

Asthma in Minnesota

2005 Epidemiology Report



Asthma Program
Chronic Disease and Environmental Epidemiology
Health Promotion and Chronic Disease
Minnesota Department of Health

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EXECUTIVE SUMMARY

Asthma is one of the most common chronic diseases in the United States, characterized by inflammation and narrowing of the airways. In 2002, asthma accounted for 484,000 hospitalizations and nearly 2 million visits to the emergency room nationally. Asthma is a cause of missed days from school and work, interrupted sleep and limited physical activity. While it cannot be cured, it can be controlled through adequate access to medical care, medications and self-management.

The Minnesota Department of Health Asthma Program has established an asthma surveillance system to better understand and describe the burden of asthma in Minnesota. Tracking different aspects of asthma – the number of people with the disease, visits to the hospital and the emergency room, quality of life, and mortality – are important guides to planning education and intervention programs and to developing policies that are necessary for preventing and controlling asthma in the future.

Overall, Minnesota's asthma rates are lower than national rates; however, within certain subgroups of the population, there are areas of concern. Most significantly, there are large disparities in asthma hospitalizations between those who live in the Minneapolis-St. Paul metropolitan area and those who live in the rest of the state. Asthma hospitalization rates among children under 5 in Minneapolis are almost 50% higher than the national average. School survey data from greater Minnesota suggests that asthma is also having an impact in rural areas of the state in terms of symptoms and missed days from school and other activities. Asthma mortality rates appear to be decreasing; however, rates for those over 65 are higher than the national average.

While much has been learned about asthma in Minnesota, the picture remains incomplete. A major gap is the lack of data on rates of asthma by race and ethnicity. Other gaps include the lack of data on work-related asthma and asthma rates at the community or neighborhood level.

Key Findings:

Adults with Asthma

- An estimated 10.5% of Minnesotans age 18 and older report having ever been told by a doctor they had asthma. Approximately 6.8% of Minnesotans currently suffer from the disease. That translates to an estimated 390,000 Minnesota adults who have a history of asthma and an estimated 255,000 who currently have asthma.
- The prevalence of asthma in Minnesota adults has been stable over the past 10 years.
- Women are more likely than men to report having asthma.
- Adults living in the Twin Cities metropolitan area are more likely to report having asthma than adults in greater Minnesota.

Children

- An estimated 7.9% of Minnesota children age 0-17 are reported to have asthma, which is equivalent to more than 98,000 Minnesota children.

Executive Summary

- Asthma prevalence is higher among students in Minneapolis public schools than in St. Paul public schools.
- Two surveys of students in greater Minnesota show that many Minnesota children are wheezing but have not been diagnosed with asthma. Wheezing is a common symptom of asthma, and while not everyone who wheezes has asthma, a substantial portion of these students may have undiagnosed asthma.

Quality of Life

- Nearly 18% of Minnesota adults with asthma reported one or more days in the past year in which their activities were limited due to asthma.
- 19.5% of families with children who have asthma reported being greatly or moderately affected by their child's health condition.

Asthma Management

- 58% of Minnesota adults with asthma report having had at least one routine checkup for asthma in the past year.
- People with asthma are more likely than those without asthma to receive an annual flu shot.

Obesity and Asthma

- Adults with asthma are more likely than those without asthma to be obese.

Smoking and Asthma

- Adults with asthma are just as likely to smoke cigarettes as those without asthma. Smoking can be a trigger of asthma symptoms.

Health Care Utilization

- 15% of Minnesota adults with asthma visited an emergency room or urgent care center at least once in the past year because of their asthma.
- Asthma hospitalizations are highest among children under the age of 5. Boys under 5 have the highest rates.
- Between 1998 and 2003, statewide asthma hospitalization rates remained relatively stable.
- Asthma hospitalization rates in the seven-county Twin Cities metropolitan area are higher than in any other region in the state. Within the Twin Cities, asthma hospitalization rates are highest in the city of Minneapolis.
- Asthma hospitalization rates peak in the fall, usually September, with the most distinct peaks seen in children.

Mortality

- Asthma mortality rates appear to be decreasing in Minnesota.
- In 2002, there were 91 deaths due to asthma among Minnesota residents; 66% occurred in persons aged 65 and older; of these, 58% were in women.

INTRODUCTION

Asthma is one of the most common chronic diseases in the United States, characterized by episodes of bronchoconstriction (tightening of the muscles around the airways in the lungs) and inflammation (swelling of the bronchial tubes). Symptoms of asthma can include wheezing, breathlessness, chest tightness, and coughing.

A variety of factors can trigger an asthma episode, including viral infections, allergens (like pollen, mold and dust mites), irritants (like second hand smoke and air pollution) and other factors (like aspirin, stress and exercise). However, little is known about the causes of asthma. To date, only exposure to dust mites and second hand smoke among young children have been identified as having the potential to cause asthma (Institute of Medicine, 2000).

Asthma is of increasing concern in Minnesota and across the country due to rising incidence rates, most notably in children. In 2002, asthma accounted for 484,000 hospitalizations (National Hospital Discharge Survey, 2002) and 1.9 million visits to the emergency room nationally (National Hospital Ambulatory Medical Care Survey, 2002). Asthma is a cause of missed days from school and work, interrupted sleep, and limited physical activity. While it cannot be cured, it can be controlled and managed by adequate access to medical care, medications, trigger avoidance, and self-management.

Minnesota was one of four states funded in 1999 by the Centers for Disease Control and Prevention (CDC) to develop approaches to address asthma as an emerging public health problem. In 2002, Minnesota became one of six states funded to implement its state asthma plan. The Minnesota Department of Health (MDH) Asthma Program has established an asthma surveillance system to better understand and describe the burden of asthma in Minnesota.

This report uses all available data sources to provide a picture of the state of asthma in Minnesota. It establishes baselines for asthma prevalence, health care utilization, quality of life and mortality that can be used to evaluate the impact of future public health efforts, plan education and intervention programs, and develop policies that are necessary for preventing and controlling asthma in the future.

Asthma Prevalence

ASTHMA PREVALENCE

Asthma prevalence is a measure of the number of people who have asthma in a particular population at a particular time. In Minnesota we have data on the prevalence of asthma in adults, both statewide and for Hennepin County. Likewise, we have statewide and regional information on the extent to which Minnesota children are affected by asthma, although we know less about trends over time. And we know little about differences in asthma prevalence by racial and ethnic groups.

Asthma prevalence can vary significantly depending on how it is measured. For example, telephone surveys asking about asthma generally show a higher prevalence than studies in which hospital and clinic billing records are used to determine how many people have asthma. This may partially explain the difference between the prevalence of asthma found in adults enrolled in Minnesota's public health insurance plans versus the statewide adult asthma prevalence found by a telephone survey.

Adult Asthma Prevalence

STATEWIDE

Data on the prevalence of asthma in Minnesota adults come from the Behavioral Risk Factor Surveillance System (BRFSS). The BRFSS is a joint CDC/state survey which asks adults age 18 years and older about risk factors for chronic disease. This telephone survey is completed yearly among approximately 4,000 randomly-selected non-institutionalized adults age 18 years and older residing in Minnesota.

The question "Have you ever been told by a health care provider you have asthma?" was used on the Minnesota BRFSS between 1991 and 1999 to estimate *lifetime asthma prevalence*. In 2000, the lifetime asthma question was changed to "Did a doctor ever tell you that you had asthma?" For persons indicating they had a history of asthma, the question "Do you still have asthma?" was asked to estimate *current asthma prevalence*. In addition, the order in which the questions were asked was changed, which, along with the wording changes, may affect the reported asthma prevalence. Since 2001, the question "Have you ever been told by a doctor, nurse or other health professional that you had asthma?" has been used to track lifetime asthma prevalence.

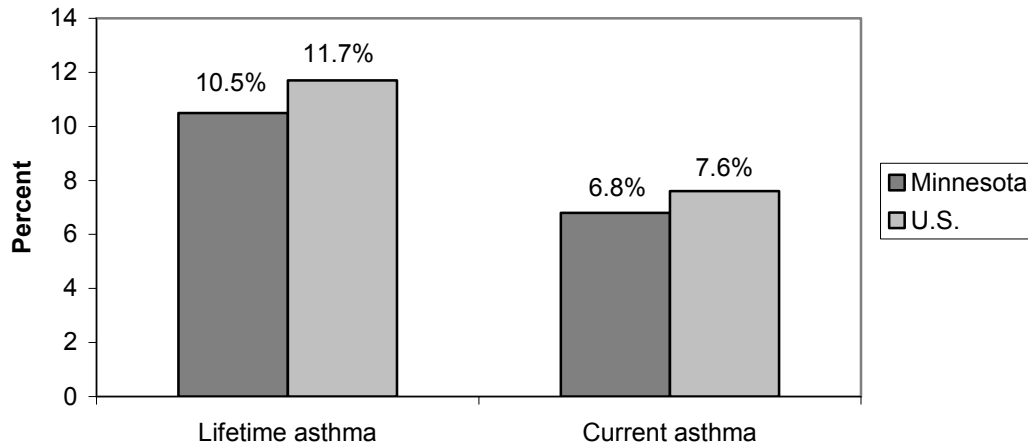
The BRFSS estimates are designed to be representative of all Minnesota adults. The annual cooperation rate in Minnesota is greater than 80%, which is among the highest in the country (2003 Minnesota cooperation rate=83.6%; median for states=74.8%) (CDC, 2003). Because the asthma questions listed above are among the core set of questions which are asked in all states, national comparisons can be made. Although self-report of any disease has limitations, various studies, including one done by MDH, demonstrated that there is a good correlation between a positive answer and the presence of an asthma diagnosis in the medical record (MDH, 1991). A significant advantage of the BRFSS is that information on a wide variety of other factors is also collected at the same time.

Asthma Prevalence

The biggest limitation of the BRFSS is that it only provides data on adults 18 years of age and older who have telephones, speak English, and are not institutionalized. Thus some of the groups at highest risk for asthma may be under-represented. Another limitation is that the sample, while large on a statewide basis, is too small to permit analysis on small groups (for example, by race/ethnicity or by geographic location other than the Twin Cities metropolitan area versus the non-metro area). In addition, small changes in wording or a change in the order of the questions from year to year may cause changes in the estimates. Finally, the BRFSS only tracks diagnosed asthma. People who have symptoms of asthma, but have not yet been diagnosed by a health care provider, would answer “no” when asked if a doctor, nurse, or other health professional had ever told them that they had asthma.

Asthma Prevalence

Figure 1. Lifetime and Current Asthma Prevalence, Minnesota and U.S. Adults, 2003

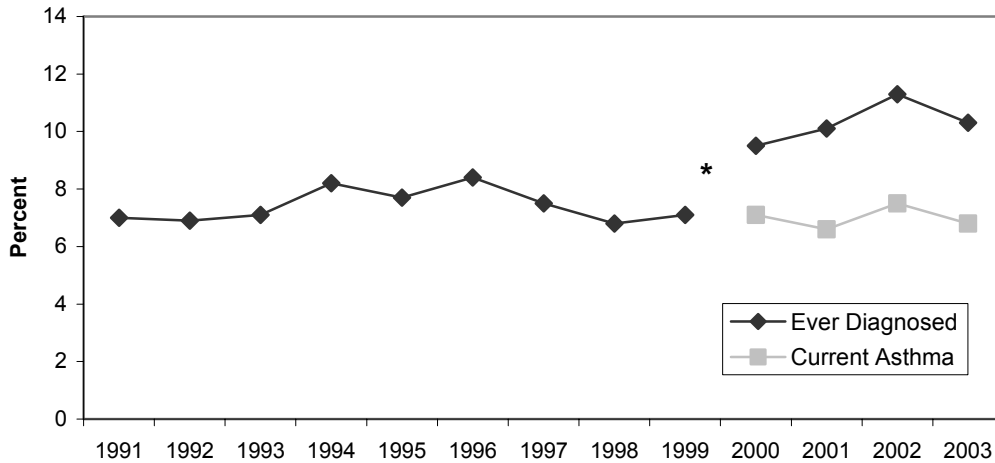


Source: Minnesota BRFSS, 2003

In 2003, 10.5% of adults reported that they had been told sometime in their lifetime that they had asthma; 6.8% reported that they still had asthma. That translates to an estimated 390,000 Minnesota adults who have a history of asthma and an estimated 255,000 who currently have asthma. The prevalence of asthma among Minnesota adults is slightly lower than the median estimate for all states for both lifetime and current asthma.

Among Minnesota adults with asthma, 56.3% were diagnosed when they were younger than age 18, while 43.7% were diagnosed when they were age 18 and older.

Figure 2. Lifetime and Current Asthma Prevalence, Minnesota Adults, 1991-2003



*Change in wording and order of questions in 2000

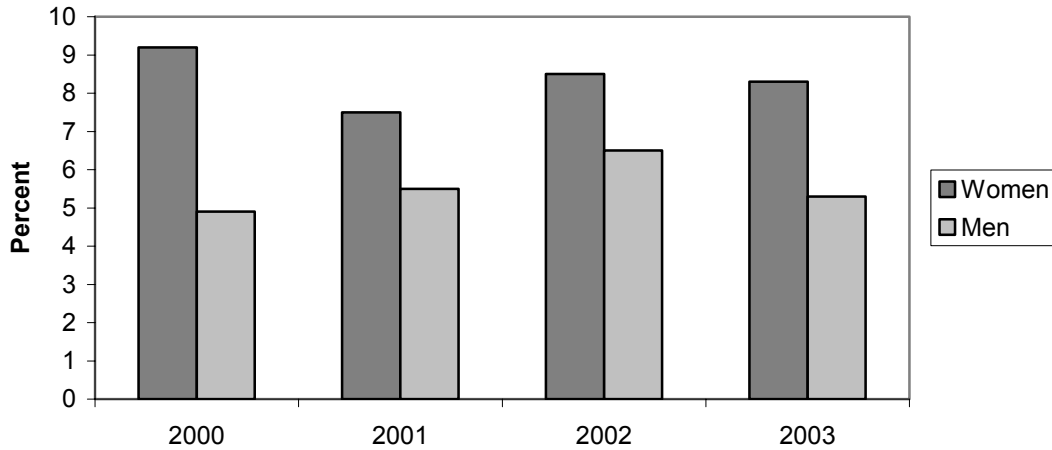
Source: Minnesota BRFSS, 2003

Lifetime asthma prevalence remained fairly stable between 1991 and 1999, ranging from a low of 6.8% in 1998 to a high of 8.4% in 1996. Because of the changes made to the BRFSS survey in 2000, data before and after 2000 cannot be compared. The jump in lifetime asthma prevalence in the year 2000 may be due to the small change in wording or change in order of questions in that year.

In 2000, people who reported a lifetime diagnosis of asthma were asked if they still had asthma (current prevalence). Between 2000 and 2003, the percentage of Minnesota adults who reported having asthma in the past 12 months was relatively stable.

