ASTHMA IN MINNESOTA

2012 EPIDEMIOLOGY REPORT

MINNESOTA
MDH
DEPARTMENT OF HEALTH

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MINNESOTA MDH DEPARTMENT OF HEALTH

Protecting, maintaining and improving the health of all Minnesotans

June 2012

Dear Colleague:

I am pleased to present the "Asthma in Minnesota 2012 Epidemiology Report". This report, which contains the most recent Minnesota data on asthma, was prepared by the Minnesota Department of Health's Asthma Program.

Asthma affects an estimated 392,000 Minnesota children and adults who currently have the disease. Indirectly, it often affects their family members and others as well. The good news is that many indicators of the burden of asthma are trending in the "right" direction for public health. For example, rates of asthma-related hospitalizations among children living in the Twin Cities metropolitan area continue to decline.

However, work is still needed to improve the health of Minnesotans with asthma, in terms of both asthma awareness and asthma control. One in 10 Minnesota youth report having asthma-like symptoms but do not have an asthma diagnosis. Fifty-three percent of youth with asthma, compared with 42% of youth who do not have asthma, report being exposed to secondhand smoke, a potential trigger of asthma exacerbations.

This report also includes information on asthma risk factors, asthma disparities and asthma self-management education. Detailed data tables, including rates of asthma-related emergency department visits and hospitalizations by county, are included at the end of the report. With the advent of Minnesota's optimal asthma care measure, we also have data on the extent to which Minnesota's prescribing providers are implementing and utilizing best practices for managing asthma.

Thank you for your interest in this important disease. For more information about this report, please contact Dr. Wendy Brunner at 651-201-5895 or wendy.brunner@state.mn.us.

Sincerely,

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This report is available on the web at:
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EXECUTIVE SUMMARY

Asthma is one of the most common chronic diseases in the United States affecting 25.7 million children and adults in 2010. Asthma prevalence increased dramatically from 1980 through the mid-1990s. The pace of the increase has since slowed, yet asthma prevalence is still at an all-time high. Asthma accounted for 456,000 hospitalizations and 1.8 million visits to the emergency room in 2007 and 10.5 million missed school days and 14.2 million missed work days in 2008. Asthma is costly, with $56 billion in direct and indirect costs in 2007. 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 maintains 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, many of the measures of the burden of asthma have improved since the 2008 Asthma in Minnesota report was published. Asthma hospitalization rates continue to decline in the Twin Cities metropolitan area, particularly among children, and the percentage of youth with asthma who report having asthma action plans has increased. However, there are notable disparities in asthma prevalence by race/ethnicity. In addition, geographic disparities in rates of asthma-related emergency department visits and hospitalizations remain.

Key Findings:

Asthma prevalence

- 7.0% or 1 in 14 Minnesota children ages 0-17 currently have asthma. That translates to an estimated 90,000 children.
- 7.6% or 1 in 13 Minnesota adults age 18 and older report that they currently have asthma. That translates to an estimated 302,000 adults.
- 12.4% or 1 in 8 Minnesota youth (grades 6-12) currently have asthma.
- Asthma prevalence in Minnesota is lower than the national average and is not currently increasing.
- American Indian and African/African American students in grades 6, 9 and 12 are more likely than other students to have been diagnosed with asthma at some point in their lives.
- 1 in 10 Minnesota youth report asthma-like symptoms but do not have a provider diagnosis of asthma.

Asthma control

- 16% of adults with asthma experienced sleep disruptions due to asthma on 3 or more nights in the past month.
- 48% of adults with asthma experienced an asthma attack in the past year.
- 17% of adults with asthma report that their activities were limited by asthma on one or more days in the past year.

- 59% of youth with current asthma have asthma that is not controlled.
- 24% of child (ages 5-17) and 16% of adult (ages 18-50) asthma patients met the Minnesota Community Measurement criteria for optimal asthma care in 2010.

Asthma management

- 47% of youth with asthma report that they have an asthma action plan, a key tool in asthma management.
- 37% of adults with asthma report that they have ever received an asthma action plan.
- 57% of adults with asthma report having had a flu shot in the past year.

Self-management education

- 67% of adults with asthma report having been taught how to recognize early signs of an asthma attack.
- 39% of adults with asthma report having been taught how to monitor peak flow.

Risk factors associated with asthma

- Adults with asthma are just as likely as adults without asthma to smoke cigarettes.
- Youth (grades 6-12) with current asthma are just as likely as their peers who never had asthma to smoke cigarettes.
- Youth with current asthma are more likely than those without asthma to report being exposed to secondhand smoke in the past week (53% vs. 42%).

Asthma among Minnesota public health care program enrollees

- Asthma prevalence is higher among enrollees in Medical Assistance than Minnesota Care.
- In Medical Assistance, asthma prevalence is highest among African/African American enrollees; in Minnesota Care, asthma prevalence is highest among American Indian enrollees.
- Asthma prevalence is higher among enrollees living in the seven-county Twin Cities metropolitan area than among those living in Greater Minnesota.

Work-related asthma

- 31% of adults with asthma report that their asthma was made worse by exposures to chemicals, smoke, fumes or dust in the workplace.

Asthma emergency department visits

- There were nearly 20,000 emergency department (ED) visits for asthma in 2010.
- Rates of asthma ED visits have remained relatively stable since 2005.
- Rates of asthma ED visits are 80% higher among children living in the seven-county Twin Cities metropolitan area than among children living in Greater Minnesota.

Asthma hospitalizations

- There were more than 3,500 asthma hospitalizations in 2010.
- Rates of asthma hospitalizations have steadily declined since 2000.
- Rates of asthma hospitalizations are 50% higher among children living in the seven-county Twin Cities metropolitan area than among children living in Greater Minnesota.

- Rates of asthma hospitalizations are 30% higher among adults living in the seven-county Twin Cities metropolitan area than among adults living in Greater Minnesota.

Asthma mortality

- After a dramatic decline through the mid-2000s, the statewide asthma mortality rate increased between 2008 and 2010.
- In 2010, there were 73 deaths due to asthma among Minnesota residents.
- Asthma deaths among young people in Minnesota are relatively rare. Between 1999 and 2010, there were 36 deaths among Minnesota residents under the age of 20.

Healthy People 2010

- Minnesota has met the targets for all age groups for reducing hospitalizations for asthma.
- Minnesota has achieved the targets only for the 0-4, 35-64 and 65 and older age groups for reducing deaths from asthma.
- Minnesota has met the targets for ages 5-64 for reducing ED visits for asthma.

INTRODUCTION

Asthma is a chronic respiratory disease characterized by episodes of bronchoconstriction (tightening of the muscles around the airways in the lungs) and inflammation (swelling of the bronchial airways). Symptoms of asthma can include wheezing, breathlessness, chest tightness, and coughing. Asthma attacks or episodes can be triggered by allergens, irritants or other factors, like exercise. The factors that can trigger an asthma episode are well known; however, the factors that cause asthma to develop in the first place are largely unknown.

Asthma is one of the most common chronic diseases in the United States. An estimated 18.7 million adults and 7.0 million children have asthma.[1] In 2008, asthma accounted for 456,000 hospitalizations and 1.8 million emergency department visits. Adults and children with asthma experienced 14.2 million missed work days and 10.5 million missed school days, respectively, in 2008.[2] Asthma was associated with $56 billion in total costs in the U.S. in 2007.[3] In Minnesota, it is estimated that, in 2004, asthma cost $240 million directly in hospitalizations, emergency department visits, office visits, and medications, and $181 million indirectly in lost school and work days, for total of $421 million.[4] While asthma cannot be cured, it can be controlled and managed with adequate access to medical care, medications, trigger avoidance, and self-management.

Asthma has been of increasing concern in Minnesota and across the country due to rising asthma prevalence, most notably in children, since the mid-1980s. The rate of increase in asthma prevalence has slowed since the mid-1990s; however, the CDC notes that the percentage of Americans with asthma is at an historic high.[2] The good news is that rates of asthma-related hospitalizations and asthma deaths are decreasing, although disparities in the burden of asthma persist.

About this report:

The purpose of this report is to use all available data sources to describe the burden 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. When possible, this report has been organized around the National Heart, Lung, and Blood Institute (NHLBI) Expert Panel Report 3 (EPR-3) national guidelines for asthma diagnosis and management; specifically, the four key components of asthma care: (1) assessment and monitoring of asthma symptoms, (2) medications, (3) education provided to patients on how to manage their asthma, and (4) recognition and control of comorbid conditions and environmental factors that can make asthma worse.

Because much of the data used in this report comes from surveys, 95% confidence intervals (95% CI) are shown, when available, as an indication of the margin of error associated with the survey results. In some cases, confidence intervals have not been included, but statistically significant differences are noted as such in the text.

ASTHMA PREVALENCE

Asthma prevalence is a measure of the percentage of people who have asthma—both newly-diagnosed and existing cases—in a particular population at a particular time. Typically, asthma prevalence is measured using surveys. Respondents are asked: "Has a doctor or nurse ever told you that you had asthma?" to determine the percentage of people who have been impacted by asthma at some point in their lives. Those answering yes are then asked: "Do you still have asthma?" to determine the percentage currently experiencing asthma. Note that these questions only track diagnosed asthma; thus, trends in asthma prevalence are also affected by trends in asthma awareness and diagnosis.

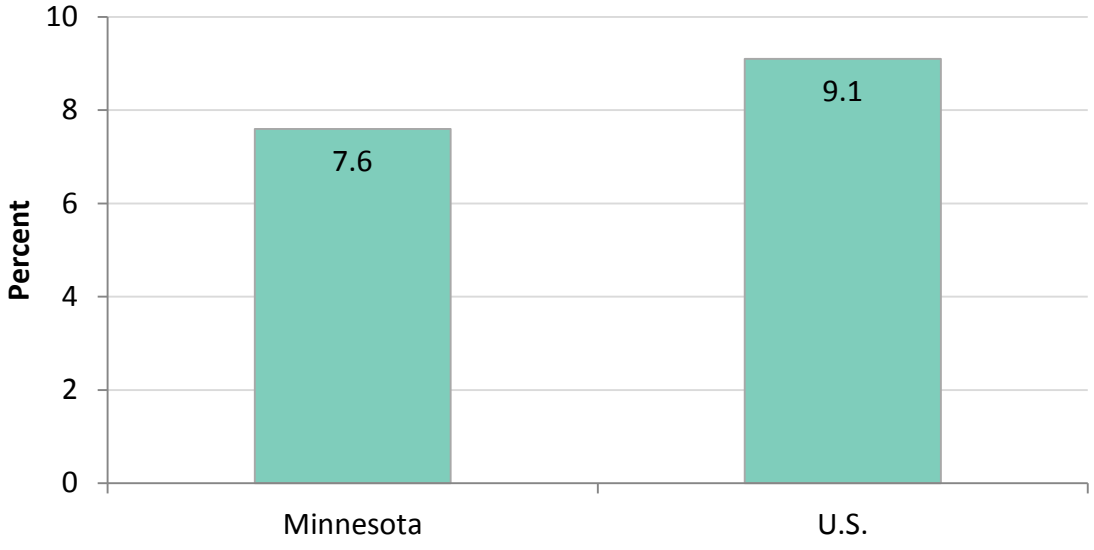
In Minnesota, the prevalence of asthma in adults is tracked using the Behavioral Risk Factor Surveillance System (BRFSS), while the prevalence of asthma in children is tracked using BRFSS, the National Survey of Children's Health, the Minnesota Student Survey and the Minnesota Youth Tobacco and Asthma Survey. Local data on asthma prevalence is available for Hennepin County through the Survey of the Health of All the Population and the Environment (SHAPE).

