Environmental toxin exposure Planned future relevant content: • Spirometry 2007
National Survey of Children's Health (NSCH) http://www.cdc.gov/nchs/about/major/slaits/nsch.htm • Questionnaires and data files: http://www.cdc.gov/nchs/about/major/slaits/nsch.htm Centers for Disease Control and Prevention (CDC)	The NSCH examines the physical and emotional health of children ages 0–17 years. Special emphasis is placed on factors that may relate to well-being of children, including medical homes, family interactions, parental health, school and after-school experiences, and safe neighborhoods.	• Periodic data collection (2003–2004 data released) • Telephone interview • Nationally representative • Stratified probability sample, households with telephones among the civilian noninstitutionalized population (ages 0–17 years) • Geography: National and state estimates Sponsored by Health Resources and Services Administration (HRSA)	Seven asthma questions (ages 0–17 years): • Lifetime asthma diagnosis • Current asthma prevalence • Asthma attack prevalence • Asthma severity • Family burden • Time since medication taken • Hospitalization in past 12 months

Selected federal data sets with asthma content—Con.

Data source	Purpose/Scope	Design/Sample/Geographic coverage	Selected asthma content
Youth Risk Behavior Survey (YRBS) http://www.cdc.gov/HealthyYouth/yrbs/index.htm • Questionnaires: http://www.cdc.gov/HealthyYouth/yrbs/index.htm (see right lower panel) • Data files: http://www.cdc.gov/HealthyYouth/yrbs/data/index.htm Centers for Disease Control and Prevention (CDC)	The YRBS was developed in 1990 to monitor priority health risk behaviors that contribute to the leading causes of death, disability, and social problems among youth and adults in the United States. Six categories of priority health-risk behaviors are monitored.	• Conducted every 2 years • Self-administered questionnaire in school setting • National, state, and local school-based surveys of representative samples of 9th through 12th grade students • Geography: National and state estimates Administered by the National Center for Chronic Disease Prevention and Health Promotion, CDC	Asthma prevalence questions added in 2005 (not directly comparable to NHIS, BRFSS above): • Lifetime asthma diagnosis • Current asthma prevalence • Asthma attack prevalence
National Longitudinal Survey of Youth (NLSY79) http://www.bls.gov/nls/nlsyouth.htm • Questionnaires: http://www.bls.gov/nls/79quex/y79quex.htm • Data files: http://www.bls.gov/nls/nlsy79ch.htm Bureau of Labor Statistics (BLS)	The NLSY79 is a nationally representative sample of 12,686 young men and young women who where 14 to 22 years of age when they were first surveyed in 1979. Annual data collections provide a unique opportunity to study in detail the life course experiences of this sample. In 1986, a separate survey of all children born to NLSY79 female respondents began, greatly expanding the breadth of child-specific information collected. In addition to all of the mother's information from the NLSY79, the child survey includes assessments of each child as well as additional demographic and development information collected from either the mother or child.	• Longitudinal survey; annual interviews • Face-to-face interview • Nationally representative longitudinal sample • Geography: National estimates Administered by the Bureau of Labor Statistics, U.S. Department of Labor	Asthma questions were added for data collection in 2004. 2002 data file contains question on special health care needs and limitations from chronic conditions, including asthma, for the children of NLSY79 female respondents.
Medical Expenditure Panel Survey (MEPS) http://www.meps.ahrq.gov/ • Questionnaires: Household component, including Priority Conditions: http://www.meps.ahrq.gov/mepsweb/survey_comp/survey_results_ques_sections.jsp?Section=PC&Year1=2004&Submit1=Search • Data files: http://www.meps.ahrq.gov/mepsweb/data_stats/download_data_files.jsp Agency for Healthcare Research and Quality (AHRQ)	The MEPS is a set of large-scale surveys of families and individuals, their medical providers, and employers across the United States. MEPS is the most complete source of data on the cost and use of health care and health insurance coverage.	• Continuous survey; annual data release • Household face-to-face interview • Nationally representative • Overlapping panel design sample of the civilian noninstitutionalized population • Geography: National Administered by AHRQ	Health care use, medication and device use, and expenditures for asthma.
National Health Care Survey (NHCS) http://www.cdc.gov/nchs/nhcs.htm • Data files: NAMCS: http://www.cdc.gov/nchs/about/major/ahcd/ahcd1.htm NHAMCS: http://www.cdc.gov/nchs/about/major/ahcd/ahcd1.htm NHDS: http://www.cdc.gov/nchs/about/major/hdasd/nhds.htm Centers for Disease Control and Prevention (CDC)	The NHCS embraces a family of health care provider surveys, obtaining data about the facilities that supply health care, services rendered, and patient characteristics. Data offer the most accurate and detailed data on diagnosis and treatment, as well as on the characteristics of the institutions. These data are used by policymakers, planners, researchers, and others in the health community to monitor changes in the use of health care resources, to monitor specific diseases, and to examine the impact of new medical technologies.	• Annual data release • Multistage sampling design of health care facilities/providers/patient records; medical record abstraction • Geography: National, 4 regions 1. National Ambulatory Medical Care Survey (NAMCS): physician offices 2. National Hospital Ambulatory Medical Care Survey (NHAMCS): hospital emergency departments and outpatient departments 3. National Hospital Discharge Survey (NHDS): nonfederal short-stay hospitals Administered by the National Center for Health Statistics, CDC	Ambulatory, emergency department, and hospital inpatient asthma visits and stays.