Asthma Prevalence

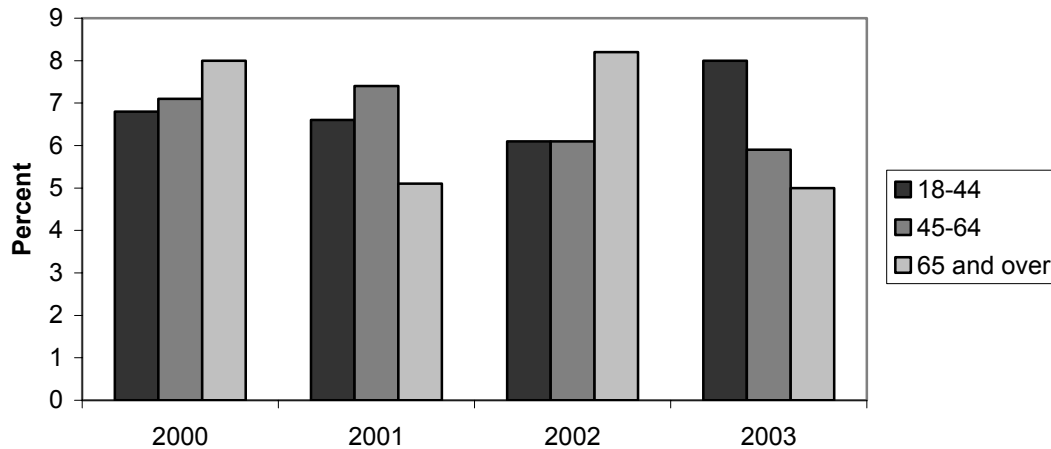
Figure 3. Current Asthma Prevalence by Sex, Minnesota Adults, 2000-2003



Source: Minnesota BRFSS, 2003

Women are generally more likely than men to report that they have asthma. In 2003, the prevalence of asthma among Minnesota women was lower than that for U.S. women (7.5% vs. 9.5%), while the prevalence among Minnesota men was only slightly lower than that for U.S. men (5.3% vs. 5.8%).

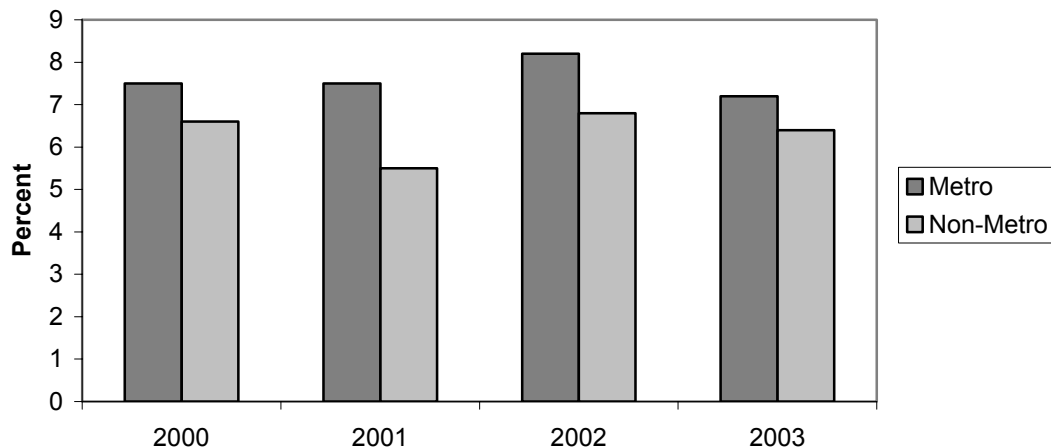
Figure 4. Current Asthma Prevalence by Age Group, Minnesota Adults, 2000-2003



Source: Minnesota BRFSS, 2003

Between 2000 and 2003, there has been a lot of variation in the reporting of current asthma prevalence by age group, with no clear trends. Some of this variation may be due to the relatively small numbers in each age group. According to 2002 data from the National Health Interview Survey, the prevalence of current asthma in the U.S. is higher in children (8.3%) than adults (6.8%).

Figure 5. Current Asthma Prevalence by Residence, Minnesota Adults, 2000-2003



Source: Minnesota BRFSS, 2003

Minnesota adults who are residents of the seven-county Minneapolis-St. Paul metropolitan area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties) are more likely to report having asthma than adults in greater Minnesota.

Asthma Prevalence

HENNEPIN COUNTY

In 1998 and 2002, Hennepin County, the most populous county in Minnesota, conducted its own health survey that included asthma questions taken from the BRFSS. The Survey of the Health of Adults, the Population, and the Environment (SHAPE) provides the only small area prevalence data we have on asthma in adults.

In 2002, 11.2% of Hennepin County adults age 18 and older reported that they had been diagnosed with asthma at some point in their lives and 7.6% reported that they currently had asthma. These numbers are slightly higher than the statewide prevalence rates found by BRFSS. Among those with current asthma, 74.4% reported that they were currently under the care of a health professional for asthma or taking medications to control asthma.

Asthma prevalence within Hennepin County varied by location. The percentage of residents reporting that they currently had asthma ranged from 7.1% in the suburban areas to 8.5% in Minneapolis, although the difference between these two areas was not statistically significant.

Table 1. Lifetime and Current Asthma Prevalence, Hennepin County, 2002

Area	Lifetime Asthma ¹	Current Asthma ²	Current Asthma Under Care ³
	% ±95% C.I.	% ±95% C.I.	% ±95% C.I.
Hennepin County Total	11.2% (10.0-12.4)	7.6% (6.6-8.6)	74.4% (68.3-80.5)
Minneapolis	12.4% (11.2-13.6)	8.5% (7.4-9.6)	73.1% (66.8-79.4)
Suburban Area	10.5% (8.7-12.3)	7.1% (5.6-8.6)	75.3% (65.6-85.0)

95% C.I. = 95% confidence interval

¹Has a doctor or other health professional ever told you that you had asthma?

²Do you still have asthma?

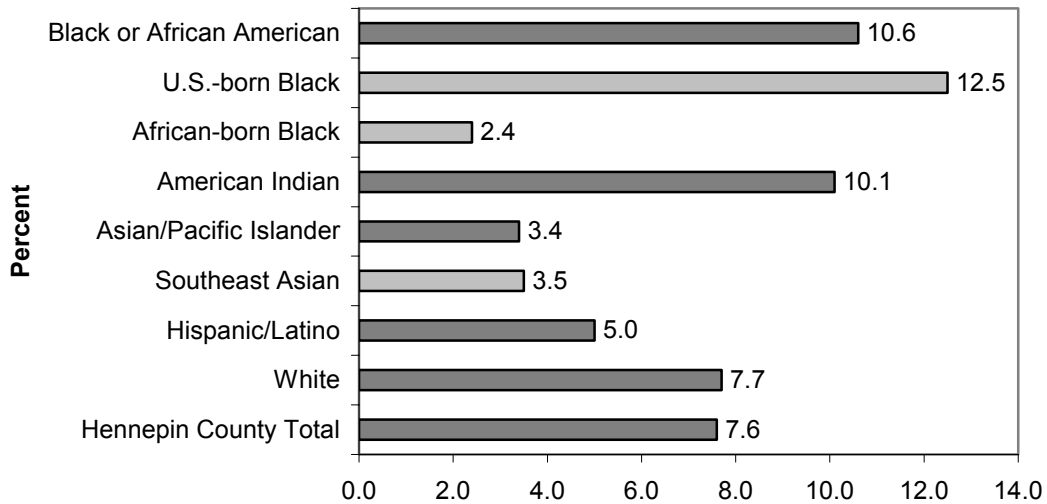
³Are you currently under the care of a doctor or other health professional for this condition or taking medications to control this? (among those who currently have asthma)

Source: Hennepin County SHAPE, 2002

Asthma Prevalence

The SHAPE survey also tracked asthma prevalence by race/ethnicity. One of the most striking observations is that African-born blacks had a much lower prevalence of self-reported asthma (2.4%; 95% confidence interval (CI): 0.1-4.7) than U.S.-born blacks (12.5%; 95% CI: 7.6-17.4).

Figure 6. Current Asthma Rates Among Adults by Racial and Ethnic Groups, Hennepin County, 2002



Note: Hispanic/Latino ethnicity and race are not mutually exclusive
Source: Hennepin County SHAPE, 2002

Asthma Prevalence

Child Asthma Prevalence

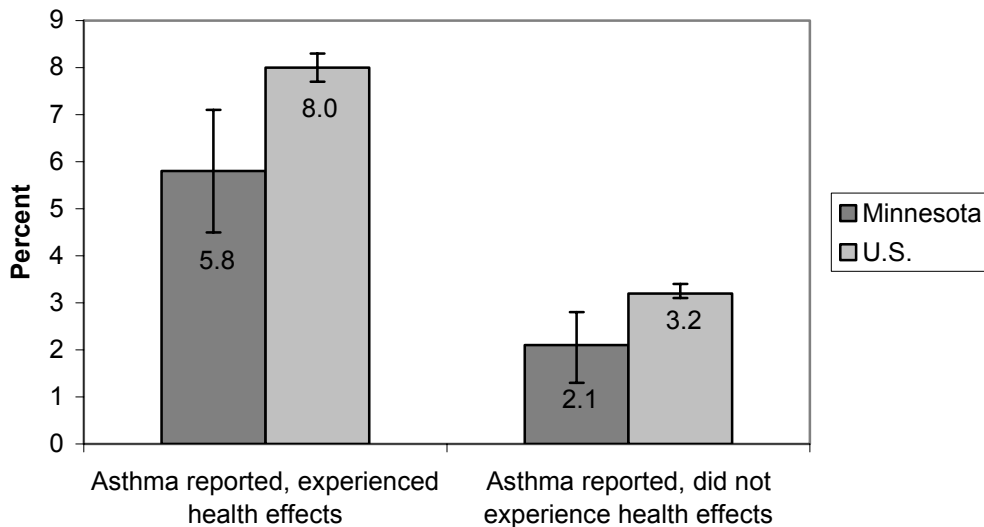
Data on the prevalence of asthma among children in Minnesota come from a number of sources. The National Survey of Children's Health, a telephone survey of households asking parents about their children's health, was conducted between 2003 and 2004 and included questions on asthma. Approximately 2,000 households in Minnesota were included in this survey, so Minnesota-specific rates are available.

Schools are another source of information on asthma in children. Both Minneapolis Public Schools and St. Paul Public Schools keep track of the number of their students who have asthma. In 2000, researchers from the Olmsted Medical Center conducted a study of the prevalence of asthma among school children in Rochester, Minnesota. In addition, MDH has conducted two school asthma surveys, one of middle school students and the other of high school students, that shed light on the impact of asthma on children in greater Minnesota.

STATEWIDE

According to the National Survey of Children's Health, 7.9% of Minnesota children aged 0-17 were reported to have asthma. An estimated 6% experienced asthma-related health effects during the past year, compared with 8.0% nationally. The study also found 19.5% of Minnesota children with asthma whose families were greatly or moderately affected in some way by their child's health condition, compared with 16.3% nationally (not a statistically significant difference).

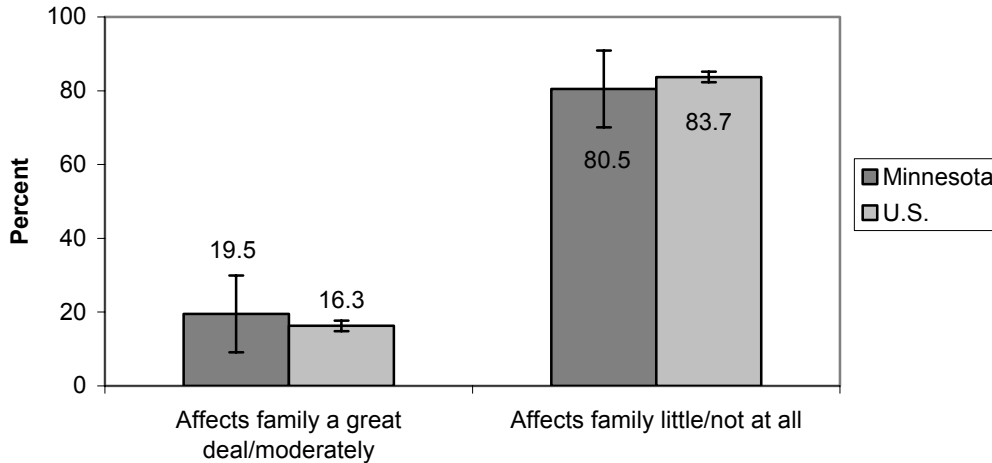
Figure 7. Children/Youth, Age 0-17, Affected by Asthma During the Past 12 Months, Minnesota vs. Nationwide



Source: National Survey of Children's Health, 2003-2004

STATEWIDE

Figure 8. Impact of Child's Asthma on Family, Among Children with Asthma, Minnesota vs. Nationwide

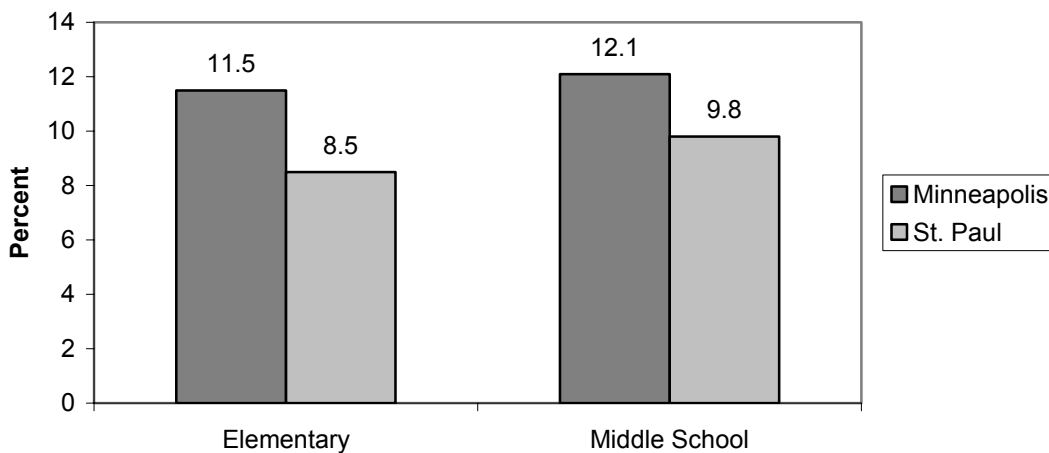


Source: National Survey of Children's Health

MINNEAPOLIS-ST. PAUL

In both elementary and middle schools, the prevalence of asthma is higher in Minneapolis than in St. Paul.