ADULT ASTHMA PREVALENCE

Behavioral Risk Factor Surveillance System

In 2010, 7.6% or 1 in 13 Minnesota adults reported that they had asthma. That translates to an estimated 302,000 Minnesota adults who currently have asthma. The prevalence of asthma among Minnesota adults is lower than the median estimate for all states.

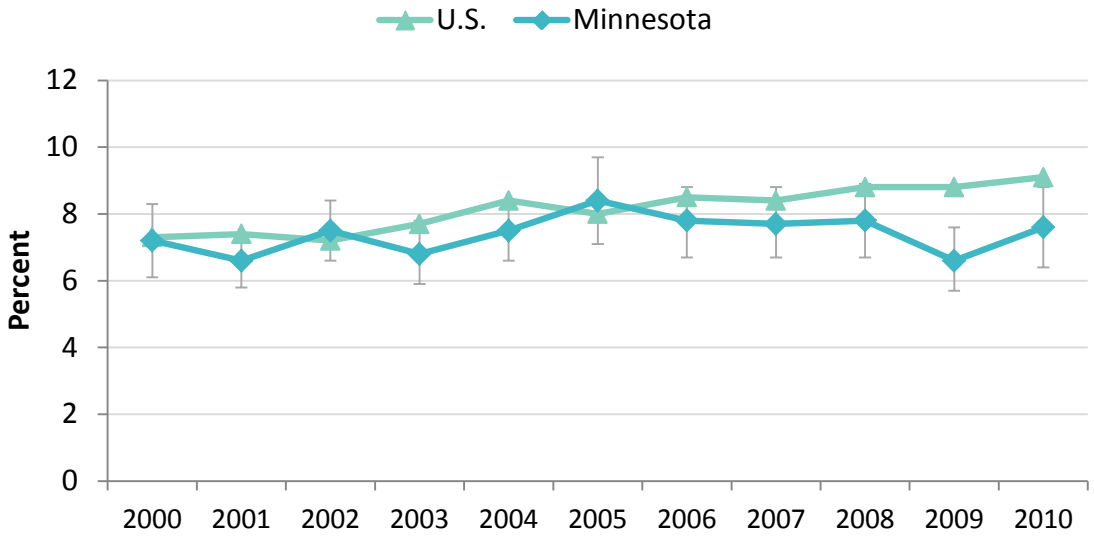
Figure 1. Percentage of adults with current asthma, Minnesota and U.S.



Source: Minnesota BRFSS, 2010

Between 2000 and 2010, the percentage of Minnesota adults who reported having current asthma increased from 7.2% in 2000 to 8.4% in 2005, and has since decreased to 7.6% in 2010. U.S. asthma prevalence has increased consistently since 2000. Note that changes in asthma prevalence over time may be due to true increases or decreases in the number of new cases of asthma and/or changes in the patterns of awareness and diagnosis of the disease.

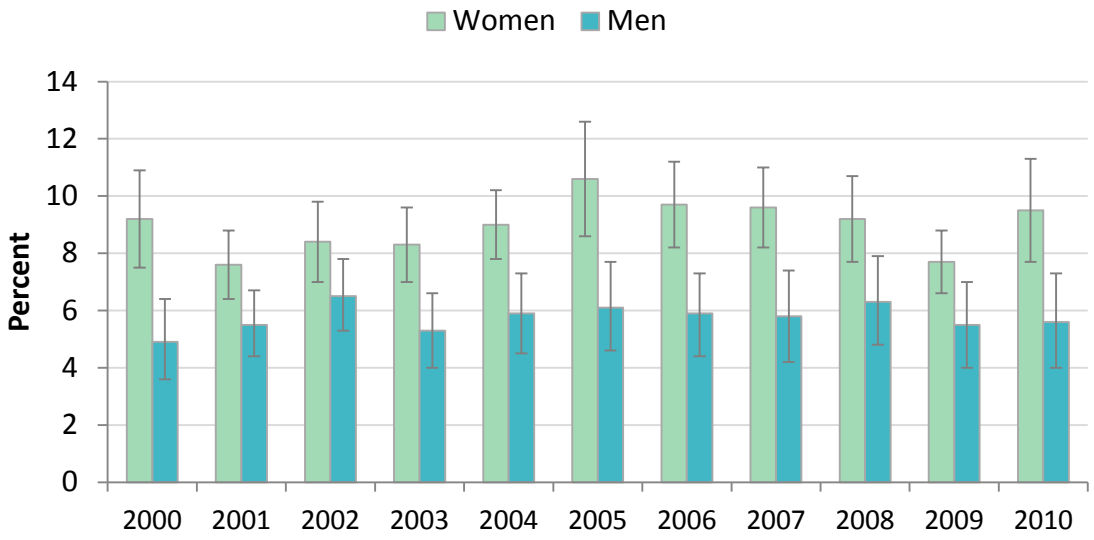
Figure 2. Percentage of adults with current asthma by year, Minnesota and U.S.



Source: BRFSS, 2000-2010

Women are more likely than men to report that they currently have asthma (9.5% vs. 5.6%). In 2010, the prevalence of asthma among Minnesota women was lower than that for U.S. women (9.5% vs. 11.1%); similarly, the prevalence among Minnesota men was lower than that for U.S. men (5.6% vs. 6.8%). (U.S. data: www.cdc.gov/BRFSS)

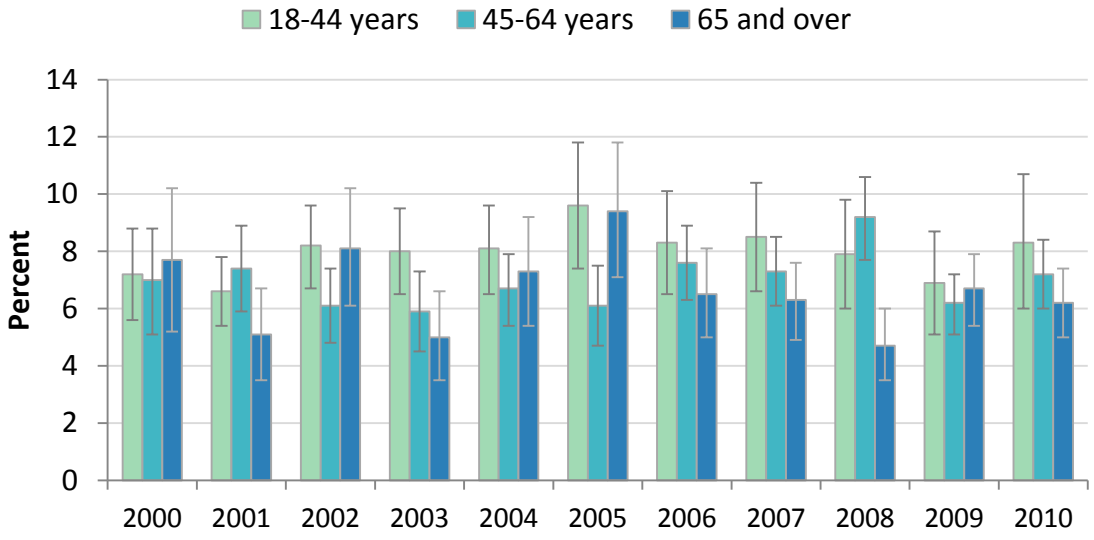
Figure 3. Percentage of adults with current asthma by sex, Minnesota



Source: Minnesota BRFSS, 2000-2010

Between 2000 and 2010, a clear trend in adult asthma prevalence by age group has not emerged. In 2010, 8.3% of 18-44 year olds, 7.2% of 45-64 year olds and 6.2% of 65+ year olds reported that they had asthma.

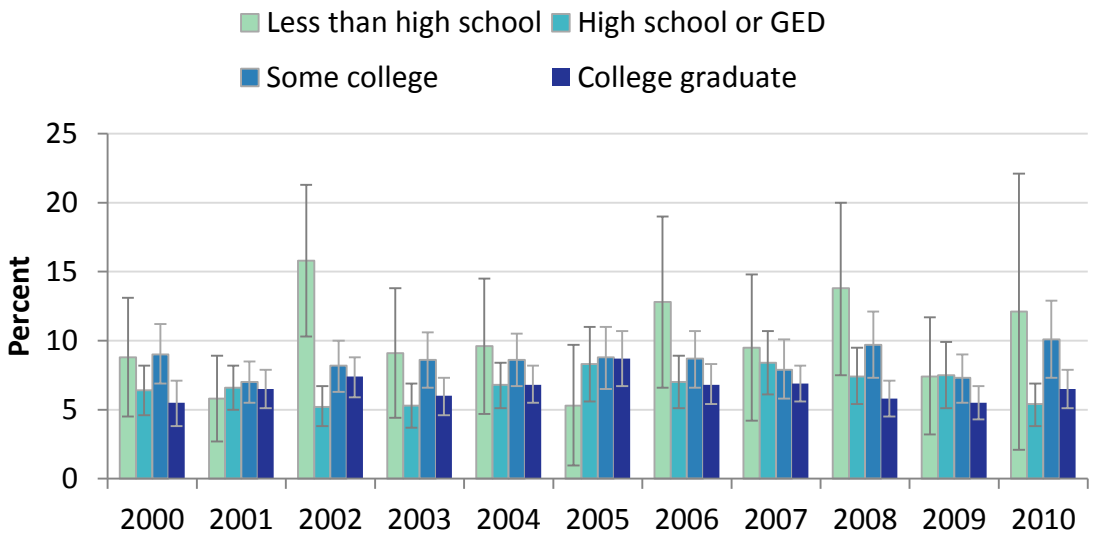
Figure 4. Percentage of adults with current asthma by age group, Minnesota



Source: Minnesota BRFSS, 2000-2010

Likewise, there is not a clear trend over time in adult asthma prevalence by level of education. In 2010, 12.1% of adults with less than a high school education, 5.4% of adults who completed high school or a GED, 10.1% of adults with some post-high school education and 6.5% of adults with a college degree reported that they had asthma.