Selected federal data sets with asthma content—Con.

Data source	Purpose/Scope	Design/Sample/Geographic coverage	Selected asthma content
Healthcare Cost and Utilization Project (HCUP), HCUPNet, and KID HCUP: http://www.ahrq.gov/data/hcup/ HCUPnet: http://hcupnet.ahrq.gov/ KID: http://www.hcup-us.ahrq.gov/kidoverview.jsp Agency for Healthcare Research and Quality (AHRQ)	• HCUP: a family of health care databases and software tools developed through a Federal-state-Industry partnership and sponsored by AHRQ. • HCUPnet: a free, on-line query system based on data from HCUP. It provides access to health statistics and information on hospital stays at the national, regional, and state level. • The Kids' Inpatient Database (KID): a powerful database of hospital inpatient stays for children. Researchers and policymakers can identify, track, and analyze national trends in health care use, access, charges, quality, and outcomes.	• Annual data release • Medical record abstraction • Geography: National and State 1. State Inpatient Databases: universe of inpatient discharge data from >35 states; >90% of US community hospital discharges. 2. State Ambulatory Surgery Databases: data from ambulatory care encounters in >20 states. 3. State Emergency Department Databases: emergency dept. abstract data for >15 states 4. Nationwide Inpatient sample: 20% stratified sample of U.S. community hospitals. 5. KID: all-payer inpatient care for children. Administered by AHRQ	Ambulatory, emergency department, and hospital inpatient asthma visits and stays.
Mortality Component of the National Vital Statistics System (NVSS) http://www.cdc.gov/nchs/deaths.htm • Data files: underlying cause of death: http://www.cdc.gov/nchs/products/elec_prods/subject/mortucd.htm multiple cause of death: http://www.cdc.gov/nchs/products/elec_prods/subject/mortmcd.htm Centers for Disease Control and Prevention (CDC)	The vital statistics general mortality data are a fundamental source of demographic, geographic, and cause-of-death information. This is one of the few sources of comparable health-related data for small geographic areas and a long time period in the U.S. The data are also used to present the characteristics of those dying in the U.S. to determine life expectancy and to compare mortality trends with other countries.	• Annual data release • Compilation of data from death certificates from 50 states and D.C. • Residential population (includes all deaths within the U.S.) • Geography: National and state Administered by the National Center for Health Statistics, CDC	Deaths with asthma as the underlying or contributing cause of death.

Selected federal asthma resources: pretabulated statistics, interactive data resources, and publications