Figure 9. Percentage of Children With Asthma in Minneapolis and St. Paul Public Schools, Fall 2004



Source: Minneapolis Public Schools, St. Paul Public Schools

Asthma Prevalence

ROCHESTER

A study of asthma prevalence among children in kindergarten through grade 12 in Rochester, Minnesota, found that 19.4% had ever been diagnosed with asthma or reactive airways disease (RAD). This finding was based on parent-report and included RAD because it is often used as an alternate diagnosis for asthma (Yawn et al., 2002a).

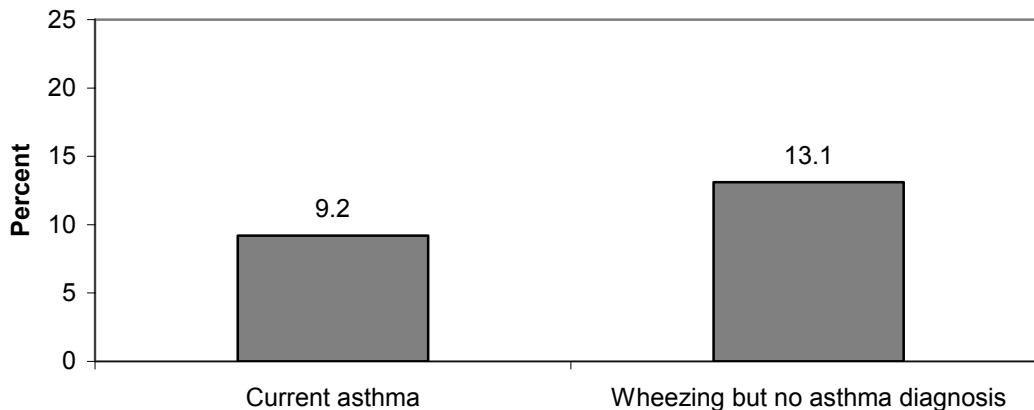
A key finding of this study was that asthma diagnosis rates and socioeconomic status (SES) were directly related; that is, children of lower SES had lower asthma incidence rates than children of higher SES (Yawn et al., 2002b).

GREATER MINNESOTA

Rural High School Survey

In the fall of 2001, MDH surveyed 13,564 students in grades 9-11 (ages 14-17) from a random sample of high schools in rural Minnesota (Brunner et al.).

Figure 10. Percentage of Students Reporting Current and Potential Asthma, Rural Minnesota High School Survey, 2001



Source: Minnesota Department of Health

Key Findings:

- 12.6% reported having ever been diagnosed with asthma.
- 9.2% reported that they currently had asthma.
- An additional 13.1% reported wheezing in the past year but had never been diagnosed with asthma.
- Girls were more likely than boys to report wheezing and asthma.
- 6.5% missed 2 or more days of school in the past month due to asthma.
- 8.0% missed 2 or more days of organized sports in the past month due to asthma.
- 38.5% of the students with asthma reported having a written asthma action plan.
- 15.4% of students with asthma reported that they smoked while 10.1% of students who did not have asthma or asthma-like symptoms reported smoking. This difference is statistically significant ($p < 0.01$).

- 36.8% of the students with asthma reported that they lived in a household where someone smokes, while 31.0% of students who did not have asthma reported that they lived in a household where someone smokes. This difference is also statistically significant ($p < 0.01$).
- Even among non-smoking students, those with asthma were more likely to report living in a household with a smoker (31.1% vs. 28.3%; $p = 0.06$).
- Students who reported asthma-like symptoms but had never been diagnosed with asthma were the most likely to live in a household where someone smokes.

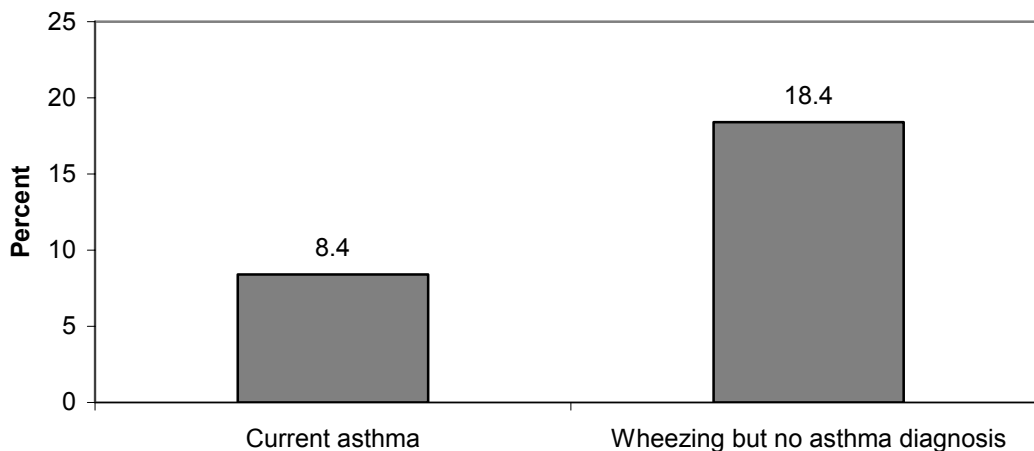
For further information, see fact sheet available at:

<http://www.health.state.mn.us/divs/hpcd/cdee/asthma/Research.html>.

Middle School Survey

In the spring of 2003, MDH surveyed 5,176 students in grades 7 and 8 from 15 schools in greater Minnesota. These schools were selected based on their willingness to participate; thus the findings are not necessarily representative of all middle school students in greater Minnesota (MDH, 2003).

Figure 11. Percentage of Students Reporting Current and Potential Asthma, Minnesota Middle School Survey, 2003



Source: Asthma Program, Minnesota Department of Health

Key Findings:

- 8.4% reported that they had asthma.
- 18.4% reported wheezing or tightness in the chest, but no asthma diagnosis.
- 24% missed one or more days of school in the past school year due to asthma symptoms.
- 36% missed recess, sports or other activities in the past year due to symptoms of asthma.
- 34% of the students with asthma reported having an asthma action plan.

Asthma Prevalence

- 46% of the students with asthma reported that they lived in a household with someone who smokes

This survey was repeated in the spring of 2005 and the results will be available in fall 2005. A report on the 2003 survey can be found at:

<http://www.health.state.mn.us/divs/hpcd/cdee/asthma/Research.html>.

The results of the middle and high school surveys show that many Minnesota children are wheezing but have not been diagnosed with asthma. Wheezing is a common symptom of asthma, and while not everyone who wheezes has asthma, a substantial portion of these students may have undiagnosed asthma.

Those who have been diagnosed with asthma are missing school, sports, and other activities. Only one third of the students with asthma have written asthma action plans. Asthma action plans contain individualized information on what symptoms to watch for and what actions to take when these symptoms occur.

The results also demonstrate the potential impact that smoking is having on children with asthma whether from their own smoking or through exposure to second-hand smoke. Secondhand smoke is strongly linked to the development of asthma in young children and is a known trigger of asthma attacks in both adults and children (Institute of Medicine, 2000).

ASTHMA AMONG MINNESOTA’S PUBLIC HEALTH INSURANCE PROGRAM ENROLLEES

In 2001, the Minnesota Department of Human Services contracted for a study of asthma among enrollees in the state’s publicly funded health insurance programs: Prepaid Medical Assistance (PMAP), MinnesotaCare, and Minnesota Senior Health Options (MSHO). Conducted by the Michigan Peer Review Organization, this study looked at the prevalence of persistent asthma between 1998 and 2000, as well as the quality of care received (Minnesota Department of Human Services, 2003).

For this study, persistent asthma was defined by the following Health Plan Employer Data and Information Set (HEDIS) 2001 “Use of Appropriate Medications for People with Asthma” criteria:

- filling of prescriptions at least 4 times for asthma medications; or
- at least one ED visit or hospitalization due to asthma; or
- a combination of at least 4 physician office visits and filling of at least 2 asthma medication prescriptions.

Individuals meeting the HEDIS criteria who were continuously enrolled in the same health plan over the two year period of the study year plus the previous year were identified as persistent asthmatics.

Note that the definition of persistent asthma used here is more specific than typical survey questions for asthma (i.e., “Has a doctor ever told you that you have asthma?”, “Do you still have asthma?”). Also, studies have shown that asthma prevalence rates based on records are generally lower than those found through surveys, like BRFSS. Both of these factors may contribute, in part, to the lower prevalence of asthma observed in this study versus the overall statewide prevalence.

Minnesota’s Public Health Insurance Programs:

Prepaid Medical Assistance Program (PMAP) provides health care to enrollees who qualify for medical assistance in 63 of Minnesota’s 87 counties.

MinnesotaCare is a program that provides health insurance for Minnesotans with low and moderate incomes who do not qualify for other health insurance coverage.

Minnesota Senior Health Options (MSHO) provides care to residents age 65 and older who are eligible for both Medicaid and Medicare.

Public Health Insurance Enrollees

Table 2. Minnesota Public Health Insurance Enrollees with Persistent Asthma, 2000

	Percent
Program	
MinnesotaCare	3.5%
PMAP	4.6%
< 65 years	3.4%
≥ 65 years	8.5%
MSHO	9.1%
Age Group	
1-4 years	4.4%
5-9	2.9%
10-17	3.4%
18-34	3.1%
35-64	3.8%
65+	8.6%
Sex	
Male	3.9%
Female	4.2%
Residence	
Metro	4.1%
Non-Metro	4.1%
Race/Ethnicity	
African American	4.8%
American Indian/Alaskan Native	4.4%
Asian	1.3%
Multiracial	6.8%
Pacific Islander/Native Hawaiian	0.0%
White	4.6%
Hispanic/Latino	4.3%

Hispanic/Latino and race not mutually exclusive.

Source: Minnesota Department of Human Services

From 1998 to 2000, the prevalence of persistent asthma increased from 3.5% to 4.1%.

Note that the high prevalence of asthma in the 65 and older age group—reflected in the higher prevalence for MSHO and PMAP (≥ 65 years)—may be due to the difficulties in diagnosing asthma in this age group. Some of the medications used to treat asthma are also used to treat conditions like chronic obstructive pulmonary disease (COPD), and so by the HEDIS criteria, might be incorrectly categorized as persistent asthma.

Interestingly, this study showed no difference in the overall prevalence of persistent asthma between those enrollees living in the seven-county Twin Cities metropolitan area versus greater Minnesota.

Public Health Insurance Program Enrollees

A key finding of this study of persistent asthma in these programs was low clinician and patient compliance with Minnesota (Institute for Clinical Systems Improvement (ICSI)) and national (National Asthma Education and Prevention Program (NAEPP)) clinical guidelines.

- Between 1998-2000, 51.5% - 56.2% of the population met the HEDIS measure for use of appropriate medications for people with asthma.
- Between 1998-2000, 44.5% - 48.2% of 1-39 year olds met the ICSI criteria for use of appropriate medications.
- “Enrollees of Minnesota Health Care Programs were less likely to require emergency department or hospital care for an asthma exacerbation if their asthma outpatient (clinic) care followed national guidelines.” (section 1, page 4)

Asthma Symptoms and Severity

ASTHMA SYMPTOMS AND SEVERITY

The severity of an individual's asthma *prior to treatment* can be determined based on how often they experience daytime and nighttime asthma symptoms, along with the results of their lung function testing. The National Heart, Lung, and Blood Institute's Guidelines for the Diagnosis and Management of Asthma provides a scheme for classifying asthma severity (National Heart Lung and Blood Institute, 2002). Note that an asthma severity classification is based on having any feature that fits that category. For example, an individual with daytime symptoms less than 2 days per week, but frequent nighttime symptoms would be classified as severe persistent.

Table 3. Asthma Severity Classifications, National Asthma Education and Prevention Program Guidelines, 2002

	Clinical Features Before Treatment			
	Symptoms		Lung Function	
Severity Classification	Daytime	Nighttime	PEF* or FEV ₁ **	PEF Variability
<i>Step 4</i> Severe Persistent	Continual	Frequent	≤60%	>30%
<i>Step 3</i> Moderate Persistent	Daily	>1 night per week	>60% - <80%	>30%
<i>Step 2</i> Mild Persistent	>2 days per week but <1 time per day	>2 nights per month	≥80%	20-30%
<i>Step 1</i> Mild Intermittent	≤2 days per week	≤2 nights per month	≥80%	<20%

*PEF=Peak expiratory flow

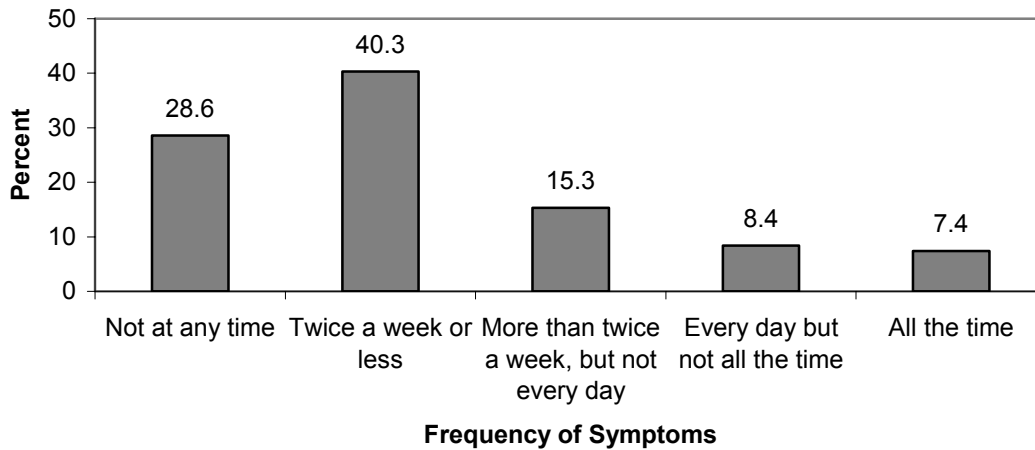
**FEV₁=Forced expiratory volume in 1 second

Source: National Heart, Lung, and Blood Institute (NHLBI), 2002

Daytime Symptoms

Of those Minnesota adults with asthma, 31.1% reported that they experienced daytime asthma symptoms, including cough, wheezing, shortness of breath, chest tightness or mucus production, more than twice a week (equivalent to mild persistent or higher severity).