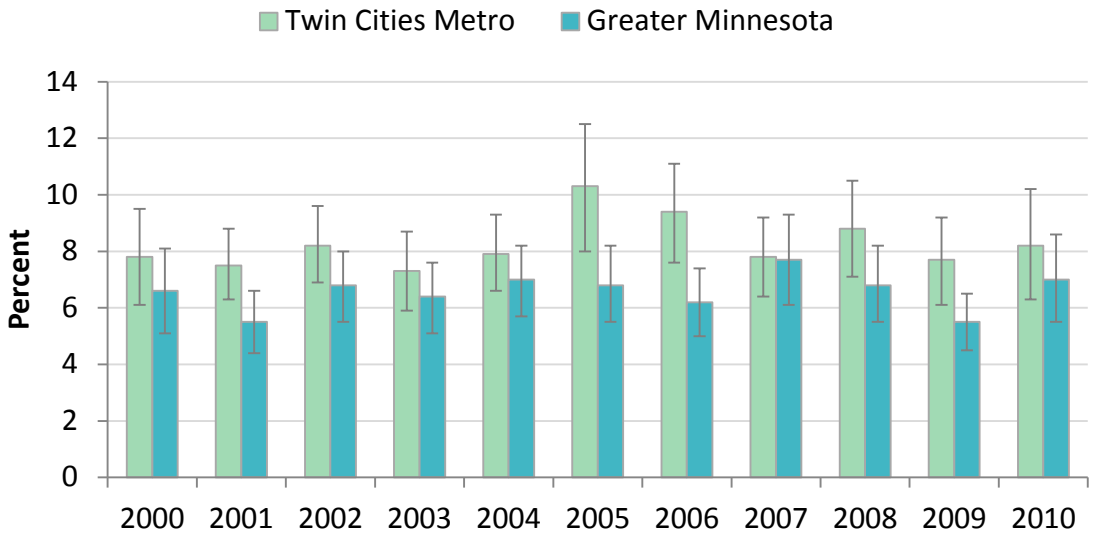
Figure 5. Percentage of adults with asthma by education, Minnesota



Source: Minnesota BRFSS, 2000-2010

In 2010, 8.2% of adults residing in the seven-county Twin Cities metropolitan area (Anoka, Carver, Dakota, Hennepin, Ramsey, Scott, and Washington counties) reported having asthma compared with 7.0% of adults in Greater Minnesota, although this difference is not statistically significant (i.e., within the margin of error).

Figure 6. Percentage of adults with asthma by residence, Minnesota



Source: Minnesota BRFSS, 2000-2010

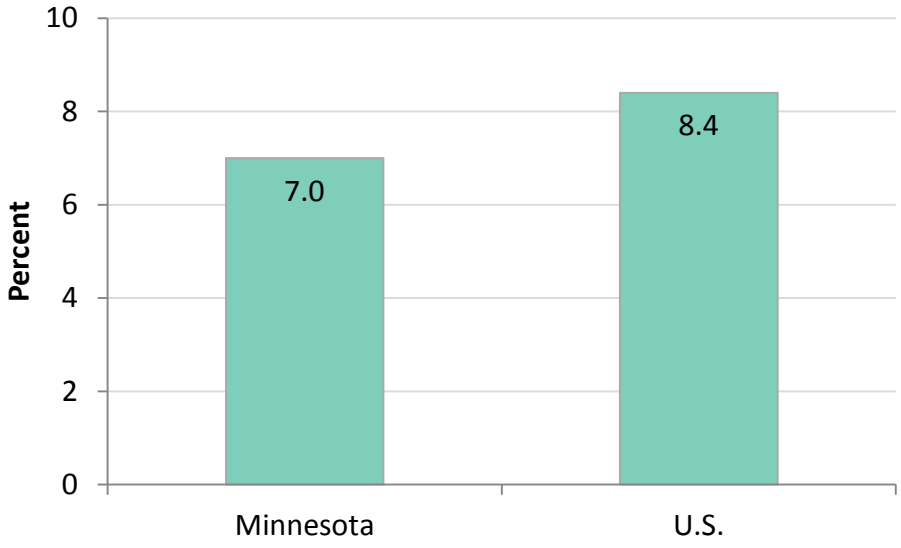
CHILD ASTHMA PREVALENCE

Behavioral Risk Factor Surveillance System

In 2010, 7.0% of Minnesota children were reported to have asthma. That translates to an estimated 90,000 children with current asthma or 1 in 14 children.

Currently, a national estimate of current asthma prevalence among U.S. children from BRFSS is not available. Data from 38 states and the District of Columbia show that 8.4% of children have current asthma. National estimates available from the 2010 National Health Interview Survey (NHIS) and the 2007 National Survey of Children's Health (NSCH) are slightly higher at 9.4% and 9.0%, respectively.

Figure 7. Percentage of children with current asthma, Minnesota and U.S.*

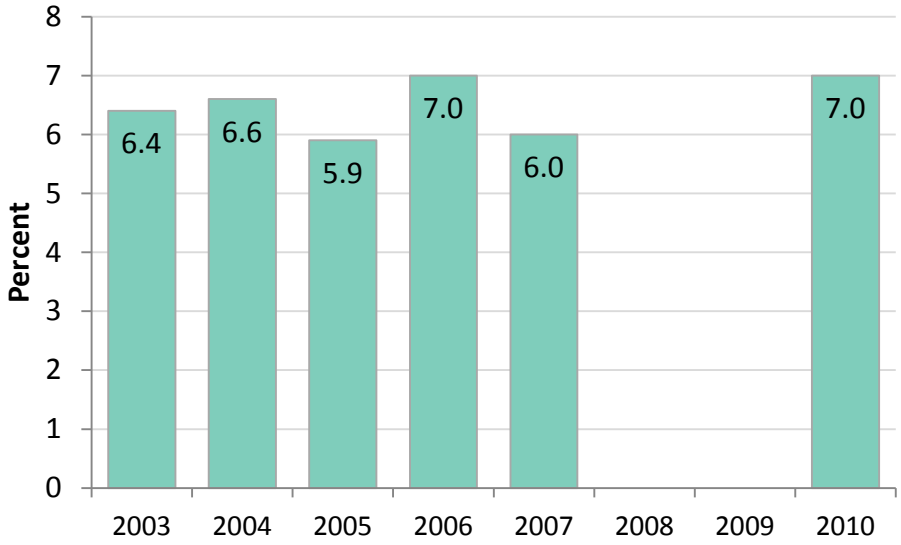


Source: BRFSS, 2010

*U.S. estimate is based on data from 38 states and the District of Columbia

Between 2003 and 2010, child asthma prevalence in Minnesota has remained relatively stable, ranging from 5.9% in 2005 to 7.0% in 2006 and 2010. (Child asthma prevalence was not measured in 2008 and 2009.)

Figure 8. Percentage of children with current asthma by year, Minnesota



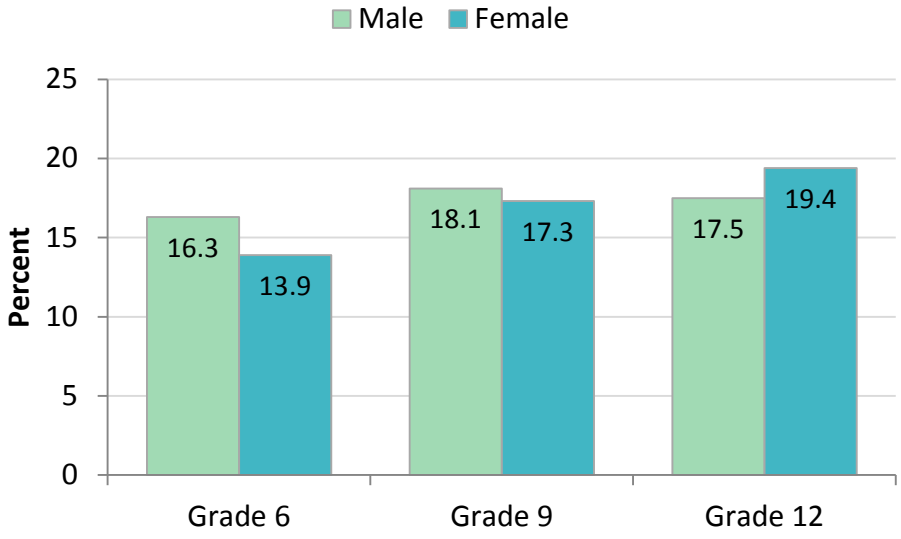
Source: BRFSS, 2003-2006, 2010; National Survey of Children's Health, 2007

YOUTH ASTHMA PREVALENCE

Minnesota Student Survey

In the Minnesota Student Survey, students are asked "Has a doctor or nurse ever told you that you have asthma?" Data from the 2010 Minnesota Student Survey show differences in asthma prevalence by sex and grade. In grades 6 and 9, a greater percentage of boys than girls have ever been diagnosed with asthma. In grade 12, the pattern switches, with a greater percentage of girls than boys diagnosed with asthma. Overall, 15.1% of 6th graders, 17.7% of 9th graders and 18.4% of 12th graders have been impacted by asthma at some point in their lives.

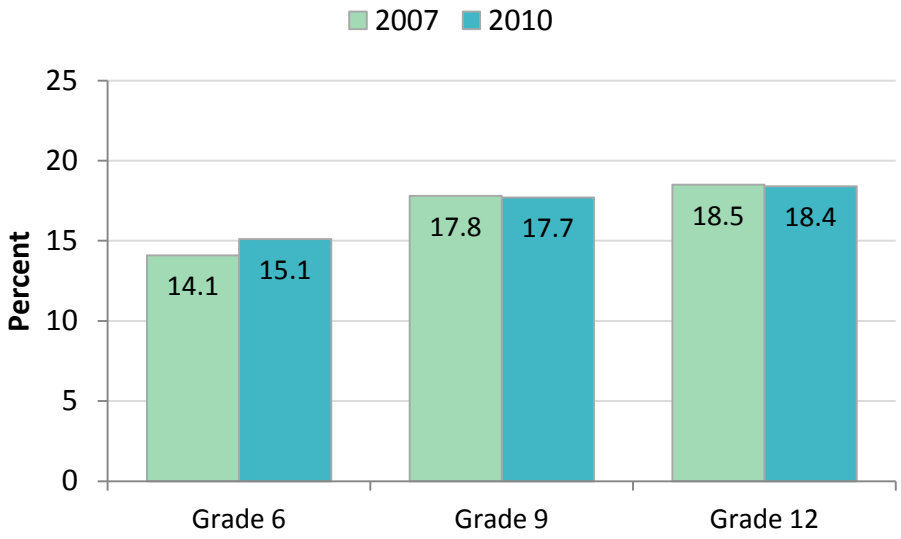
Figure 9. Percentage of youth ever diagnosed with asthma by grade and sex, Minnesota



Source: Minnesota Student Survey, 2010

Aside from a small increase among 6th graders, there has been no change in asthma prevalence since 2007.