Resource/Agency	Site content	Asthma-specific content
Behavioral Risk Factor Surveillance System (BRFSS) Centers for Disease Control and Prevention (CDC)	Interactive statistical tool (query system) Statistical tables online	Interactive statistical tool: Prevalence data by geographic location (national/state/territory) and sex, age, race/ethnicity, income, or education: http://apps.nccd.cdc.gov/brfss/ • Adults who have been told they currently have asthma • Adults who have ever been told they have asthma Online asthma prevalence tables by geographic location (state/territory) and sex, age, race/ethnicity, education, or education: http://www.cdc.gov/asthma/brfss/default.htm
National Survey of Children's Health (NSCH) Data Resource Center http://www.nschdata.org/Content/Default.aspx Centers for Disease Control and Prevention (CDC)	Interactive statistical tool (query system) Chartbooks Publications & Presentations	User can produce data tables for asthma by geographic location (National and state) • Percentage of children with asthma-related health issues in past 12 months • Percentage of children with current asthma but no symptoms in past 12 months • The extent to which a child's asthma affects the family • Percentage of children hospitalized for asthma in past 12 months
Youth Risk Behavior Survey (YRBS) Youth Online: Comprehensive Results http://apps.nccd.cdc.gov/yrbss/ Centers for Disease Control and Prevention (CDC)	Interactive statistical tool (query system)	View by health topic—user can choose "other" topics to view asthma results by geographic location (National and state), year, age, sex, and grade: • Percentage of students who had ever been told by a doctor or nurse that they had asthma • Percentage of students who have ever been told by a doctor or nurse that they had asthma and who have asthma but had not had an episode of asthma or an asthma attack during the past 12 months, or who had an episode of asthma or an asthma attack during the past 12 months (i.e., current asthma) • Among students with current asthma, the percentage who had an episode of asthma or an asthma attack during the past 12 months
Medical Expenditure Panel Survey Agency for Healthcare Research and Quality (AHRQ)	Interactive statistical tool (query system) Publications Statistical tables online	Interactive statistical tool: • MEPSnet http://www.meps.ahrq.gov/mepsweb/data_stats/MEPSnetHC.jsp Step 1: Data Source Selection - Select a data year; Step 2: Variable Selection - Choose variables to use; Step 3: (Optional) Variable Recoding - Regroup variables your way; Step 4: (Optional) Record Selection - Select the records you want; Step 5: Descriptive Statistics - Select Show Statistics to generate the statistics. Statistical tables online: • Expenditures by medical condition by service site (customizable by age) http://www.meps.ahrq.gov/mepsweb/data_stats/quick_tables_results.jsp?component= 1&subcomponent=0&tableSeries=2&year=-1&SearchMethod=1&Action=Search Publications: • Statistical brief "Demographic and Clinical Variations in Health Status" http://www.meps.ahrq.gov/mepsweb/data_stats/Pub_ProdResults_Details.jsp?pt=Methodology%20Report&opt=2&id=674 • Persons diagnosed with diabetes, asthma, or hypertension had worse physical health status overall than those who did not have these conditions (adults only) • Use of different medications and devices in children and adults with asthma (forthcoming)
National Center for Health Statistics Centers for Disease Control and Prevention (CDC)	Interactive statistical tools Publications	Interactive statistical tools • Health Data for All Ages: http://www.cdc.gov/nchs/health_data_for_all_ages.htm, and Trends in Health and Aging: http://www.cdc.gov/nchs/agingact.htm. Enter "asthma" into the search box to access interactive tables on asthma prevalence, health care use and mortality. Users can customize tables with any or all of the following characteristics: age, gender, race/ethnicity, and geographic location (national/state depending on data source). • Healthy People Data 2010: http://wonder.cdc.gov/DATA2010focus.htm. Users can view asthma data (national/state depending on data source) on Healthy People Objectives by selecting focus area 24 (respiratory diseases). Publications/Fact sheets • Health E Stat: "Asthma Prevalence, Health Care Use and Mortality, United States" http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm • FASTSTATS asthma page: http://www.cdc.gov/nchs/fastats/asthma.htm • Health, United States: http://www.cdc.gov/nchs/hus.htm (search for "asthma')

Selected federal asthma resources: pretabulated statistics, interactive data resources, and publications—Con.

Resource/Agency	Site content	Asthma-specific content
National Center for Environmental Health Centers for Disease Control and Prevention (CDC)	Publications Resources	List of Morbidity and Mortality Weekly Reports (MMWR) on asthma: http://www.cdc.gov/asthma/asthmadata.htm#mmwr. Updated MMWR Asthma Surveillance Summary to be released in 2007. Asthma Surveillance Data summary: http://www.cdc.gov/asthma/asthmadata.htm#data. Includes overview of asthma surveillance questions on CDC surveys, and links to asthma tables, maps, charts, and slides. Statistical tables online: • Asthma prevalence tables from the National Health Interview Survey (NHIS) for the U.S. by age, sex, race/ethnicity, geographic region, and income: http://www.cdc.gov/asthma/nhis/default.htm. • Asthma prevalence tables from the Behavioral Risk Factor Surveillance Survey (BRFSS) by geographic location (state/territory) and sex, age, race/ethnicity, education, or education: http://www.cdc.gov/asthma/brfss/default.htm CDC asthma resources: http://www.cdc.gov/health/asthma.htm
Agency for Healthcare Research and Quality (AHRQ)	Research syntheses Research findings Ongoing research Quality improvement resources	Research syntheses: • Chronic Care for Low-Income Children with Asthma: Strategies for Improvement Research in Action, Issue 18 http://www.ahrq.gov/research/chasthria/chasthria.htm • Closing the Quality Gap: A Critical Analysis of Quality Improvement Strategies—Volume 5: Asthma (forthcoming–check http://www.ahrq.gov/clinic/epcix.htm) Research Findings: • Child Health Research Findings: http://www.ahrq.gov/research/childfind/ (update in progress). Research in progress: • Grants on Line Database http://www.gold.ahrq.gov/ (Type ''pediatric asthma'' into keyword search box.) Quality Improvement Resources: • Asthma Care Quality Improvement Workbook and Resource Guide for States http://www.ahrq.gov/qual/asthmaqual.htm

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