Figure 12. Frequency of Daytime Asthma Symptoms in Past Month Among Minnesota Adults with Asthma, 2003



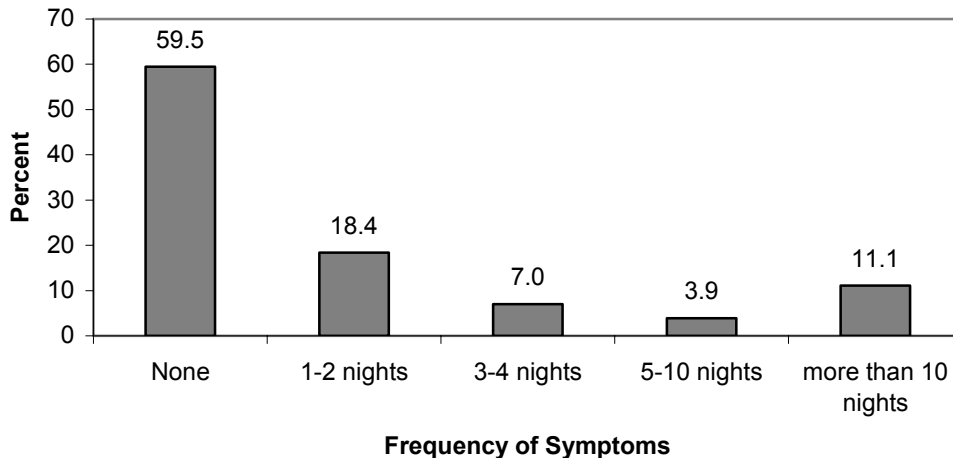
Source: Minnesota BRFSS, 2003

Asthma Symptoms and Severity

Nighttime Symptoms

Of those Minnesota adults with asthma, 22% reported that asthma symptoms made it difficult for them to stay asleep more than two nights in the past month (equivalent to mild persistent or higher severity).

Figure 13. Frequency of Nighttime Asthma Symptoms in Past Month Among Minnesota Adults with Asthma, 2003



Source: Minnesota BRFSS, 2003

The frequency of asthma symptoms is related to both the severity of the disease in an individual and control with appropriate medication. The preceding charts do not distinguish between individuals with severe asthma and those whose asthma is not under control.

Asthma Attacks

Asthma attacks are episodes during which asthma symptoms escalate causing bronchoconstriction, increasing airway inflammation and excessive mucus production. An individual with asthma may experience an exacerbation of their symptoms when exposed to a trigger or irritant. Exercise can also be a trigger of an asthma episode.¹ Attacks are indicative of how severe an individual's asthma is and/or whether it is being appropriately treated. More than half (61%) of Minnesota adults with asthma report having had an asthma attack in the past 12 months.

¹ We do not have data specific to the prevalence of exercise-induced asthma in Minnesota to include in this report.

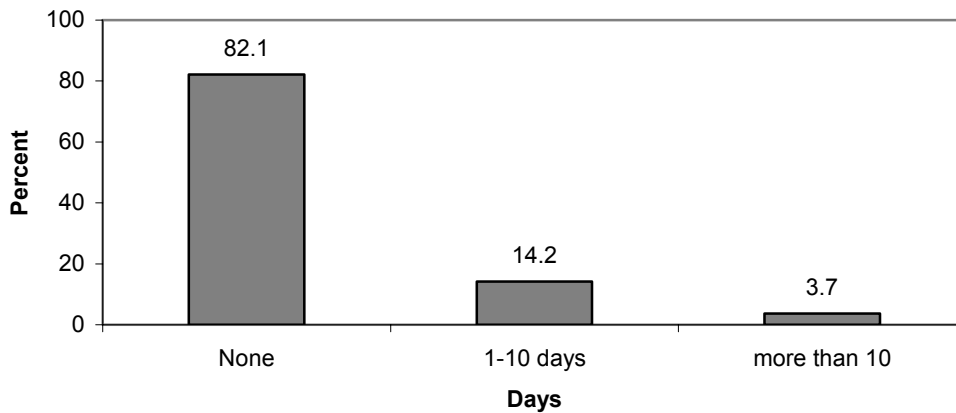
QUALITY OF LIFE

Uncontrolled asthma can negatively impact one’s quality of life. Theoretically, people who have asthma that is under control can lead healthy, active lives. According to the NHLBI guidelines, the goals of asthma management include the prevention of recurring asthma symptoms and exacerbations, and maintenance of normal levels of physical activity (NHLBI, 2002).

Activity Limitations

Nearly 18% of Minnesota adults with asthma reported one or more days in which they were unable to work or carry out their usual activities because of their asthma.

Figure 14. Number of Days in Past Year with Activity Limitations Due to Asthma, Minnesota Adults, 2003



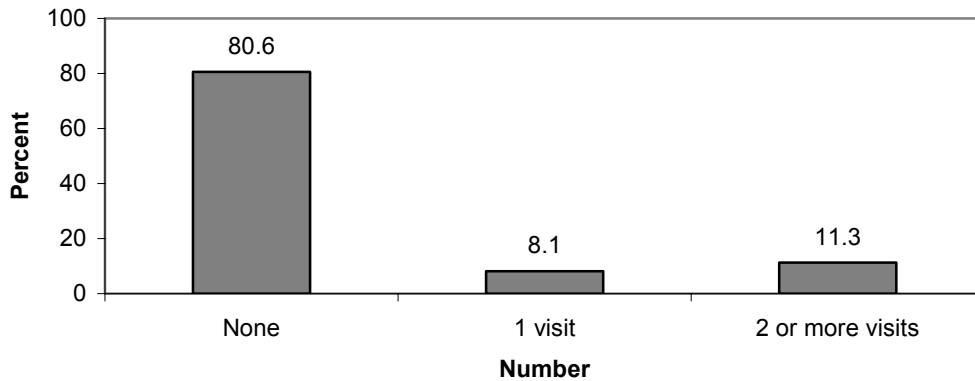
Source: Minnesota BRFSS, 2003

Quality of Life

Urgent Doctor Visits

Nearly 20% of Minnesota adults with asthma reported seeing a doctor, nurse, or other health professional at least once in the past year for urgent treatment of worsening asthma symptoms.

Figure 15. Number of Urgent Visits for Worsening Asthma Symptoms in Past Year Among Minnesota Adults with Asthma, 2003

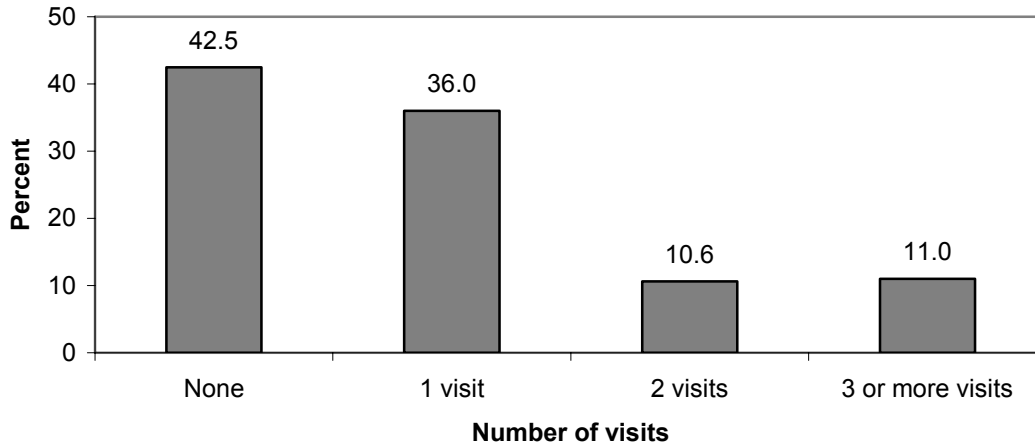


Source: Minnesota BRFSS, 2003

ASTHMA MANAGEMENT

Routine Asthma Checkups

Figure 16. Number of Routine Asthma Checkups in Past Year Among Minnesota Adults with Asthma, 2003



Source: Minnesota BRFSS, 2003

Among Minnesota adults with asthma, 58% report having had at least one routine checkup for asthma in the past year. NHLBI guidelines for asthma management suggest that individuals who have mild intermittent or mild persistent asthma that has been under control for at least 3 months should see their doctor for an asthma checkup about every 6 months. The guidelines recommend that those with asthma that is not under control (i.e., experiencing frequent exacerbations) and/or those with severe persistent asthma should be seen more often (NHLBI, 2002).

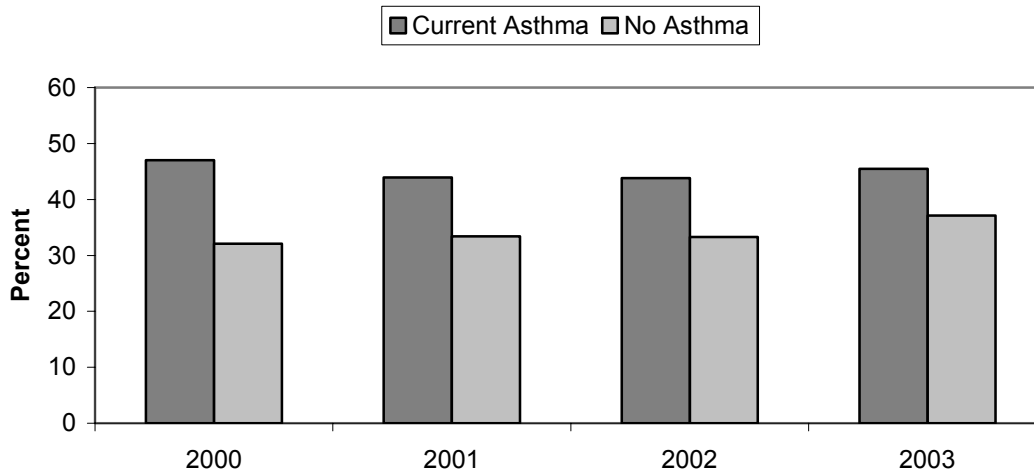
Asthma Medication Use

Of those Minnesota adults with asthma, 71.4% report taking asthma medication in the past 30 days. This is not necessarily an indication of the percentage of adults whose asthma is under control. It is possible to overuse a quick reliever (bronchodilator), an indication of asthma that is not under control.

Asthma Management

Vaccinations

Figure 17. Flu Shot in Past Year by Asthma Status, Minnesota Adults, 2000-2003

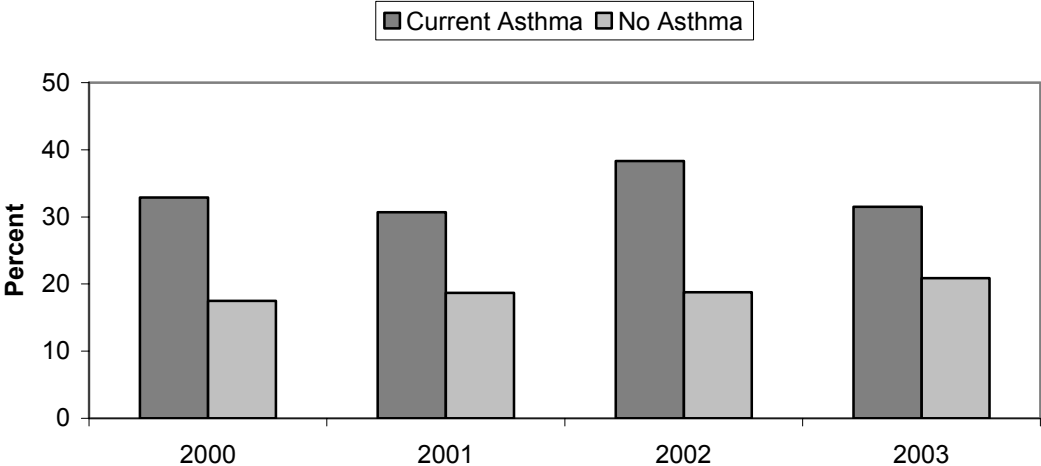


Source: Minnesota BRFSS, 2003

Adults with asthma are more likely to report receiving a flu shot in the past year than those without asthma. This finding is encouraging since people with asthma are more likely to become seriously ill if they contract influenza. Annual flu shots are recommended for people with asthma (NHLBI, 2002). Nonetheless, with less than half of those with asthma reporting a flu shot in 2003, there is clearly a need to increase the proportion of people with asthma who receive an annual flu shot.

The CDC reports that among adults aged 18-64 years with asthma, 34% reported receiving a yearly flu shot in 2003. Minnesota's rate for this year was 40.1%. For those with asthma aged 65 and older, the median rate for the country was 69.9%, with Minnesota the highest at 80.3% (CDC, 2004).

Figure 18. Ever Had Pneumonia Vaccine by Asthma Status, Minnesota Adults, 2000-2003



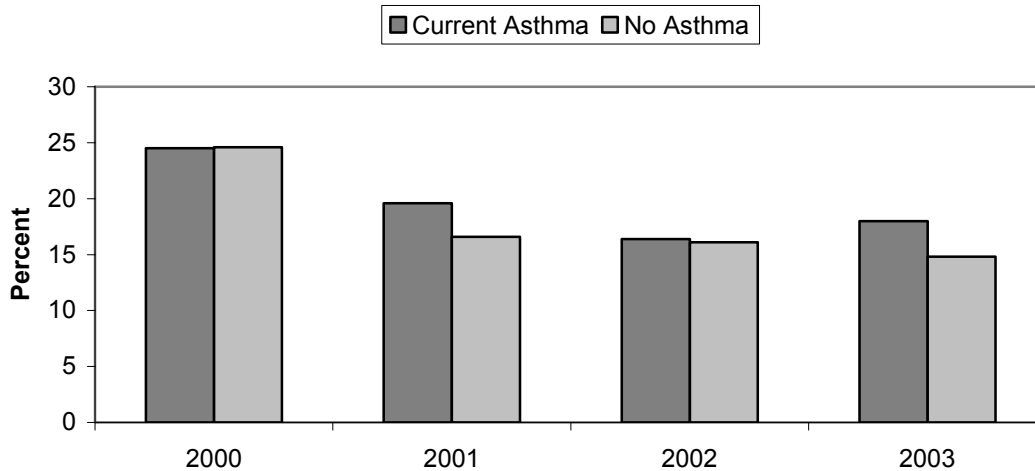
Source: Minnesota BRFSS, 2003

Likewise, adults with asthma are more likely than those without asthma to report ever having received a pneumococcal vaccine in their lifetime. The pneumococcal vaccine protects against pneumococcal infections, specifically meningitis, bacteremia and pneumonia. In 2003, the percentage of people with asthma who had ever received the vaccine was only 32%. A recent study indicates that people with asthma are twice as likely to contract pneumococcal disease; thus it is important to increase vaccination rates in this high risk population (Talbot et al., 2005).