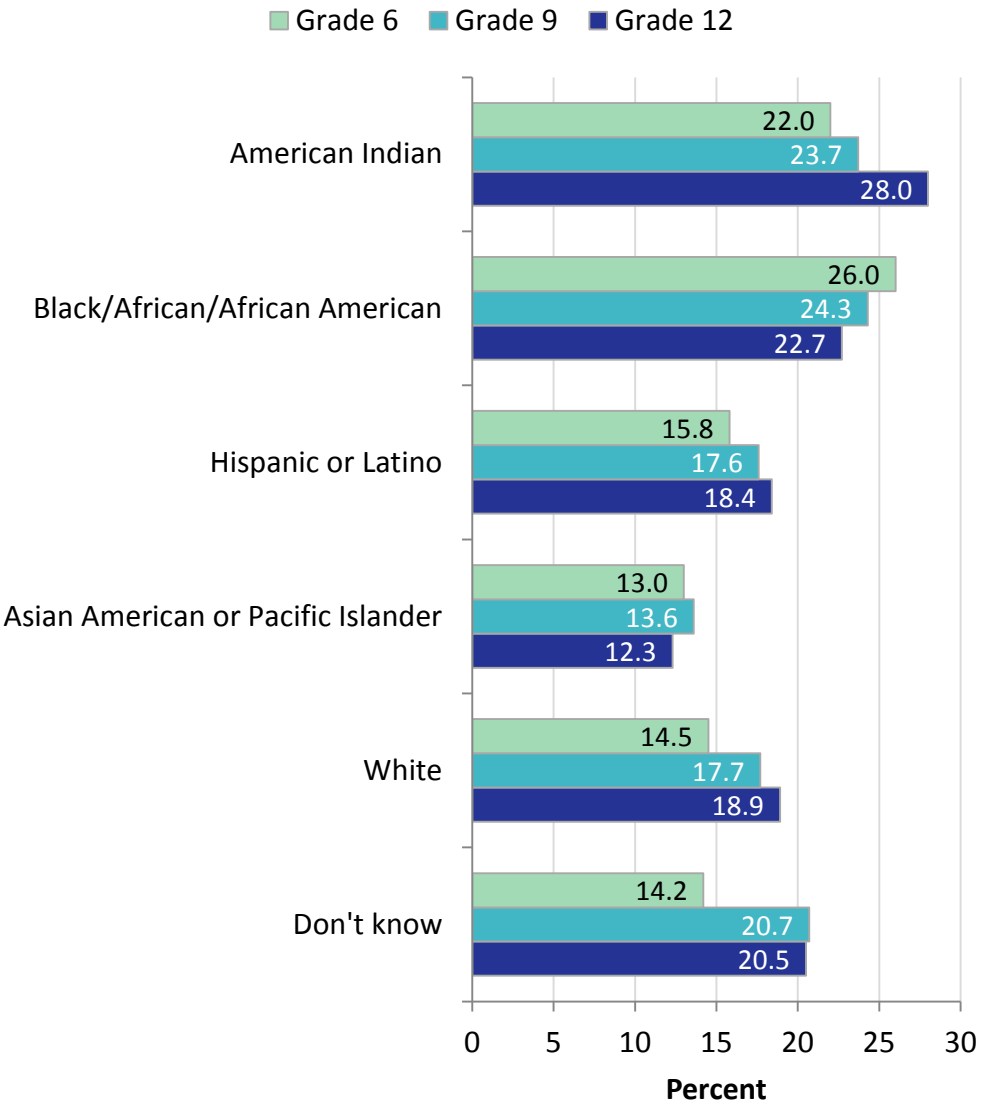
Figure 10. Percentage of youth ever diagnosed with asthma by grade and year, Minnesota



Source: Minnesota Student Survey, 2007, 2010

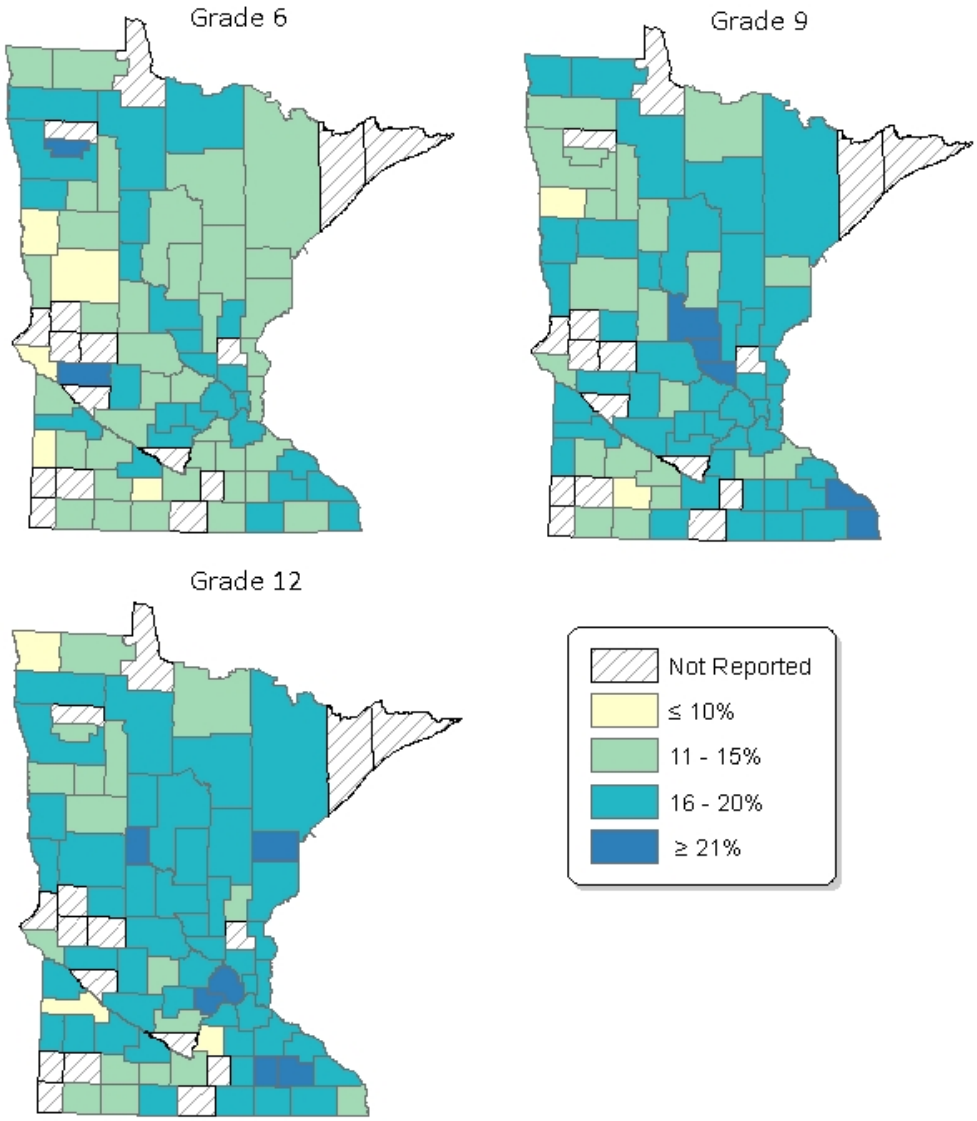
There are disparities in asthma prevalence by race/ethnicity among youth in Minnesota. In grade 6, asthma prevalence is highest among Black students; in grade 9, prevalence is highest among American Indian and Black students; and in grade 12, prevalence is highest among American Indian students.

Figure 11. Percentage of youth ever diagnosed with asthma by race/ethnicity, Minnesota



Source: Minnesota Student Survey, 2010
Note: In the Minnesota Student Survey, students are asked to choose one or more racial/ethnic categories to indicate how they describe themselves. In this graph each racial/ethnic category includes all students checking that category; thus, responses for a student could be included in more than one category.

Figure 12. Percentage of youth ever diagnosed with asthma by grade and county, Minnesota



Source: Minnesota Student Survey, 2010

The maps above show the percentage of students who have ever been diagnosed with asthma by grade and county. Note that diagonal stripes indicate that a county did not report data. The maps indicate that the percentage of students diagnosed with asthma increases by grade with a greater number of counties shaded in the darker colors in the grade 12 map. That is, new diagnoses of asthma continue through the teenage years resulting in an increase in the overall percentage of students who have ever received a diagnosis of asthma.

Minnesota Youth Tobacco and Asthma Survey

Since 2008, the Minnesota Youth Tobacco and Asthma Survey has included a set of questions on asthma symptoms, diagnosis, activity limitations and health care utilization.

Table 1. Percentage of middle and high school students by asthma status, Minnesota

	Middle School	High School	Total
Had wheezing, chest tightness or other asthma symptoms in past year[1]	21.6%	22.4%	22.1%
Has ever received an asthma diagnosis[2]	16.7%	17.9%	17.4%
Still has asthma[3]	11.8%	12.9%	12.4%

Source: Minnesota Youth Tobacco and Asthma Survey, 2011

[1]Yes to: During the past 12 months, have you had wheezing, tightness in your chest or other symptoms of asthma? (Not counting times when you had a cold or the flu)

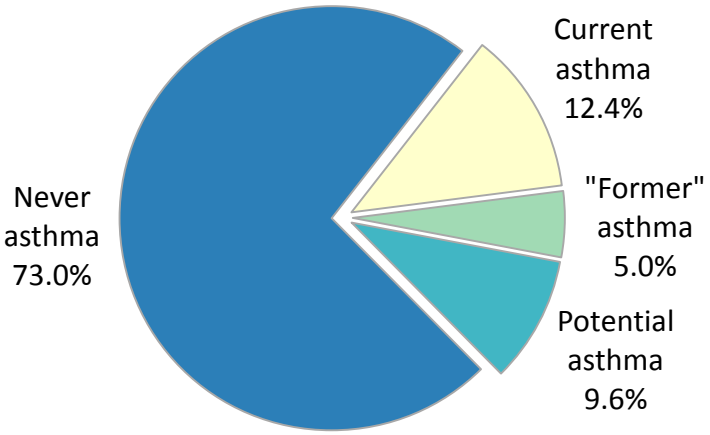
[2]Yes to: Has a doctor or nurse ever told you or your parents that you have asthma?

[3]Yes to both: During the past 12 months, have you had wheezing, tightness in your chest or other symptoms of asthma? and Has a doctor or nurse ever told you or your parents that you have asthma?

Students were defined as having *current asthma* if they had ever been diagnosed with asthma and reported having asthma-like symptoms when they did not have a cold or flu. Students were defined as having "*former" asthma* if they reported ever being diagnosed but not having asthma-like symptoms in the past year. ("Former" is in quotes to acknowledge that asthma is a chronic condition. Even during periods of clinical remission in which symptoms of asthma disappear, in most cases inflammation in the airways persists.[5-7]) Students were classified as having *potential asthma* if they have never been diagnosed but indicated that they experienced asthma-like symptoms in the past year. All other students were classified as never having asthma.

The graph below shows the percentage of students in each of the asthma status categories. It is notable that 1 in 10 students fall into the potential asthma category; i.e., reporting asthma-like symptoms without a diagnosis. Not everyone classified as having potential asthma has undiagnosed asthma—there may be other factors causing asthma-like symptoms such as deconditioning. However, it is likely that some portion of this group truly has asthma. These numbers have shifted slightly since the 2008 Youth Tobacco and Asthma Survey when 11.4% of students were classified as having current asthma, 4.8% as "former" asthma and 9.6% as potential asthma.

Figure 13. Percentage of youth (grades 6-12) by asthma status, Minnesota



Source: Minnesota Youth Tobacco and Asthma Survey, 2011

There are notable differences in the prevalence of current, "former" and potential asthma by race/ethnicity among Minnesota youth; however, these differences are all within the margin of error (i.e., not statistically significant). The lack of statistical significance may largely be due to the relatively small numbers of students of color in the survey.