Asthma Management

Physical Activity

Figure 19. No Leisure Time Physical Activity by Asthma Status, Minnesota Adults, 2000-2003

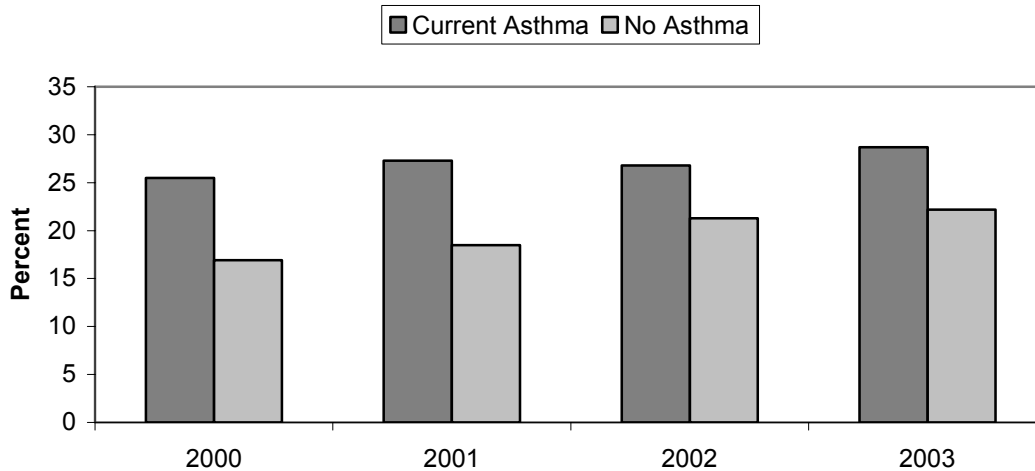


Source: Minnesota BRFSS, 2003

Decreasing numbers of Minnesota adults report that they are physically inactive (no leisure time physical activity in the past 30 days), with little difference between those with asthma and those who do not have asthma. This is a good sign because when asthma is under control, those with asthma should not be limited in their ability to participate in physical activities.

Obesity

Figure 20. Obesity by Asthma Status, Minnesota Adults, 2000-2003



Source: Minnesota BRFSS, 2003

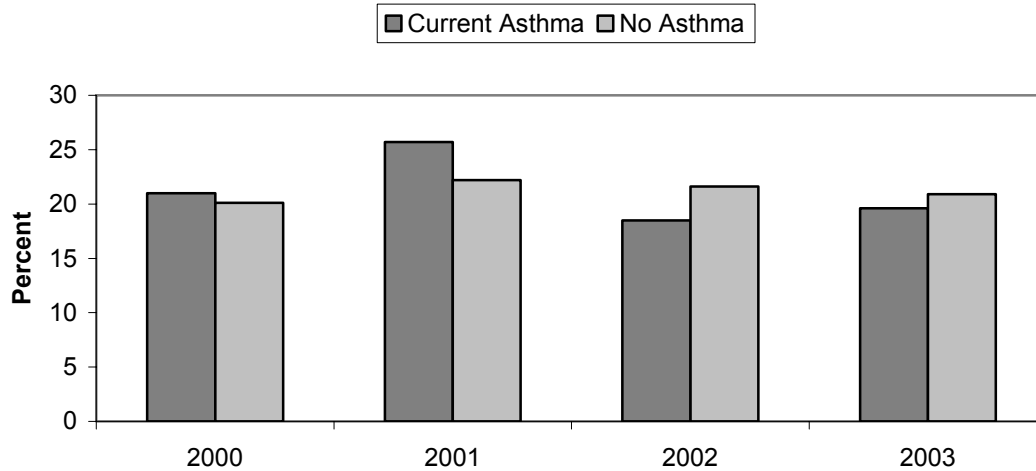
Weight status is based on a person’s reported height and weight, which are used to calculate body mass index (BMI = weight in kilograms divided by the square of the height in meters). Overweight is defined as a BMI greater than 24 and less than 30. Obese is defined as a BMI greater than or equal to 30.

Since 1991, there has been little difference in the percentage of those who are overweight and have asthma compared to those who are overweight and do not have asthma (data not shown). However, adults with asthma are much more likely than those without asthma to be obese. We cannot say for certain whether people who are obese are more likely to develop asthma or whether people with asthma are more likely to become obese because asthma has caused them to limit their activities (Ford, 2005).

Asthma Management

Smoking

Figure 21. Current Smoking by Asthma Status, Minnesota Adults, 2000-2003



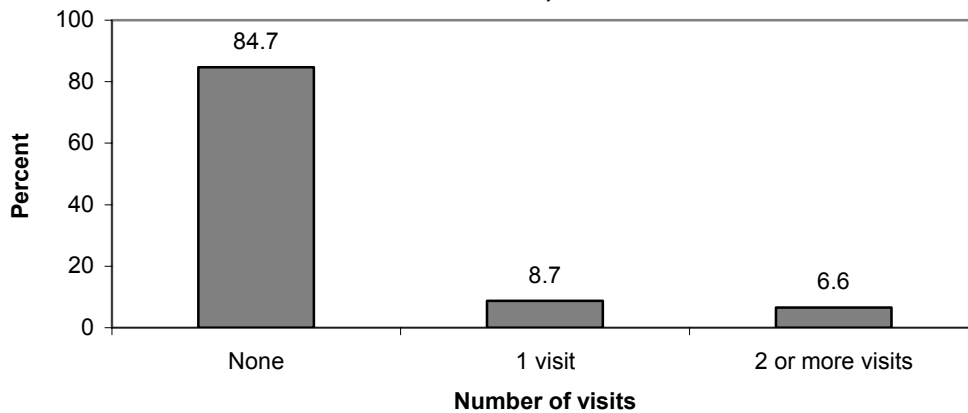
Source: Minnesota BRFSS, 2003

Adults with asthma are just as likely to report that they smoke cigarettes as people without asthma. These findings suggest that people with asthma continue to smoke. Smoking can be a trigger of asthma symptoms and environmental tobacco smoke (also known as secondhand smoke) is known to exacerbate asthma and cause asthma in young children.

ASTHMA-RELATED EMERGENCY DEPARTMENT VISITS

Asthma-related emergency department visits are an indication of asthma that may not be under control and/or the lack of a primary health care provider. More than 15% of Minnesota adults with asthma reported having visited an emergency room or urgent care center at least once in the past year because of their asthma. Note that these self-reported data are not comparable to actual hospital discharge data on emergency department visits (which will be available in future reports).

Figure 22. Number of Self-Reported Emergency Department or Urgent Care Visits in Past Year Among Minnesota Adults with Asthma, 2003



Source: BRFSS, 2003

Asthma Hospitalizations

ASTHMA HOSPITALIZATIONS

Hospitalizations due to asthma are an indicator both of the severity of the disease and barriers to regular asthma care (e.g., lack of health insurance). Asthma hospitalizations are costly and many are preventable when asthma is under control.

Minnesota hospitals report their data on hospitalizations to the Minnesota Hospital Association (MHA), an association representing Minnesota's hospitals and health systems. Currently 95% of all hospitalizations in the state are reported. The information is submitted using the standardized billing form (UB-92). An asthma hospitalization is defined as one for which the hospital records list a primary diagnosis of asthma (ICD-9 code 493.0-493.9). Only hospitalizations for Minnesota residents who were admitted to Minnesota hospitals are included in this report.²

To protect patient privacy, the hospital discharge data do not contain identifying information, such as name or address. As a result, it is impossible to identify repeat hospitalizations. Thus, these data reflect the overall number of asthma hospitalizations, not the number of individuals who were hospitalized. Rates presented here are the number of asthma hospitalizations per 10,000 population, with population estimates from the U.S. Census Bureau (www.census.gov).

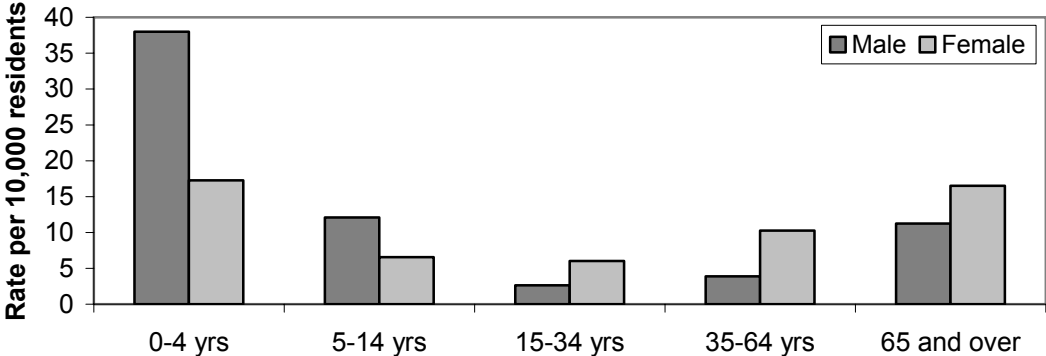
Some of the limitations of the hospitalization data include the fact that federal and sovereign hospitals (e.g., Veteran's Administration, Indian Health Service) do not submit data to MHA. In addition, Minnesota residents receiving care outside of the state are not included. This is a particular problem in rural Minnesota, where the nearest hospital may be across the state line. Another crucial limitation of the hospital discharge data is the lack of information on race and ethnicity.

The hospital discharge data do provide the age and sex of the hospitalized individual, along with their zipcode allowing for comparisons of rates between different regions of the state.

In 2003, there were more than 4,500 asthma hospitalizations among Minnesota residents, for an overall rate of 9 hospitalizations per 10,000 people. In comparison, the 2002 U.S. rate was nearly double that at 17 hospitalizations per 10,000 people (Mannino et al., 2002).

² Data on outpatient visits (including emergency department visits) are also collected by MHA and that for 1998-2002 has been obtained by MDH; however quality control procedures on these data were not completed in time for this report. They will be included in future reports. Data on self-reported emergency department visits can be found on page 31.

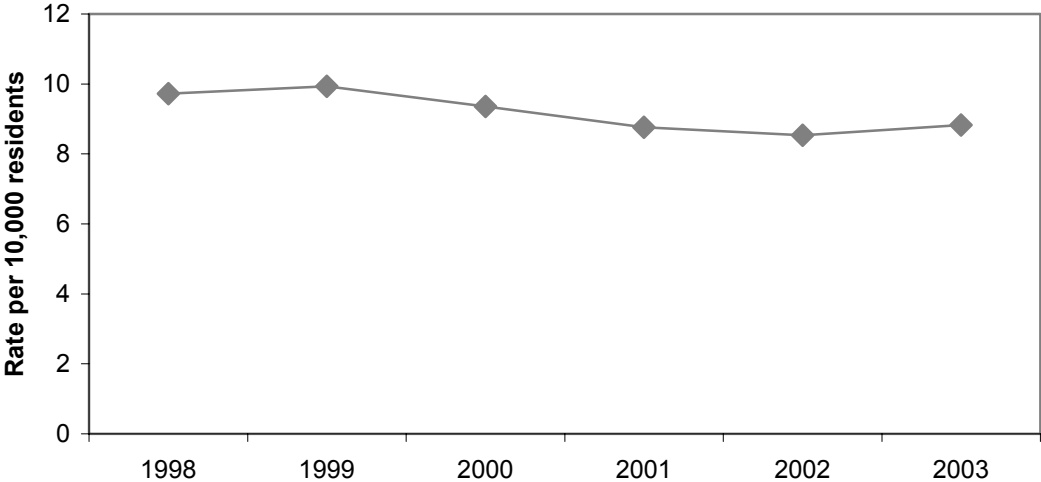
Figure 23. Asthma Hospitalizations by Age and Sex, Minnesota, 2003



Source: Minnesota Hospital Association

Asthma hospitalizations are highest among children under the age of 5. The rate steadily decreases through middle age, and then starts to increase. Asthma hospitalization rates are higher for boys than girls until the late teenage years at which point rates become higher for girls than boys.

Figure 24. Asthma Hospitalizations, Minnesota, 1998-2003

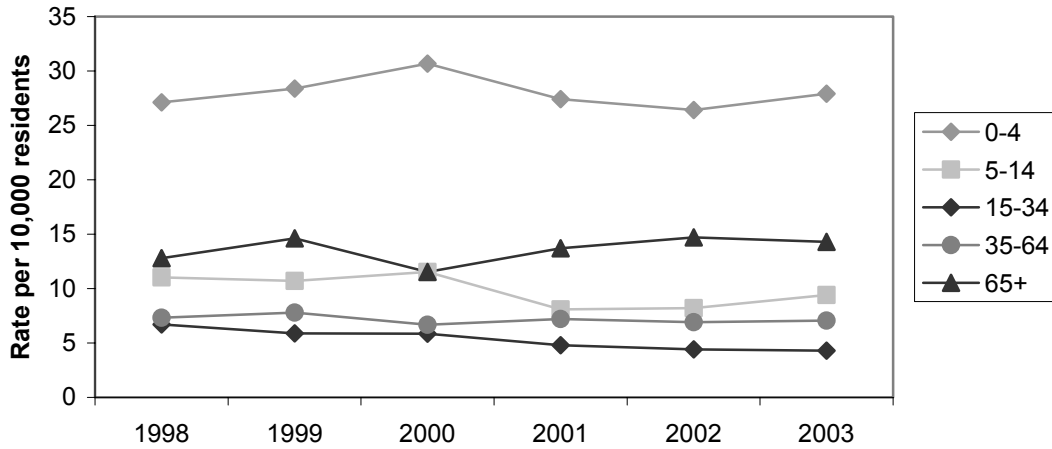


Source: Minnesota Hospital Association

Between 1998 and 2003, asthma hospitalization rates remained relatively stable across all age groups.

Asthma Hospitalizations

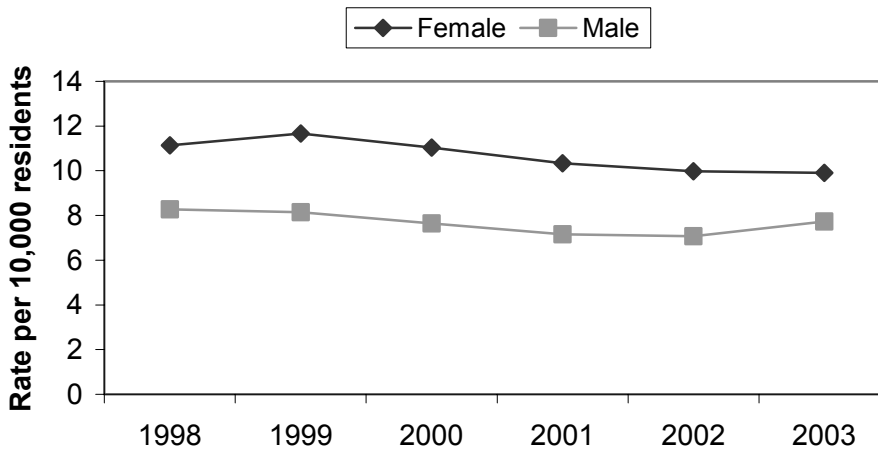
Figure 25. Asthma Hospitalizations by Age Group, Minnesota, 1998-2003



Source: Minnesota Hospital Association

Trends in asthma hospitalization rates differ by age group, with some (age 5-14 and age 15-34) that appear to be decreasing, others that appear to be increasing (age 65 and older), and the rest that are relatively stable (age 0-4 and age 35-64). Rates are highest in children aged 0-4, followed by those aged 65 and older.

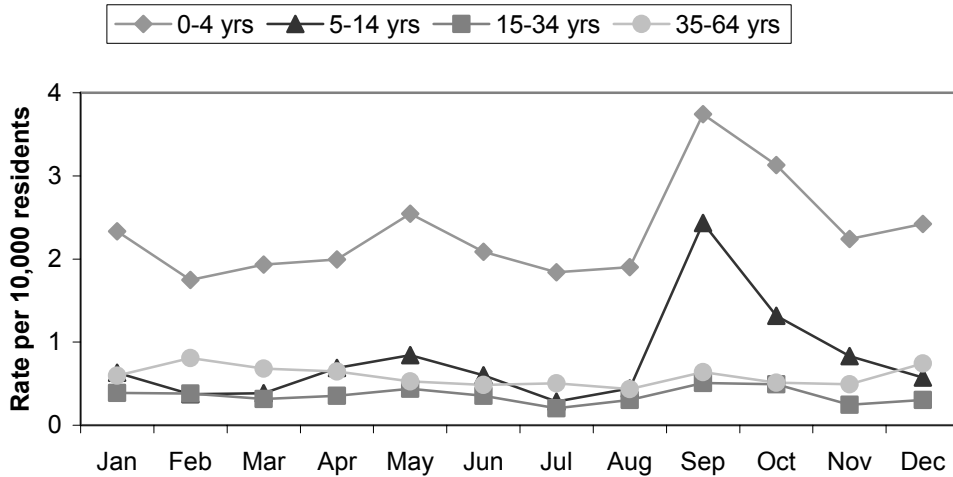
Figure 26. Asthma Hospitalizations by Sex, Minnesota, 1998-2003



Source: Minnesota Hospital Association

Asthma hospitalization rates have consistently been higher in females than males.

Figure 27. Seasonal Variations in Asthma Hospitalizations by Age, Minnesota, 2003



Source: Minnesota Hospital Association

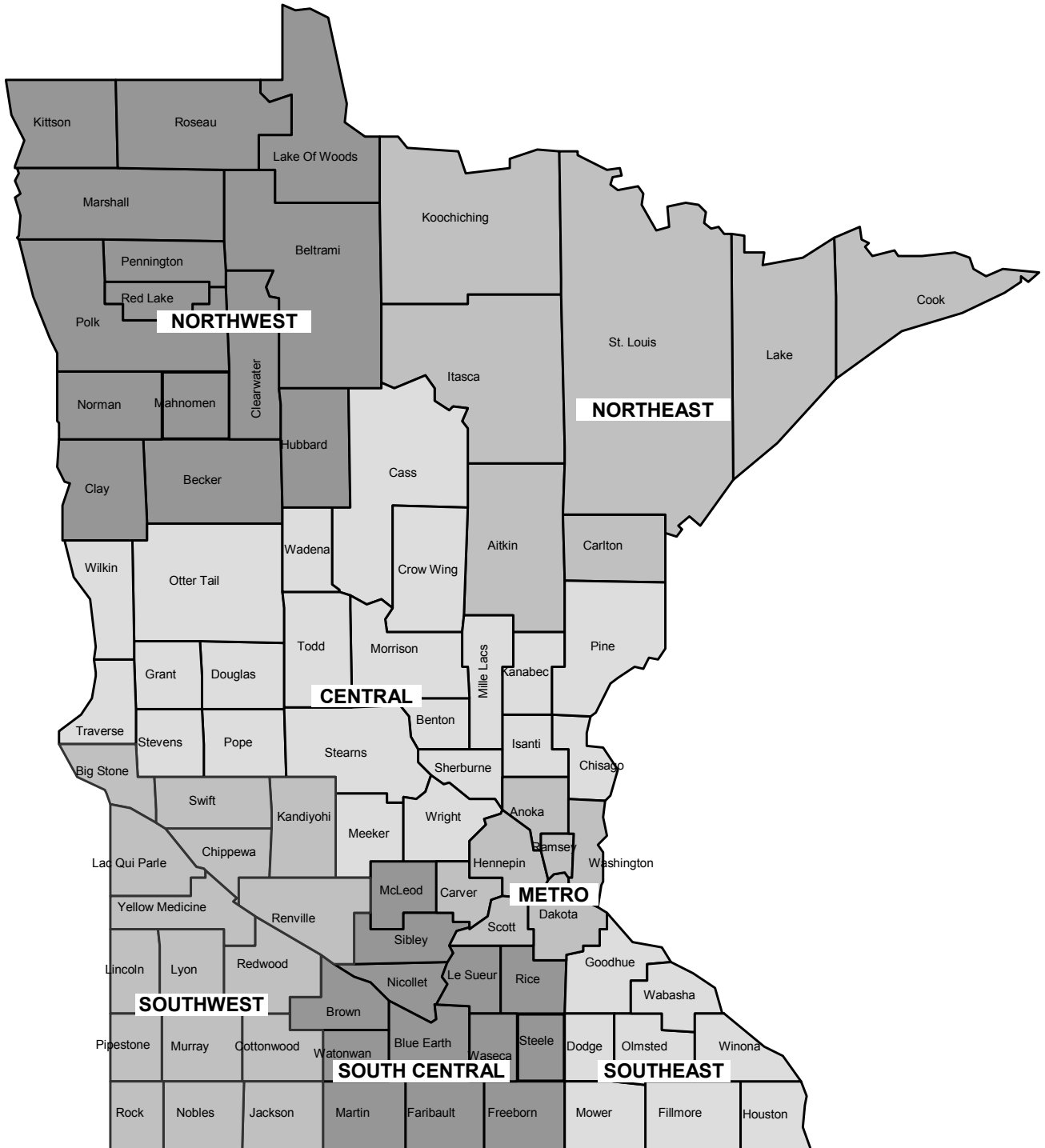
In Minnesota, asthma hospitalization rates follow seasonal patterns. The greatest number of hospitalizations is seen in the fall months, usually September, with a smaller peak in the spring. The lowest rates are generally seen in July. In 2003, there were 4,466 hospitalizations across all ages in Minnesota, ranging from a low of 256 in July to a high of 557 in September. This pattern has been consistent over the years for which the data are available (1998-2003). Other states including Michigan, Vermont, New Hampshire, and Nebraska have reported similar patterns.

The most distinct peaks are seen in children, with children under 5 having the highest rates of asthma hospitalizations throughout the year. Older age groups exhibit less seasonal variation. (Note that persons aged 65 and older are not included in the graph because of the difficulty of distinguishing asthma from chronic obstructive pulmonary disease (COPD) in this age group.)

The causes of the fall increase in asthma hospitalizations are believed to include respiratory infections and increased pollen and mold counts.

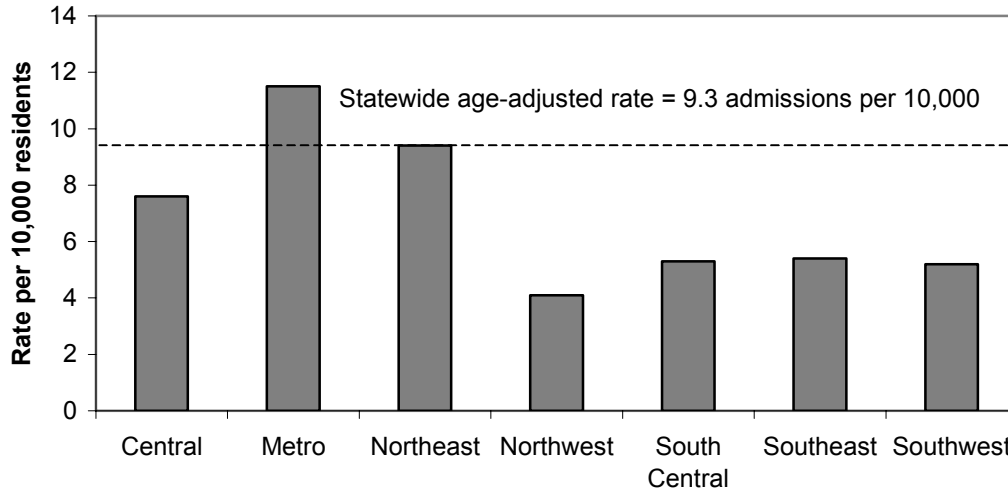
Asthma Hospitalizations

Figure 28. Minnesota Asthma Coalition Regions



Note: The West Central, Central and East Central Asthma Coalition regions have been combined in this map for the purposes of data analysis.

Figure 29. Age-Adjusted Asthma Hospitalization Rates by Minnesota Asthma Coalition Region, 1998-2002



Source: Minnesota Hospital Association

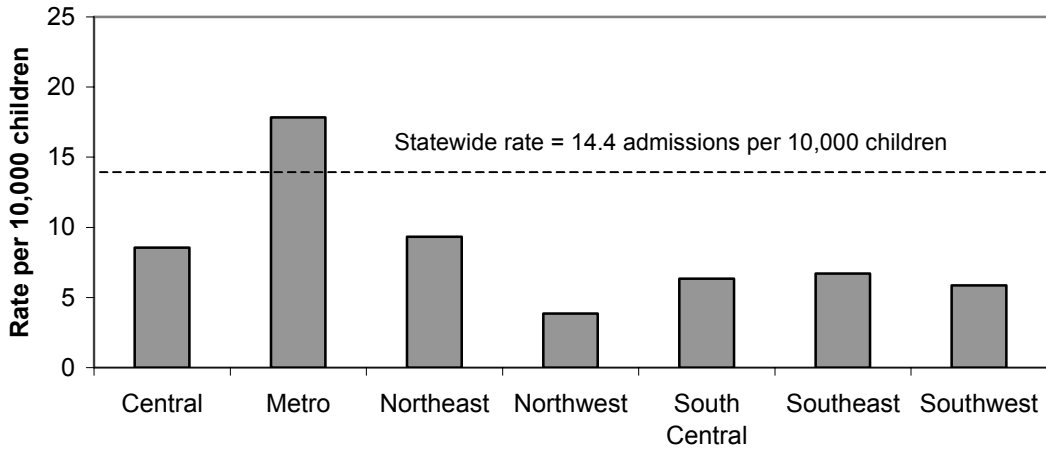
Asthma hospitalizations are highest in the Twin Cities seven-county metropolitan region. The Northeast region is also slightly above the state average. Rates for regions that border other states, notably the Northwest region, may be significantly underestimated since their residents may be more likely to seek care outside of Minnesota. Through interstate data sharing agreements, it is hoped that future years of data will include that for Minnesota residents hospitalized in border states.

Notes:

- Charts comparing regions contain only data from 1998-2002 because those are the years for which the greatest number of hospitals reported data.
- The Central region is comprised of the West Central, Central, and East Central Minnesota Asthma Coalition regions.

Asthma Hospitalizations

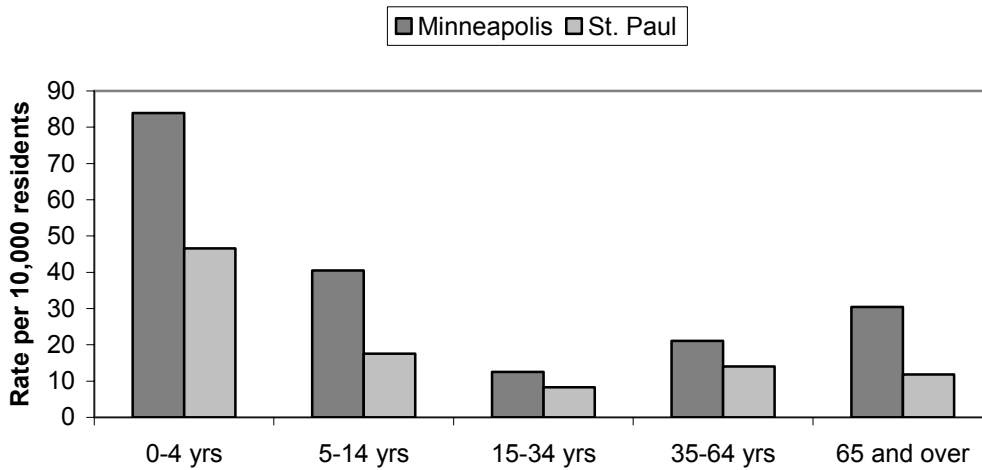
Figure 30. Asthma Hospitalization Rates, Age 0-17, by Minnesota Asthma Coalition Region, 1998-2002



Source: Minnesota Hospital Association

The seven-county Twin Cities metropolitan area has the highest child asthma hospitalization rates in the state.

Figure 31. Asthma Hospitalization Rates by Age Group, Minneapolis and St. Paul, 1998-2003



Source: Minnesota Hospital Association

Asthma hospitalization rates are higher in the city of Minneapolis than in St. Paul across all age groups.

ASTHMA MORTALITY

Asthma deaths should be preventable with timely and proper diagnosis and appropriate care. Known risk factors for asthma death include poorly-controlled asthma and severe asthma.

Death from asthma is rare among young people in Minnesota. Between 1999 and 2002, there were 13 deaths in Minnesota residents under the age of 20.

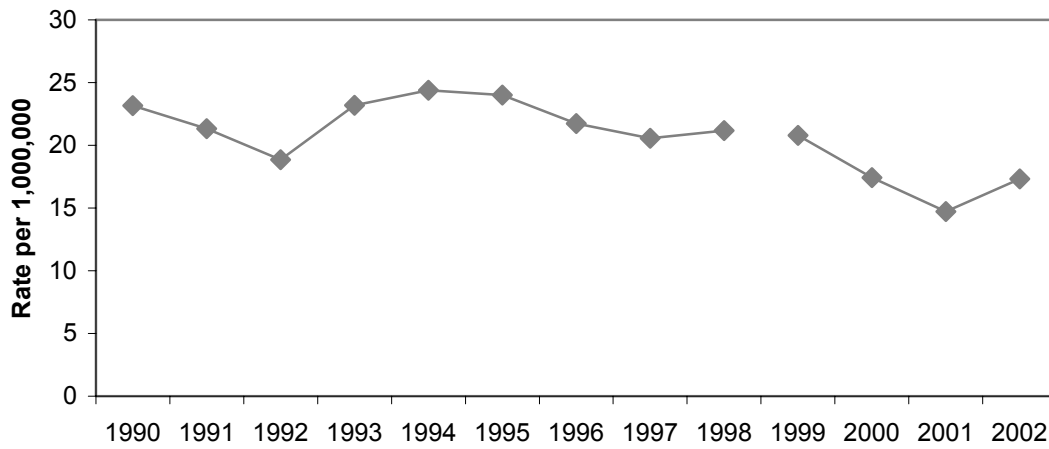
The highest rate of asthma mortality occurs among those 65 and older. However, distinguishing asthma from other chronic respiratory conditions is difficult in this age group. In addition, although there have been efforts to improve the quality of death certificate data, death certificates are frequently filled out by people who may not be intimately acquainted with the deceased's medical history. Thus some asthma deaths may be missed if they were documented as another cause on the death certificate.

Conversely, some of the deaths attributed to asthma may in reality be due to other causes. A study conducted by researchers at the Mayo Clinic in Rochester, Minnesota, suggested that death certificates are likely to underestimate the true number of asthma deaths in a population (Hunt et al., 1993); while other studies have shown that death certificates overestimate the true number of asthma deaths (Barger et al., 1988, Guite et al., 1996, Reid et al., 1998). The MDH Asthma Program is currently conducting a study, "Asthma Deaths in Older Minnesotans", in which records for Minnesota residents 55 and older who had asthma listed on their death certificates will be reviewed to determine whether the listing was accurate and to examine factors that may have played a role in these deaths.