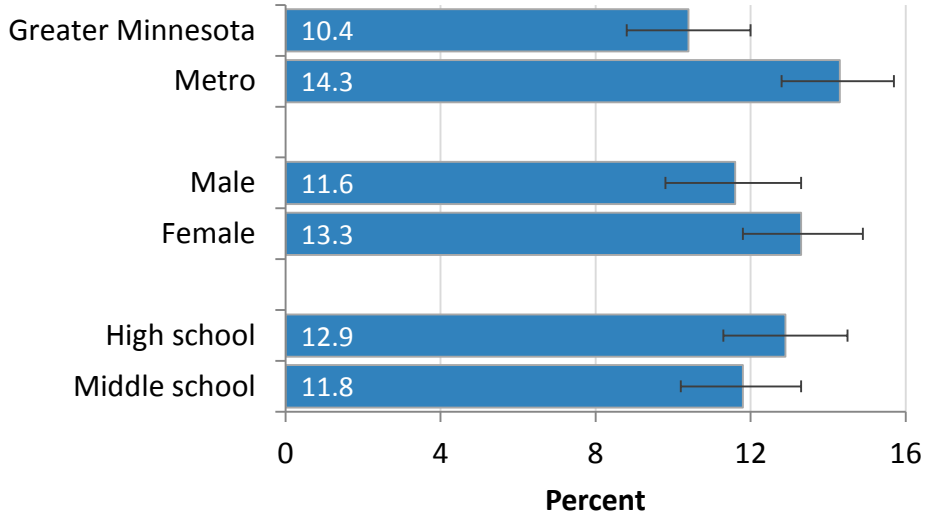
Table 2. Percentage of youth with asthma by race/ethnicity, Minnesota

	American Indian	Asian/Pacific Islander	Black	Hispanic	White
Current asthma	22.4%	11.5%	12.8%	6.6%*	12.2%
"Former" asthma	3.5%*	7.0%	7.2%	6.0%*	4.6%
Potential asthma	14.8%	7.2%*	8.9%	12.4%	9.4%

*Relative standard error is greater than 30%; thus results may be unreliable.
Source: Minnesota Youth Tobacco and Asthma Survey, 2011
Note: Race/ethnicity is based on the student's report of the category that best describes them.

The graph below shows characteristics of students with current asthma. The prevalence of current asthma is higher among youth living in the seven-county Twin Cities metro area than in Greater Minnesota. The differences by sex and grade are not statistically significant.

Figure 14. Percentage of youth with current asthma by sex, grade and residence, Minnesota



Source: Minnesota Youth Tobacco and Asthma Survey, 2011

ASTHMA CONTROL

The severity of asthma in an individual *prior to treatment* can be assessed based on the frequency of daytime and nighttime asthma symptoms, the need for quick-relief medication, activity limitations and the results of lung function testing. The "*Expert Panel Report 3 (EPR-3) Guidelines for the Diagnosis and Management of Asthma,"* released in 2007 by the National Asthma Education and Prevention Program (NAEPP), emphasizes the importance of asthma control; that is, the reduction of asthma symptoms through appropriate use of medication and control of environmental factors and comorbid conditions (e.g., gastroesophageal reflux).[8]

The measures of impairment used to assess asthma control in youth (age 12 and older) and adults are shown in Table 3. (A similar table for children can be found in the EPR-3 Guidelines.) The EPR-3 Guidelines define impairment as "frequency and intensity of symptoms and functional limitations the patient is experiencing currently or has recently experienced".[8]

Table 3. Factors used to classify asthma control in individuals age 12 and older.

Components of Asthma Control		**Classification of Asthma Control (≥12 years of age)**		
		Well Controlled	**Not Well Controlled**	**Very Poorly Controlled**
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime awakenings	≤2x/month	1-3x/week	≥4x/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting beta2-agonist use for symptom control	≤2 days/week	>2 days/week	Several times per day
	FEV1 or peak flow	>80% predicted/ personal best	60-80% predicted/ personal best	<60% predicted/ personal best
Risk	Exacerbations requiring oral systemic corticosteroids	0-1/year	≥2/year	
	Progressive loss of lung function	Evaluation requires long-term follow-up care		
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		

Source: Expert Panel Report 3 (EPR-3) Guidelines for the Diagnosis and Management of Asthma.

The table below shows the percentage of Minnesota adults with current asthma who are experiencing different degrees of asthma impairment.

Table 4. Asthma control among adults with asthma, Minnesota

	Adults
Had symptoms on 3 or more days in the past month	40.4%
Sleep disrupted by asthma on 3 or more nights in the past month	15.5%
Asthma attack or episode in past 12 months	47.9%
Unable to work or carry out usual activities due to asthma on one or more days in past 12 months	17.0%

Source: Minnesota BRFSS, 2008

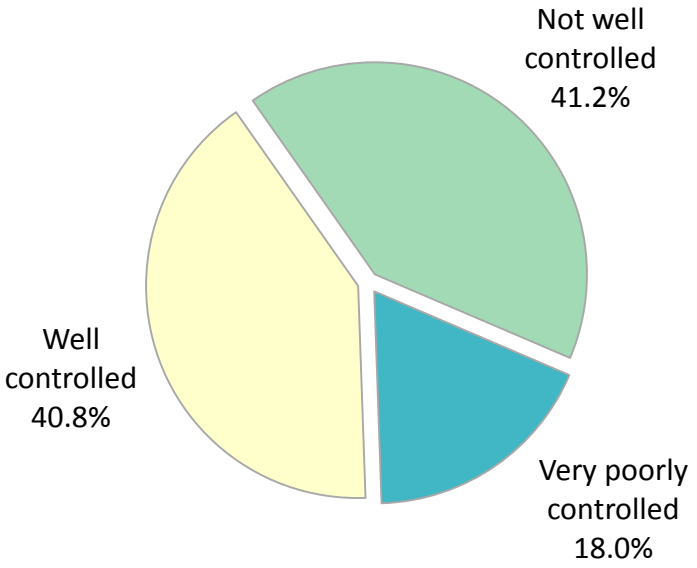
Data from the Minnesota Youth Tobacco and Asthma Survey can be used to classify students with current asthma by level of asthma control based on their reports of daytime symptoms, nighttime awakenings and activity limitations. The table below shows the questions and responses used to create these classifications. A student's overall control classification is based on the response indicating the least control. For example, if a student falls into the "well controlled" category based on responses to the daytime symptoms and activity limitation questions, but falls into the "not well controlled" category based on response to the nighttime symptoms question, then the student's overall level of control would be classified as "not well controlled".

Table 5. Asthma control classifications in the Minnesota Youth Tobacco and Asthma Survey

Question	Well controlled	Not well controlled	Very poorly controlled
During the past 30 days, how often have you had symptoms of asthma such as wheezing, coughing, shortness of breath, chest tightness or pain?	less than 3 days per week	3 or more days per week	throughout the day
During the past 30 days, how often have symptoms of asthma made it difficult for you to stay asleep?	less than 3 times per month	1-3 nights per week	4 or more nights per week
During the past 30 days, how much of the time did asthma limit your usual activities?	Not at all	Some	A lot

According to the Minnesota Youth Tobacco and Asthma Survey, the majority of students with asthma (59.2%) have asthma that is not controlled. Nearly 1 in 5 Minnesota youth with asthma have very poorly controlled asthma.

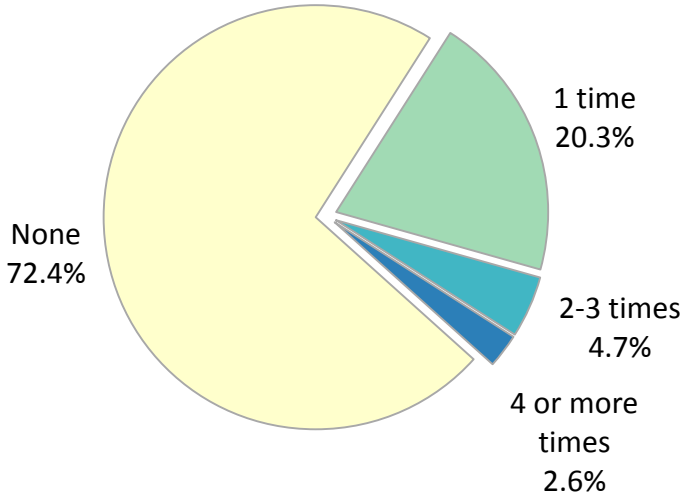
Figure 15. Asthma control among youth with current asthma, Minnesota



Source: Minnesota Youth Tobacco and Asthma Survey, 2011

Twenty-eight percent of Minnesota youth with asthma report having had one or more urgent care visits, emergency department visits or hospitalizations due to worsening symptoms of asthma in the past 12 months.

Figure 16. Frequency of urgent care/ED visits or hospitalizations for worsening asthma symptoms among youth with current asthma, Minnesota

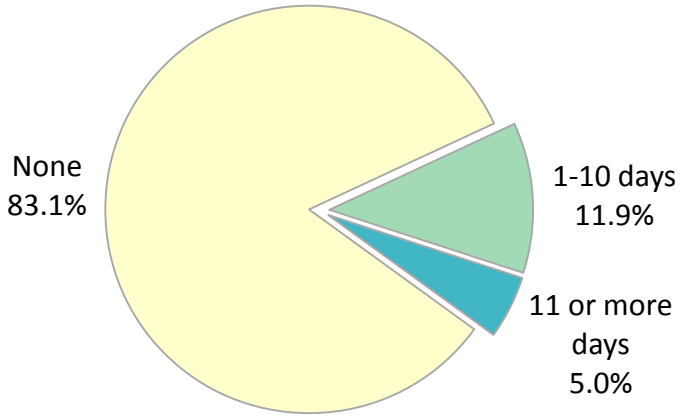


Source: Minnesota Youth Tobacco and Asthma Survey, 2011

Activity Limitations

People with asthma should be able to lead healthy, active lives. In 2008, 83% of Minnesota adults with asthma reported that they had not experienced any days in the past year in which their activities were limited by asthma. Seventeen percent were limited on one or more days.