Asthma deaths were identified as those for which the underlying cause of death was listed as asthma. In 1999, the codes used to indicate the underlying cause of death on death certificates changed from the International Classification of Disease (ICD) revision 9 (493.0-493.9) to revision 10 (J45-J46). For this reason, rates before and after 1999 cannot be directly compared.

Asthma Mortality

Figure 32. Age-Adjusted Asthma Mortality Rates, 1990-2002



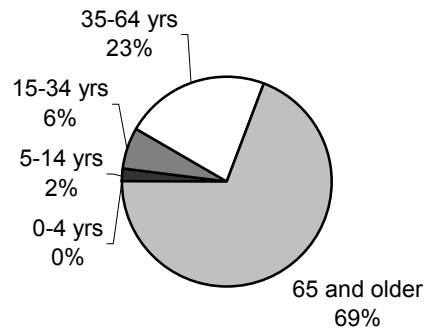
Source: Minnesota Center for Health Statistics

Note: Break in line due to coding change in 1999 from ICD-9 to ICD-10.

After increases in the 1990's, the asthma mortality rate in Minnesota has plateaued and may be starting to decline. A similar trend has been observed at the national level.

The break in the line between 1998 and 1999 represents the change in coding of the cause of death from ICD-9 to ICD-10. When the age-adjusted rate for 1998 (21.2 per 1,000,000) is adjusted for comparability between ICD-9 and ICD-10, the rate becomes 18.1 per 1,000,000, which is not significantly different from the age-adjusted rate for 1999 which is 20.8 per 1,000,000 ($p=0.32$).

Figure 33. Asthma Mortality by Age Group, Minnesota, 1999-2002



Source: Minnesota Center for Health Statistics

During 2002, there were 91 deaths for which asthma was listed as the underlying cause of death on the death certificate. Two-thirds (66%) of these deaths occurred in persons aged 65 and older; 58% of these deaths were in women. On average, there are 90 deaths every year due to asthma among Minnesota residents.

Asthma Mortality

Standardized mortality ratios were calculated to compare asthma mortality rates by region. In Table 4, the “observed” number of asthma deaths are those that occurred in a region in 1999-2002. The “expected” number of asthma deaths is calculated by applying the 1999-2002 age-specific mortality rates for the entire state to the 4-year population of the region. In other words, the expected number of asthma deaths for a region is the number that would have occurred if the asthma mortality rates for each region and the state were identical. The standardized mortality ratio is calculated as the ratio of the observed number of deaths over the expected number of deaths.

Table 4. Asthma Mortality Rates by Minnesota Asthma Coalition Region, 1999-2002

Region	Observed	Expected	Standardized Mortality Ratio
Central	54	59.5	0.91
Metro	148	164.0	0.90
Northeast	49	29.6	1.66*
Northwest	19	21.5	0.88
South Central	34	30.9	1.10
Southeast	31	27.9	1.11
Southwest	25	26.7	0.94

*Significantly different from statewide rate (p<0.05).

Source: Minnesota Center for Health Statistics

Asthma mortality rates are highest in the Northeast region of the state. None of the other regions’ asthma mortality rates differed significantly from the statewide rate.

HEALTHY PEOPLE 2010 GOALS

How does Minnesota measure against federal guidelines in terms of asthma? The U.S. Department of Health and Human Services coordinated an effort to create a set of national health goals to be reached by the year 2010. The Commissioner of Health's Asthma Advisory Work Group also developed goals to measure the effects of the intervention efforts of the State's Strategic Plan for Asthma. The following are the Healthy People 2010 goals relating to asthma and the Strategic Plan's goals, along with Minnesota's status on meeting these goals.

Reduce asthma deaths.

The ultimate goal should be zero deaths due to asthma. Minnesota already meets the Healthy People 2010 goals in the 0-4 age group but exceeds them in all other age groups. However, Minnesota rates are lower than the U.S. baseline for all but the 65 and older population. Even when Minnesota's older age distribution is taken into account (age-adjusted rate for the 65 and older age group = 96.7 per 1,000,000), the state's rate is still higher than both the Healthy People 2010 target and the U.S. baseline rate. Fortunately, in recent years, asthma mortality rates appear to be decreasing both in Minnesota and nationwide.

Table 5. Asthma Mortality Rates* for Minnesota and U.S. and Healthy People 2010 Goals

Age group	Minnesota, 1999-2002		U.S., 1999	Healthy People
	Number	Rate*	Baseline*	2010 Goal*
0 to 4	0	0 [#]	1.7	1.0
5 to 14	7	2.4 [#]	3.1	1.0
15 to 34	23	4.2	5.6	2.0
35 to 64	81	10.5	15.5	9.0
≥65	249	104.3	69.5	60.0

*Rate per 1,000,000

[#]Rates based on fewer than 20 deaths per age group.

Source: Minnesota Center for Health Statistics, National Vital Statistics System-Mortality (NVSS-M), CDC, NCHS

Healthy People 2010 Goals

Reduce hospitalizations for asthma.

Minnesota asthma hospitalization rates are lower than U.S. baseline rates in all age groups. Minnesota has already met, or is very close to meeting the Healthy People 2010 goals in the 0-4 and 5-64 age groups, however, the 2002 rate for the 65 and older group is still above the federal target. Hospitalization rates have been relatively stable in Minnesota since 1998.

Table 6. Asthma Hospitalization Rates* for Minnesota and U.S. and Healthy People 2010 Goals

Age Group	Minnesota, 1999	Minnesota, 2002	U.S. baseline, 1998	U.S., 2001	Healthy People 2010 Goal
0 to 4	28.0	26.4	45.6	56.2	25.0
5 to 64	7.5 [#]	6.3 [#]	12.5 [#]	11.8 [#]	7.7 [#]
≥65	14.3 [#]	14.3 [#]	17.7 [#]	21.4 [#]	11.0 [#]

*Rate per 10,000 residents

[#]Age-adjusted to the year 2000 standard population.

Sources: Minnesota Hospital Association, National Hospital Discharge Survey (NHDS), CDC, NCHS

Greater Minnesota has nearly attained the Healthy People 2010 goals. The Twin Cities are above the Healthy People 2010 goals for every age group, but the rates for 0 to 4 year olds are of particular concern at more than two times the target.

Table 7. Asthma Hospitalization Rates* for Greater Minnesota and Minneapolis-St. Paul and Healthy People 2010 Goals

Age Group	Greater Minnesota, 2002	Minneapolis-St. Paul, 2002	Healthy People 2010 Goal
0 to 4	19.2	59.8	25.0
5 to 64	5.1	14.3	7.7
≥65	13.7	23.5	11.0

*Rate per 10,000 residents

Source: Minnesota Hospital Association

Reduce activity limitations among people with asthma from an estimated 28% to 15% based on lifetime diagnosis and report of current activity limitations.

In 2003, 17.9% of Minnesota adults with asthma reported 1 or more days in which they were unable to work or carry out their usual activities because of their asthma.

Source: BRFSS, 2003

Reduce frequency of symptoms and number of school and work days missed by children and adults with asthma due to their asthma by 25% or more.

Baseline data:

In 2001, 6.5% of 9th-11th grade students with asthma in rural Minnesota reported missing 2 or more days of school in the past month due to asthma.

In 2003, 24% of 7th and 8th grade students with asthma from 15 Minnesota middle schools reported missing a day or more in the past year due to asthma symptoms.

In 2003, 17.9% of Minnesota adults with asthma reported 1 or more days in which they were unable to work or carry out their usual activities because of their asthma.

Increase the number of visits made to a health care provider by people with asthma for a routine check-up by 15%.

Baseline data:

In 2003, 58% of Minnesota adults with asthma reported having had at least one routine checkup for asthma in the past year.

Summary

SUMMARY

The purpose of this report is to show trends in asthma prevalence and to identify those at highest risk for asthma morbidity and mortality. Overall, Minnesota's asthma rates are lower than national rates; however within certain subgroups of the population, there are areas of concern. Most significantly, there are large disparities in hospitalization rates between those who live in the Minneapolis-St. Paul metropolitan area and those who live in the rest of the state.

Analysis of asthma prevalence and hospitalization data suggests that the trends in Minnesota parallel those seen in the rest of the country: children, women, and inner city urban populations are at highest risk for asthma morbidity. The asthma hospitalization rates for children under 5 in Minneapolis are almost 50 percent higher than the national rates for that age group. Our high school and middle survey data demonstrate that asthma is also having an impact on young people in rural areas of the state, with many children reporting possible symptoms of asthma who have not yet been diagnosed. Many children with asthma live in households where someone smokes, which is of particular concern because tobacco smoke can trigger asthma exacerbations.

Mortality rates appear to be decreasing in Minnesota. Clearly asthma mortality is not a significant problem for those under age 65 (although any death from asthma in this age group represents a serious failing somewhere in the system). However, for those over 65, and particularly for women over 65, there may be a significant problem. We say "may be" because asthma diagnosis in this age group is notoriously unreliable. The MDH Asthma Program's "Asthma Deaths in Older Minnesotans" study is being conducted to help establish whether the apparently elevated mortality rate is a cause for concern. This is a critical issue to resolve as preventable mortality in the elderly is an important issue.

There is a significant opportunity for better education of people with asthma, as is evidenced by the high proportion who smoke, do not have routine asthma checkups, and do not receive pneumococcal vaccinations or annual flu shots. In addition, people with asthma, especially children, should be encouraged to develop asthma action plans, written instructions on how to manage asthma symptoms, with their health care providers.

There are still many gaps in our knowledge of the impact of asthma in Minnesota. A major limitation in the asthma data is the lack of information on asthma rates by race and ethnicity. For example, we know very little about asthma in Minnesota's Native American population. Minnesota has some of the largest populations in the United States of Hmong and Somali immigrants, yet we know very little about their asthma status. Other gaps include the lack of data on work-related asthma and asthma prevalence at the community or neighborhood level.

Next steps in asthma surveillance:

- **Address Data Gaps**
Data being collected in 2005 will address some of the aforementioned data gaps. The National Asthma Survey, a project of the CDC, is being conducted in 2005 in Minnesota and the results will provide detailed information on asthma among children and adults in Minnesota, including asthma triggers, medications, and work-related asthma.
- **Learn More About Asthma Mortality in Older Minnesotans**
The “Asthma Deaths in Older Minnesotans” study is currently being conducted by the MDH Asthma Program to look at the circumstances surrounding asthma deaths in the 55 and older population in Minnesota. The study will look into whether factors such as access to medical care, use of medications, family history and asthma triggers play a role in asthma deaths in this age group. Because of the difficulties in diagnosing asthma in older people, this study will also determine whether the listing of asthma is accurate on the death certificates for persons in this age group.
- **Increase Reporting of Hospital Discharge Data**
MDH is working to increase the number of hospitals reporting hospital discharge data to the Minnesota Hospital Association, including those hospitals in border states that see Minnesota residents.
- **Prepare and Analyze Data on Asthma-Related Emergency Department Visits**
Hospital discharge data on asthma-related emergency department visits for the years 1998-2003 will be analyzed and rates compared to Healthy People 2010 goals. Results will be made available in the Asthma Program’s Breathing Space newsletter and in program fact sheets.

In summary, our knowledge of asthma in Minnesota is growing, but remains incomplete. Continued analysis of available datasets, combined with new data-gathering efforts, such as the National Asthma Survey, will be critical to filling in the picture.

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Acronyms

ACRONYMS

BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
COPD	Chronic obstructive pulmonary disease
HEDIS	Health Plan Employer Data and Information Set
ICD	International Classification of Disease
ICSI	Institute for Clinical Systems Improvement
MDH	Minnesota Department of Health
MHA	Minnesota Hospital Association
NAEPP	National Asthma Education and Prevention Program
NCHS	National Center for Health Statistics
NHAMCS	National Hospital Ambulatory Medical Care Survey
NHLBI	National Heart, Lung and Blood Institute
NVSS	National Vital Statistics System
SHAPE	Survey of the Health of Adults, the Population, and the Environment

GLOSSARY

Age-adjustment – to take the age distribution of a population into account when calculating a rate. Age-adjusted rates are useful when comparing populations that have different age distributions.

Asthma – a chronic disease of the respiratory system characterized by episodes of tightening of the muscles around the airways in the lungs (bronchoconstriction) and swelling of the bronchial tubes (inflammation).

Incidence – the number of new cases of a disease in a particular population at a particular time

Mortality Rate – rate of death in a population; the number of deaths divided by the population for that time period

Prevalence – the number of existing cases of a disease in a particular population at a particular time. For example, a 10% prevalence of asthma in a particular county with a population of 10,000 would mean that 1,000 people in the county had asthma.

Current asthma prevalence – refers to people who currently have asthma

Lifetime asthma prevalence – refers to people who have been diagnosed with asthma at some point in their lives

Rate – a measure of how often an event occurs; in epidemiology, the number of events (e.g., childhood asthma hospitalizations) in a population divided by the number of people in a population at risk for that event (e.g., 0-17 year old population)

Standardized Mortality Ratio – the actual number of deaths in a population, in this case deaths due to asthma in a particular region, divided by the number of deaths that would have been expected if the population had the same asthma mortality rate as that for the state as a whole.

Statistical significance – use of statistics to determine whether a difference in rates is likely to exist. E.g., 95% confidence intervals indicate the range of values that a point estimate would be expected to fall within 95 times out of 100.

TECHNICAL NOTES

95% confidence intervals for age-adjusted rates were calculated in STATA using the following equation:

$$95\% \text{ confidence interval} = \text{Age-adjusted rate} \pm \left[1.96 \times \left(\frac{1}{\sum w_i} \sqrt{\sum_{i=1}^k \frac{w_i^2 R_i (1 - R_i)}{n_i}} \right) \right]$$

Where:

w_i = weight for i^{th} age group of the standard population

R_i = age-specific rate in the i^{th} age group

n_i = population in the i^{th} age group

(Cochran, 1977)

Standardized Mortality Ratios were calculated in STATA using the following equation:

$$\text{Standardized Mortality Ratio} = \frac{O}{E}$$

Where:

O = observed number of deaths in a region

E = expected number of deaths in a region based on statewide rates applied to regional age distribution

$$E = \sum_{i=1}^k n_i R_i$$

95% confidence intervals for standardized mortality ratios were calculated assuming a Poisson distribution.