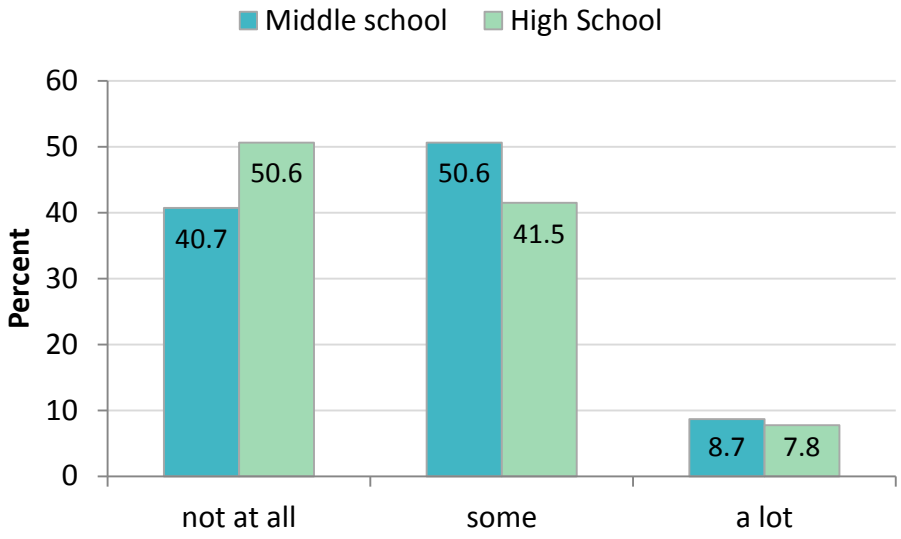
Figure 17. Frequency of asthma-related activity limitations in past 12 months among adults with current asthma, Minnesota



Source: Minnesota BRFSS, 2008

In the Minnesota Youth Tobacco and Asthma Survey, students with asthma were asked how often asthma limited their activities. More than half of middle school students with asthma (59.3%) and nearly half of high school students with asthma (49.3%) reported some or a lot of activity limitations due to asthma.

Figure 18. Activity limitations among middle and high school students with current asthma, Minnesota

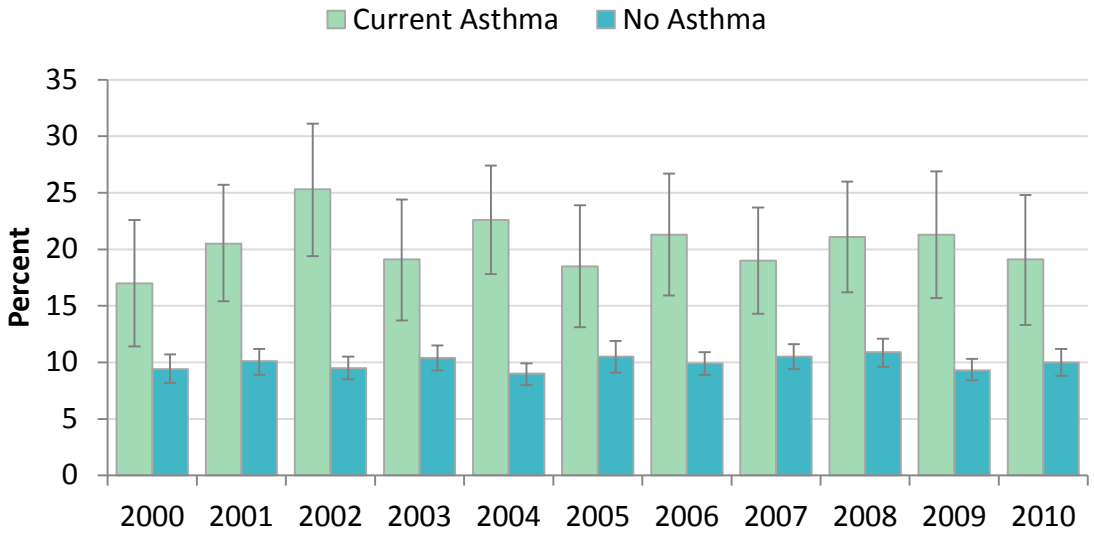


Source: Minnesota Youth Tobacco and Asthma Survey, 2011

Quality of Life

Uncontrolled asthma can negatively impact quality of life for people with asthma. Since 2000, adults with asthma have been more likely than adults without asthma to report fair or poor health. In 2010, 19.1% of adults with asthma described their health as fair or poor compared with 10.2% of adults who did not have asthma.

Figure 19. Fair or poor health by asthma status, Minnesota adults



Source: Minnesota BRFSS, 2000-2010

Optimal Asthma Care

Minnesota Community Measurement, an organization that reports quality of care measures by clinic and medical group, has adopted a composite measure of optimal asthma care. This measure is composed of three elements: asthma control, risk of exacerbation ,and patient education.

Optimal asthma care measure definition

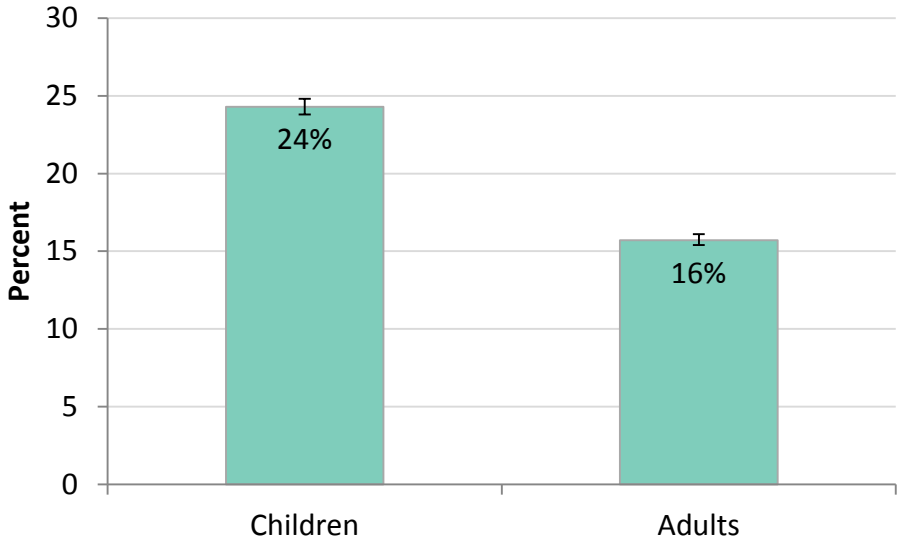
The percentage of asthma patients ages 5-50 having:

- Well-controlled asthma
  - Asthma Control Test (ACT) score ≥20 or Child-ACT score ≥20 or Asthma Control Questionnaire (ACQ) ≤0.75 or Asthma Therapy Assessment Questionnaire (ATAQ) score=0
- No elevated risk of exacerbation
  - number of emergency department visits and hospitalizations due to asthma in past 12 months<2
- Education on asthma and self-management of the condition
  - written asthma action plan in chart documenting purpose of medication and doses, how to recognize and what to do during an exacerbation and information on triggers

Excludes patients with COPD, emphysema, cystic fibrosis, or acute respiratory failure.

According to this definition, only 24% of child asthma patients (ages 5-17) and 16% of adult asthma patients (ages 18-50) across Minnesota received optimal asthma care in 2010.

Figure 20. Percentage of children and adult asthma patients receiving optimal asthma care, Minnesota



Source: Minnesota Community Measurement, 2010-2011

ASTHMA MANAGEMENT

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.[8] The EPR-3 describes four components of asthma care needed to achieve those goals: assessment and monitoring of symptoms, medication use, asthma self-management education, and control of comorbid conditions and environmental factors that can make asthma worse. The previous section addressed the first component; data in this section address the second, along with other steps taken to manage asthma.

Asthma Medication Use

There are two major categories of medication used to treat asthma: long-term control medications (used to treat underlying inflammation and to relieve bronchoconstriction in the airways) and quick-relief medication (used to treat an asthma attack as it's occurring or prior to exercise for exercise-induced asthma). Examples of long-term control medication include corticosteroids, long-acting beta$_2$-agonists and leukotriene modifiers; examples of quick-relief medication include short-acting beta$_2$-agonists and anticholinergics.

The table below includes data on asthma medication use among adults with current asthma. Note that the survey questions asked about medication use (i.e., used to prevent an attack versus used during an attack) rather than medication type (i.e., long-term control versus quick-relief medications).

Table 6. Asthma medication use among adults with current asthma, Minnesota

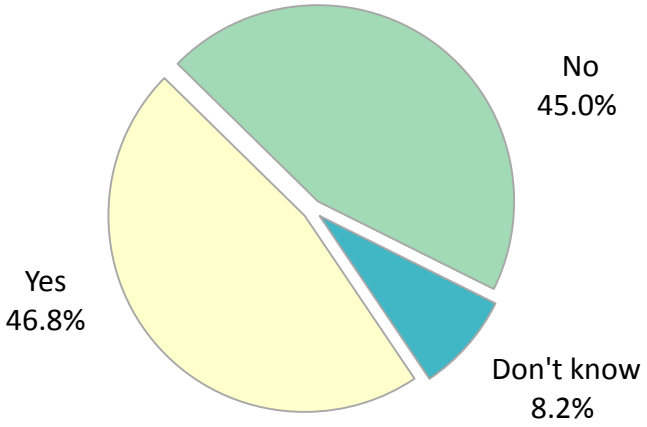
	Adults
Used medications on one or more days in the past month to prevent an attack from occurring	57.5%
Used medications on one or more days in the past month during an asthma attack	39.1%

Source: Minnesota BRFSS, 2008

Asthma Action Plans

The national guidelines recommend that healthcare providers provide a written asthma action plan for their patients with asthma. Asthma action plans include instructions for everyday asthma care (e.g., daily medications) and steps to take when symptoms worsen. According to data from the 2011 Minnesota Youth Tobacco and Asthma Survey, 47% of Minnesota youth with current asthma report that they have an asthma action plan. Note that the survey did not ask whether the asthma action plan was current. This figure has increased dramatically since the 2008 Minnesota Youth Tobacco and Asthma Survey when only 29% of youth with current asthma reported having an asthma action plan.

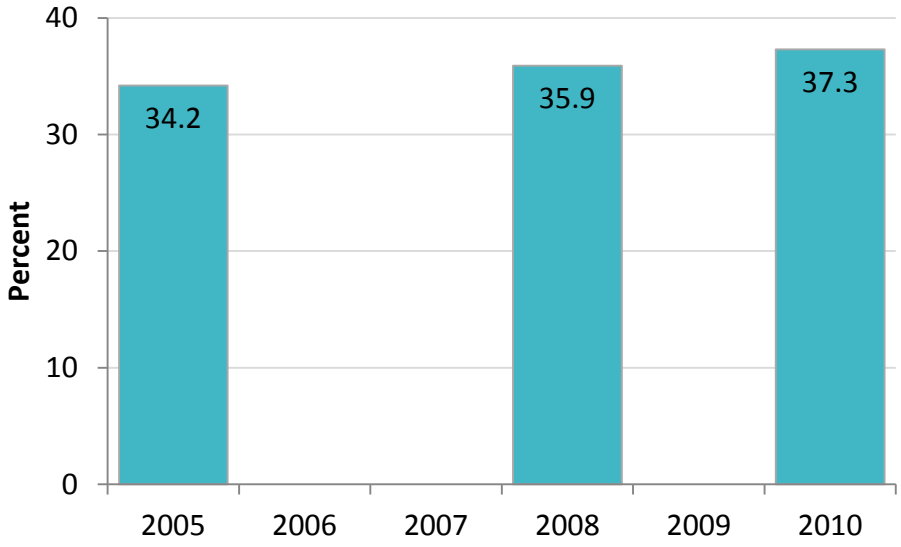
Figure 21. Percentage of youth with current asthma having an asthma action plan, Minnesota