(Breslow et al., 1987)

Appendix A: BRFSS Adult Asthma Questions

1. Have you ever been told by a doctor, nurse or other health professional that you had asthma?
Yes
No
Don't know/Not sure
Refused

2. Do you still have asthma?
Yes
No
Don't know/Not sure
Refused

If Yes to Question #1:

3. How old were you when you were first told by a doctor, nurse or other health professional that you had asthma?
Age in years 11 or older
Age 10 or younger
Don't know / Not sure
Refused

If Yes to Question #2:

4. During the past 12 months, have you had an episode of asthma or an asthma attack?
Yes
No
Don't know / Not sure
Refused
5. During the past 12 months, how many times did you visit an emergency room or urgent care center because of your asthma?
___ Number of visits
None
Don't know / Not sure
Refused
6. During the past 12 months, how many times did you see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms?
___ Number of visits
None
Don't know / Not sure
Refused

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7. During the past 12 months, how many times did you see a doctor, nurse or other health professional for a routine checkup for your asthma?
____ Number of visits
None
Don't know / Not sure
Refused
8. During the past 12 months, how many days were you unable to work or carry out your usual activities because of your asthma?
____ Number of days
None
Don't know / Not sure
Refused
9. Symptoms of asthma include cough, wheezing, shortness of breath, chest tightness and phlegm production when you don't have a cold or respiratory infection. During the past 30 days, how often did you have any symptoms of asthma?
Not at any time
Less than once a week
Once or twice a week
More than 2 times a week, but not every day
Every day, but not all the time
Every day, all the time
Don't know / Not sure
Refused
10. During the past 30 days, how many days did symptoms of asthma make it difficult for you to stay asleep?
None
One or two
Three to four
Five
Six to ten
More than ten
Don't know / Not sure
Refused
11. During the past 30 days how often did you take asthma medication that was prescribed or given to you by a doctor? This includes using an inhaler.
Didn't take any
Less than once a week
Once or twice a week
More than 2 times a week, but not every day
Once every day
2 or more times every day
Don't know / Not sure
Refused

Appendix B: MDH Rural High School Survey

ASTHMA INFORMATION

51. Have you had wheezing or whistling in your chest in the past 12 months?

- Yes No

52. Have you had wheezing or whistling in your chest in the past 12 months when you exercise?

- Yes No

53. Has a doctor ever told you that you have asthma?

- Yes

No  **THANK YOU FOR COMPLETING THIS SURVEY. PLEASE RETURN YOUR SURVEY.**

A. If YES, do you still have asthma?

- Yes No

B. If YES, is your asthma work-related?

- Yes No

54. Do you have a regular doctor or clinic where you go for asthma care?

- Yes No

55. Does your asthma bother you? (Please mark one.)

- Less than once a week
 About 2-3 times per week
 Almost every day

56. Do you have an Asthma Action Plan?

An Asthma Action Plan is a form with instructions about how to care for your asthma.

- Yes No

57. Do you have asthma medications that you take or inhale every day whether or not you have symptoms?

- Yes No

58. Do you have asthma medications that you take or inhale only when you have symptoms?

- Yes No

59. Do you have asthma medications that you take or inhale before you exercise?

- Yes No

60. During the past 30 days, how much time did you miss from the following activities due to asthma?

A. SCHOOL:

- None
 1 day or less
 2 days to 4 days
 5 days to 9 days
 10 days or more
 Don't know/unsure

B. WORK:

- None
 1 day or less
 2 days to 4 days
 5 days to 9 days
 10 days or more
 Don't know/unsure

C. ORGANIZED SPORTS:

- None
 1 day or less
 2 days to 4 days
 5 days to 9 days
 10 days or more
 Don't know/unsure

D. RECREATIONAL ACTIVITIES:

- None
 1 day or less
 2 days to 4 days
 5 days to 9 days
 10 days or more
 Don't know/unsure

THANK YOU FOR COMPLETING THIS SURVEY. PLEASE RETURN YOUR SURVEY.

This questionnaire has been developed by the Minnesota Department of Health for the grant Youth at Work.

Minnesota Department of Health, 717 Delaware Street S.E., Minneapolis, Minnesota 55440-9441



DO NOT WRITE IN THIS SHADED AREA

Appendix C: MDH Middle School Survey

When answering questions 5 through 11, please exclude times you had a cold or the flu.



- 5. Have you ever had wheezing or tightness in your chest?
 - Yes
 - No → skip to question 12

- 6. In the last 12 months, have you had wheezing or tightness in your chest?
 - Yes → go to question 6a
 - No → skip to question 7

- 6a. How many times have you had wheezing or tightness in your chest in the last 12 months?
 - Rarely
 - Sometimes
 - A lot

- 7. In the last 12 months how often have you woken up at night because of wheezing or tightness in your chest?
 - Never
 - Rarely
 - Sometimes
 - A lot

- 8. How many days this school year have you missed or had to go home from school because of wheezing or tightness in your chest?

<input type="radio"/> None	<input type="radio"/> 3-5 days
<input type="radio"/> Half a day	<input type="radio"/> A week or more
<input type="radio"/> 1-2 days	<input type="radio"/> Unsure

- 9. In the last 12 months, have you had wheezing or tightness in your chest during or after running, playing sports or exercising?
 - Never
 - Rarely
 - Sometimes
 - A lot

- 10. In the last 12 months, have you missed recess, playing sports or other after school activities because of wheezing or tightness in your chest?
 - Yes
 - No

11. In the last 12 months, if you had wheezing or tightness in your chest what did you do?

Mark all answers that apply. If none apply to you, leave blank and go to question 12.

- Nothing
- Took a break from what you were doing
- Used an inhaler
- Used Pills
- Used a Nebulizer
- Went to the school nurse
- Went to the doctor's office
- Went to the emergency room
- Stayed in the hospital overnight
- Other _____

12. Has a doctor ever told you or your parents that you have asthma?

- Yes → go to question 12a
- No → skip to question 13

12a. Do you have an **Asthma Action Plan?** (Written instructions about how to care for your asthma?)

- Yes
- No
- Don't know

13. Do you currently smoke cigarettes?

- | | |
|------------------------------|-------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Daily |
| <input type="radio"/> Weekly | <input type="radio"/> Monthly |

14. Does anyone in your house currently smoke cigarettes?

- Yes
- No

15. Which of the following do you think BEST describes you? **Mark all answers that apply.**

- Asian or Pacific Islander
- Black/African American
- Hispanic/Latino/Latina
- Hmong
- Native American
- Somali
- White
- Other (please specify) _____

THANK YOU FOR YOUR PARTICIPATION!

R19606-PFI-54321

Appendix D: Data tables

Table 8. Percent of Adults Age 18 and Older, Ever Diagnosed with Asthma and Percent of Those That Still have Asthma by Age Group, Residency, and Educational Attainment, Minnesota, 2003

	Ever Diagnosed		Still Have Asthma	
	N	%	N	%
Sex				
Female	2246	11.9	2229	8.3
Male	1628	9.2	1623	5.3
Age				
18-44	1684	12.6	1675	8.0
45-64	1358	9.1	1347	5.9
65+	832	7.0	830	5.0
Residence				
Metro	1965	11.5	1954	7.2
Non-Metro	1906	9.6	1895	6.4
Education				
<High School	213	11.5	213	9.2
High School	1028	9.4	1023	5.4
Some College	1227	13.0	1215	8.6
College Graduate	1401	9.2	1396	6.0
All Adults	3874	10.6	3852	6.8

Source: Minnesota BRFSS, 2003

Appendices

Table 9. Percent of Adults Age 18 and Older, Ever Diagnosed with Asthma and Percent of Those That Still have Asthma by Health Status and Selected Health Behaviors, Minnesota, 2003

	Ever Diagnosed		Still Have Asthma		Never Diagnosed	
	N	%	N	%	N	%
Health Status Fair/Poor	388	16.2	258	19.1	3475	10.4
Limitation of Activity	388	35.4	258	37.8	3486	22.1
Current Smoker	387	23.9	258	19.6	3469	20.9
Overweight	364	57.4	238	61.1	3349	60.7
Obese	364	26.7	238	28.7	3349	22.2
No Leisure Time Physical Activity	387	15.7	257	18.0	3480	14.8
Flu Shot in Past Year	388	40.9	258	45.5	3470	37.1
Ever Had Pneumococcal Vaccine	342	29.5	236	31.5	3186	20.9

Source: Minnesota BRFSS, 2003

Table 10. Asthma Hospitalization Rates Among Minnesota Residents, 1998-2003
Rate per 10,000 population

	1998	1999	2000	2001	2002	2003*
Sex						
Female	11.1	11.7	11.0	10.3	10.0	9.9
Male	8.3	8.1	7.6	7.2	7.1	7.7
Age						
0-4	27.1	28.4	30.7	27.4	26.4	27.9
5-14	11.0	10.7	11.5	8.1	8.2	9.4
15-34	6.7	5.9	5.8	4.8	4.4	4.3
35-64	7.3	7.8	6.7	7.2	6.9	7.1
65+	12.8	14.6	11.5	13.7	14.7	14.3
Total	9.7	9.9	9.4	8.8	8.5	8.8

*Data from two major hospitals included in 1998-2002 were not available for 2003.

Source: Minnesota Hospital Association

Table 11. Asthma Hospitalization Rates by County of Patient Residence, 2000-2002
Rate per 10,000 population

County	Number of Hospitalizations	Age-Adjusted Rate	95% Confidence Interval
Aitkin	36	8.2	5.2 - 11.2
Anoka	849	9.9	9.2 - 10.6
Becker	41	4.7	3.2 - 6.1
Beltrami	84	7.3	5.7 - 8.8
Benton	129	12.9	10.7 - 15.1
Big Stone	≤ 20	1.3*	0.0 - 2.8
Blue Earth	60	3.9	2.9 - 4.9
Brown	51	6.4	4.6 - 8.3
Carlton	91	9.1	7.2 - 11.1
Carver	133	6.4	5.3 - 7.5
Cass	93	11.4	9.0 - 13.7
Chippewa	30	6.9	4.2 - 9.5
Chisago	89	7.1	5.6 - 8.6
Clay	≤ 20	0.4*	0.1 - 0.7
Clearwater	≤ 20	4.2*	1.8 - 6.7
Cook	≤ 20	1.4*	0.0 - 2.9
Cottonwood	≤ 20	2.9*	1.1 - 4.7
Crow Wing	133	7.7	6.3 - 9.0
Dakota	869	8.2	7.7 - 8.8
Dodge	45	7.9	5.6 - 10.2
Douglas	61	5.7	4.2 - 7.2
Faribault	21	3.7	2.0 - 5.4
Fillmore	29	4.0	2.5 - 5.5
Freeborn	≤ 20	0.6*	0.1 - 1.1
Goodhue	69	5.5	4.2 - 6.9
Grant	≤ 20	4.6*	1.3 - 7.9
Hennepin	4003	12.2	11.8 - 12.6
Houston	≤ 20	1.0*	0.3 - 1.8
Hubbard	36	6.3	4.2 - 8.4
Isanti	45	4.8	3.4 - 6.2
Itasca	107	7.9	6.3 - 9.4
Jackson	≤ 20	5.5*	2.7 - 8.2
Kanabec	63	13.5	10.1 - 16.9
Kandiyohi	72	5.7	4.4 - 7.0
Kittson	≤ 20	1.1*	0.0 - 2.6
Koochiching	23	4.8	2.8 - 6.8
Lac qui Parle	21	10.3	5.5 - 15.1
Lake	≤ 20	5.3*	2.7 - 8.0
Lake of the Woods	≤ 20	12.3*	6.0 - 18.5
Le Sueur	45	6.0	4.2 - 7.8
Lincoln	38	13.3	8.7 - 17.9
Lyon	38	4.7	3.2 - 6.3
Mahnomen	≤ 20	8.2*	3.7 - 12.8
Marshall	≤ 20	1.6*	0.0 - 3.3
Martin	35	5.9	3.9 - 8.0
McLeod	78	7.1	5.6 - 8.7

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County	Number of Hospitalizations	Age-Adjusted Rate	95% Confidence Interval
Meeker	34	5.0	3.3 - 6.7
Mille Lacs	127	18.3	15.1 - 21.5
Morrison	63	6.6	5.0 - 8.3
Mower	22	1.9	1.1 - 2.7
Murray	22	7.6	4.2 - 11.0
Nicollet	29	3.4	2.1 - 4.6
Nobles	34	5.4	3.6 - 7.3
Norman	≤ 20	4.9*	2.0 - 7.9
Olmsted	307	8.1	7.2 - 9.0
Otter Tail	77	4.4	3.4 - 5.4
Pennington	27	6.0	3.7 - 8.4
Pine	69	8.4	6.4 - 10.4
Pipestone	≤ 20	3.9*	1.7 - 6.1
Polk	43	4.1	2.8 - 5.4
Pope	≤ 20	6.2	3.3 - 9.0
Ramsey	2001	13.1	12.5 - 13.7
Red Lake	≤ 20	2.6*	0.0 - 5.6
Redwood	42	7.8	5.3 - 10.3
Renville	44	8.8	6.2 - 11.5
Rice	107	6.5	5.3 - 7.7
Rock	≤ 20	1.3*	0.0 - 2.7
Roseau	≤ 20	3.6*	1.8 - 5.3
Scott	244	8.6	7.4 - 9.7
Sherburne	131	6.7	5.5 - 7.9
Sibley	36	7.9	5.3 - 10.5
St. Louis	668	11.0	10.2 - 11.9
Stearns	363	9.7	8.7 - 10.6
Steele	75	7.3	5.6 - 8.9
Stevens	≤ 20	6.4	3.5 - 9.4
Swift	56	15.4	11.2 - 19.6
Todd	28	4.2	2.6 - 5.7
Traverse	≤ 20	2.0*	0.0 - 4.5
Wabasha	21	3.2	1.8 - 4.6
Wadena	56	13.0	9.4 - 16.5
Waseca	33	5.7	3.7 - 7.6
Washington	455	7.8	7.1 - 8.6
Watonwan	≤ 20	3.4*	1.5 - 5.3
Wilkin	≤ 20	3.9*	1.3 - 6.5
Winona	51	3.7	2.7 - 4.7
Wright	192	7.3	6.3 - 8.4
Yellow Medicine	38	9.3	6.1 - 12.4
Minnesota	13257	9.0	8.8 - 9.1

Source: Minnesota Hospital Association

*Because the number of hospitalizations is less than or equal to 20, the rate may be unstable and should be interpreted with caution.

Note: Hospitalization rates for counties in which residents are likely to go out of state for care may be significantly underestimated. The most affected counties are those adjacent to Sioux Falls, SD, Fargo, ND and Grand Forks, ND. Rates for counties in which

residents are likely to visit hospitals that do not submit data to the Minnesota Hospital Association may also be artificially low.

Table 12. Number of Asthma Deaths Among Minnesota Residents, 1999-2002

	1999	2000	2001	2002
Sex				
Female	73	57	51	49
Male	31	30	27	42
Age				
0-17	3	3	2	5
18-64	29	24	19	26
65 and over	72	60	57	60
Total	104	87	78	91

Source: Minnesota Center for Health Statistics

September 2005

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