Source: Minnesota Youth Tobacco and Asthma Survey, 2011

In 2010, 37% of adults with asthma reported that they have ever received an asthma action plan. Again, note that the survey did not specifically ask whether the asthma action plan was current. This figure has increased slightly since 2005. Nationally, 29.9% of adults with asthma report ever being given an asthma action plan.[2]

Figure 22. Percentage of adults with current asthma who have ever been given an asthma action plan, Minnesota

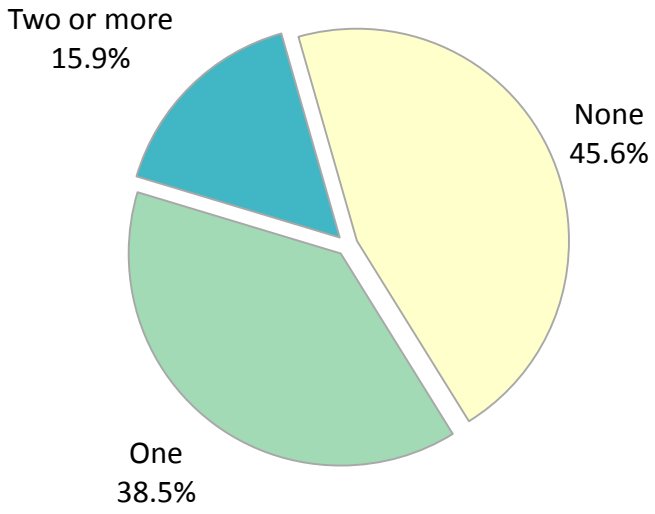


Source: Minnesota BRFSS, 2005, 2008, 2010

Routine Checkups

Fifty-four percent of adults with asthma report that they have had one or more routine checkups for asthma in the past year. The national guidelines for asthma management recommend that clinicians "monitor asthma control periodically in clinical visits, because asthma is highly variable over time and therapy may need to be adjusted (stepped up if necessary, stepped down if possible)." After asthma control is achieved, the guidelines suggest scheduling visits every one to six months to assess maintenance of asthma control.[8]

Figure 23. Number of routine checkups for asthma in the past year among adults with current asthma, Minnesota

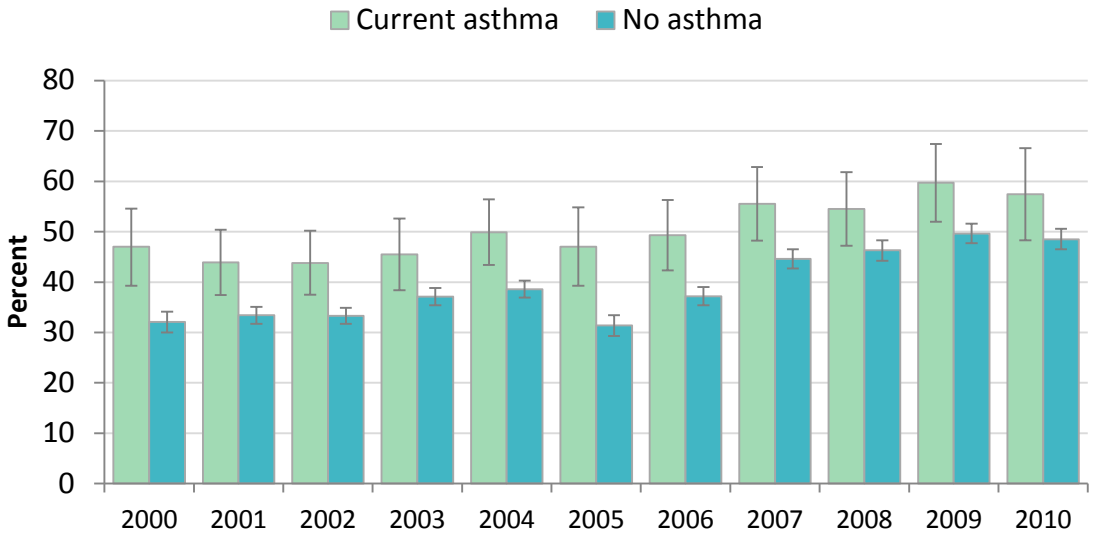


Source: Minnesota BRFSS, 2008

Flu shots

Over the past 10 years, flu vaccination rates have climbed among adults in Minnesota and have typically been higher among adults with current asthma than in the general population. This is good news since people with asthma are more likely to become seriously ill if they contract influenza. In 2010, 57% of adults with asthma reported getting a flu shot compared with 49% of adults without asthma (this difference is not statistically significant).

Figure 24. Flu shot in past year by asthma status, Minnesota adults

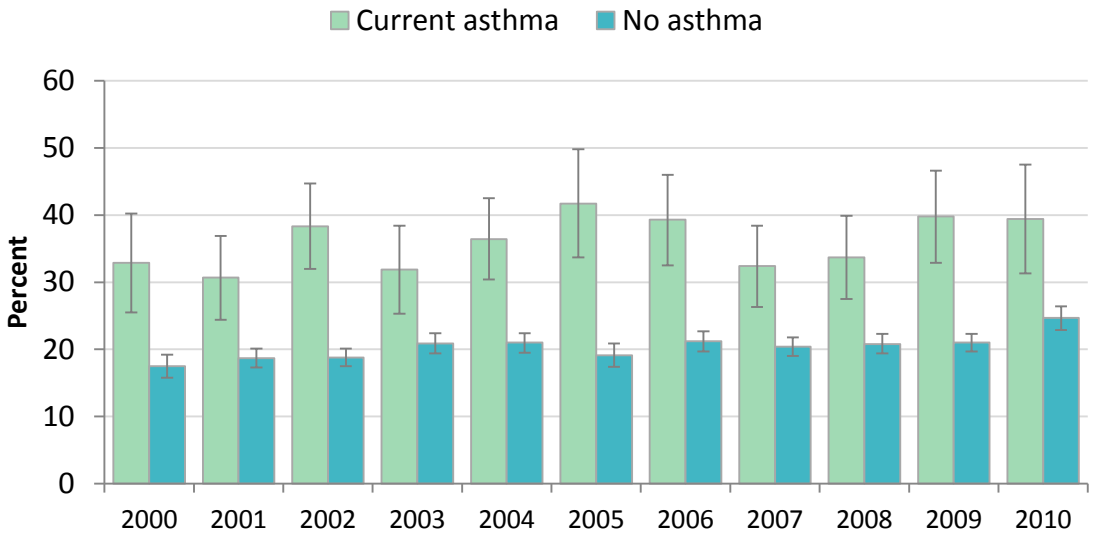


Source: Minnesota BRFSS, 2000-2010

Pneumonia Vaccine

Adults with asthma are more likely than those without asthma to report having ever received a pneumococcal vaccine ("pneumococcal polysaccharide vaccine") in their lifetime. This trend has been consistent since 2000. The pneumococcal vaccine protects against pneumococcal infections, specifically meningitis, bacteremia and pneumonia. Adults with asthma may be more likely to develop serious pneumococcal disease.[9] In 2010, the percentage of adults with asthma who had ever received the vaccine was 39.4% versus 24.7% of adults without asthma.

Figure 25. Ever had pneumonia vaccine by asthma status, Minnesota adults



Source: Minnesota BRFSS, 2000-2010

ASTHMA SELF-MANAGEMENT EDUCATION

A key component of asthma care is providing education to patients about asthma management, also known as self-management education. According to the *Expert Panel Report-3 (EPR-3) Guidelines for the Diagnosis and Management of Asthma*, self-management education involves teaching people with asthma how to monitor their level of asthma control, take medication correctly (e.g. inhaler technique, which medications to use for what purpose) and avoid environmental triggers, as well as providing them with a written asthma action plan.[8]

In Minnesota and nationwide, there is substantial room for improvement in teaching adults about how to manage their asthma.

Table 7. Asthma self-management education among adults with current asthma, Minnesota

	MN	US
Taught to recognize early signs of an asthma attack	66.8%	54.8%
Taught how to respond to an asthma attack	73.6%	63.8%
Taught how to monitor peak flow	39.1%	39.2%
Taken a class on asthma management	6.6%	12.0%

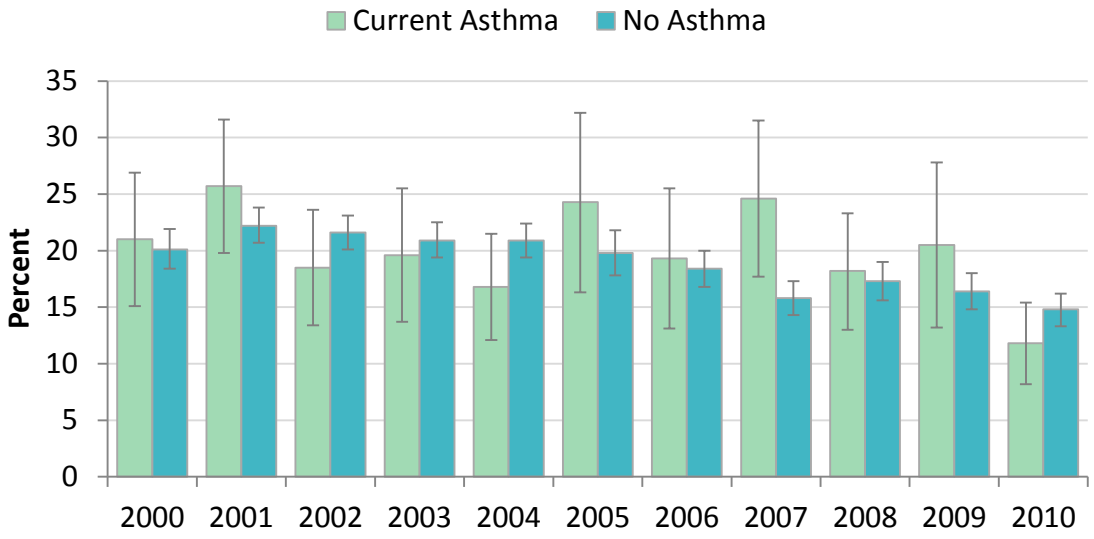
Source: Minnesota BRFSS, 2010; National Health Interview Survey, 2008

RISK FACTORS ASSOCIATED WITH ASTHMA

Smoking

Adults with asthma are just as likely as adults without asthma to report that they smoke cigarettes. Smoking can be a trigger of asthma symptoms, and environmental tobacco smoke (also known as secondhand smoke) is known to exacerbate asthma as well as cause asthma in young children.[10] In 2010, 11.8% of adults with current asthma reported smoking while 14.8% of adults without asthma reported smoking (this difference is not statistically significant). These findings suggest that people with asthma continue to smoke.

Figure 26. Current smoking by asthma status, Minnesota adults



Source: Minnesota BRFSS, 2000-2010

According to data from the Minnesota Youth Tobacco and Asthma Survey, asthma status is associated with cigarette smoking among youth. Smoking rates are higher among students with potential asthma than among students who never had asthma. The differences in smoking rates between students with current asthma and "former" asthma versus never asthma are notable but not statistically significant.

Table 8. Percentage of students reporting that they smoke cigarettes by asthma status, Minnesota

	Smoke cigarettes % (95% CI)
Current asthma	17.9 (11.1-24.8)
"Former" asthma	14.9 (8.3-21.6)
Potential asthma	21.0 (13.0-29.1)
Never asthma	9.7 (7.0-12.4)

Source: Minnesota Youth Tobacco and Asthma Survey, 2011

Environmental Tobacco Smoke

The Minnesota Youth Tobacco and Asthma Survey also provides information on exposures to environmental tobacco smoke (ETS). Students with "former" and potential asthma are more likely than their never asthma peers to report living with someone who smokes. Sixty-five percent of students with potential asthma and 53% of students with current asthma report having any exposure to ETS in the past week (e.g., in home, in car or at work), compared with 42% of students without asthma. Forty-five percent of students with potential asthma report repeated exposures to ETS in the past week (exposures experienced in more than one environment) compared with 24% of students without asthma.

Table 9. Percentage of students reporting exposures to environmental tobacco smoke by asthma status, Minnesota

	Lives with someone who smokes % (95% CI)	Any exposure to ETS* in past 7 days % (95% CI)	Repeated exposure to ETS* in past 7 days % (95% CI)
Current asthma	36.9 (31.4-42.3)	53.2 (46.6-59.8)	32.8 (25.7-39.9)
"Former" asthma	48.4 (40.0-56.9)	51.5 (42.6-60.3)	36.2 (26.6-45.7)
Potential asthma	47.1 (40.9-53.2)	64.9 (56.9-72.8)	44.8 (35.0-54.6)
Never asthma	32.3 (28.7-35.9)	42.1 (38.0-46.2)	24.3 (20.7-27.9)

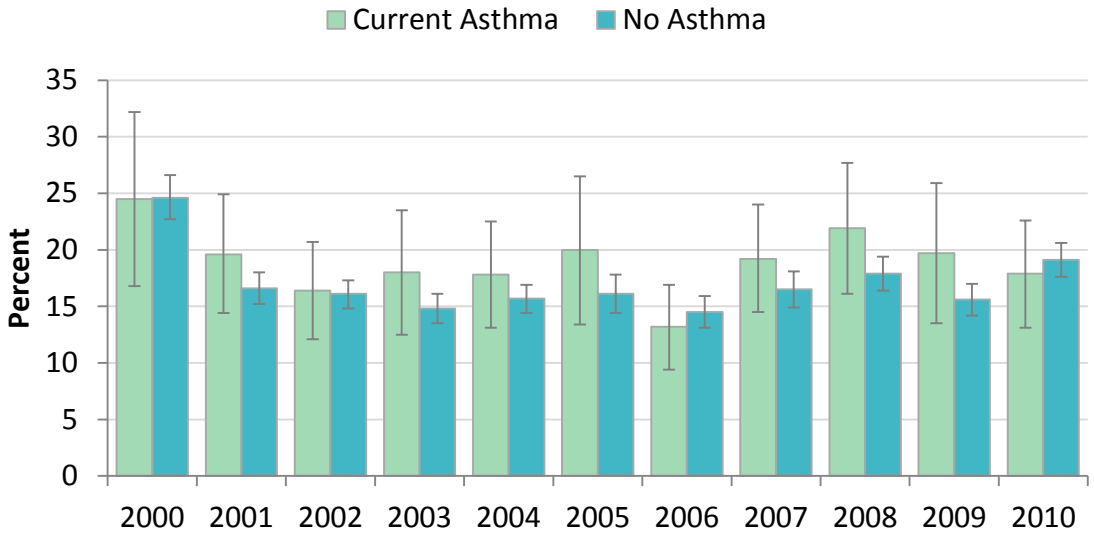
*ETS=Environmental tobacco smoke

Source: Minnesota Youth Tobacco and Asthma Survey, 2011

Physical Inactivity

The percentage of Minnesota adults reporting that they are physically inactive (i.e., no leisure time physical activity in the past 30 days) declined between 2000 and 2006 and has risen since then, with little difference between those with asthma and those who do not have asthma. This is a good sign because individuals with asthma should not be limited in their ability to participate in physical activities. During the most recent year of data (2010), 17.9% of adults with current asthma and 19.1% of adults without asthma reported that they had no leisure time physical activity in the past 30 days (this difference is not statistically significant).

Figure 27. Physical inactivity by asthma status, Minnesota adults

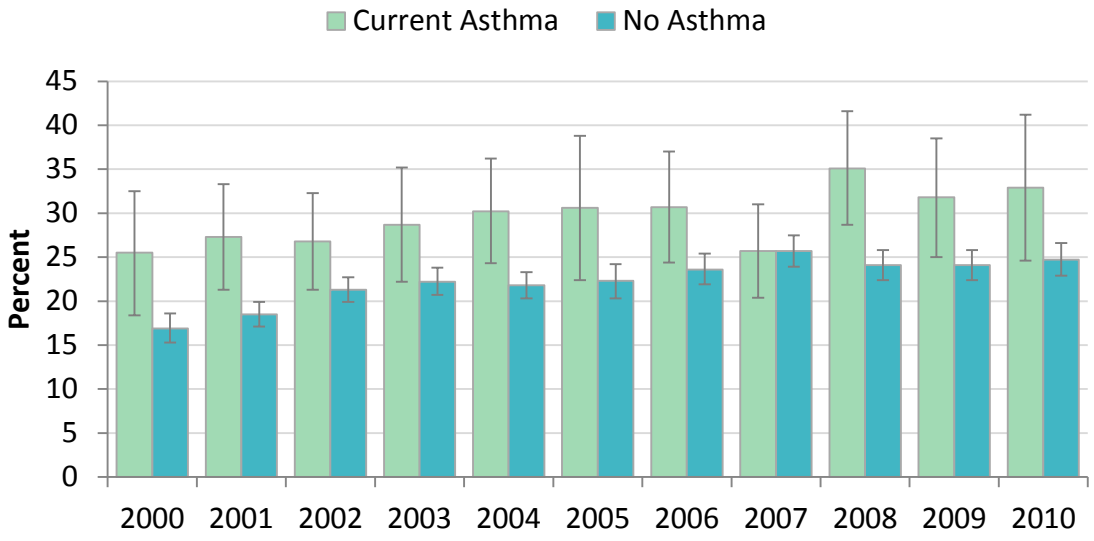


Source: Minnesota BRFSS, 2000-2010

Obesity

Since 2000, the prevalence of obesity has typically been higher among Minnesota adults with asthma than in the general population. It is not clear 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.[11] In 2010, 32.9% of adults with current asthma were determined to be obese based on their reported height and weight, compared with 24.7% of adults without asthma. This difference is not statistically significant.

Figure 28. Obesity by asthma status, Minnesota adults



Source: Minnesota BRFSS, 2000-2010

WORK-RELATED ASTHMA

Work-related asthma (WRA) includes new-onset asthma that has been caused by some aspect of work and existing asthma that is worsened or aggravated by exposures in the workplace. There are more than 350 substances in the workplace, known as asthmagens, that can cause asthma to develop or aggravate pre-existing asthma. Examples include chemicals such as isocynates, metal working fluids, welding fumes and disinfectants; plant-based substances such as flour dust and pine resin; and animal-based substances such as pet dander and poultry droppings. According to the American Thoracic Society, the percentage of adults with work-related asthma ranges from 4-58% (median=15%).[12]

In 2008, 30.6% of Minnesota adults with asthma reported that exposures to chemicals, smoke, fumes or dust in their current job had worsened their asthma. (Source: MN BRFSS, 2008)

ASTHMA AMONG PUBLIC HEALTH CARE PROGRAM ENROLLEES

It is important to understand the burden of asthma among public health care program enrollees because lower-income populations are generally at higher risk for having asthma and experiencing asthma exacerbations.[2,13] The Minnesota Department of Human Services (DHS) oversees the state's public health care programs. ***Medical Assistance*** is Minnesota's Medicaid program, providing medical care and prescription medications for residents with low incomes and residents with disabilities. Coverage is provided through two payment mechanisms: managed care and fee-for-service. ***MinnesotaCare*** is a prepaid program that provides health insurance for Minnesotans with low and moderate incomes who do not qualify for other health insurance coverage. ***General Assistance Medical Care*** (GAMC) provides medical care for low-income adults who do not have children and who are not eligible for federal coverage. Because the GAMC program was changed significantly in 2010, data for GAMC for that year are not included in this report. The GAMC program was discontinued in February 2011 with enrollees moving to Medical Assistance programs.

This analysis was limited to individuals under the age of 65 enrolled in Medical Assistance (managed care or fee-for-service programs), MinnesotaCare, or GAMC for 11 or more months in the year being analyzed. The continuous enrollment requirement excludes a large number of enrollees (see table below). Thus, it is important to keep in mind that the estimates of asthma prevalence listed in the following tables and graphs are only representative of the subset of individuals meeting the continuous enrollment criteria.

Table 10. Number of continuous enrollees in public health care programs and percentage of all enrollees by year and program, Minnesota

	2008		2009		2010	
	#	% of all enrollees	#	% of all enrollees	#	% of all enrollees
Medical Assistance	264,231	27%	292,778	28%	322,203	29%
Managed Care	148,007	34%	170,409	36%	190,597	38%
Fee-for-service	116,224	22%	122,369	22%	131,606	22%
MNCare	75,838	45%	79,410	43%	94,800	44%
GAMC	5,953	7%	7,233	7%	---	---

Source: Minnesota Department of Human Services Data Warehouse, 2008-2010

Asthma definitions

Because DHS does not collect information specifically on asthma diagnoses (i.e., information from medical records), individuals likely to have asthma are identified using criteria based on patterns of health care utilization (i.e., office visits, emergency department visits, hospitalizations) and prescription-filling. Two definitions were used to identify enrollees likely to have asthma: a broader definition ("asthma universe") and a narrower definition ("persistent asthma"). Note that the latter definition is not based on an actual measure of asthma severity.

"Asthma universe" definition:
At least one ED visit with a primary diagnosis of asthma OR
At least one hospitalization with a primary diagnosis of asthma OR
At least one office visit for asthma (any diagnosis) OR
At least 4 asthma medications filled

"Persistent asthma" definition:
At least one ED visit with a primary diagnosis of asthma OR
At least one hospitalization with a primary diagnosis of asthma OR
At least 4 office visit for asthma (any diagnosis) and 2 or more asthma medications OR
At least 4 asthma medications filled

Asthma prevalence was calculated as the number of enrollees in a particular program meeting the asthma definition in a year divided by the total number of continuous enrollees in that program in that year.

These definitions are likely to miss some individuals with mild asthma (i.e., those needing only infrequent asthma medication). In all cases, these definitions can only pick up cases for whom encounters have been accurately recorded. Because some medications used by people with asthma are also indicated for those with chronic obstructive pulmonary disease (COPD) (e.g., ipratropium bromide), these definitions may incorrectly include some people who have COPD but who do not also have asthma. COPD is a chronic lung disease that becomes more common with age and is difficult to distinguish from asthma in older people.

Note: Estimates of asthma prevalence based on claims data or encounter data (like that used in this analysis) are typically lower than estimates of asthma prevalence from surveys, such as the Behavioral Risk Factor Surveillance System (BRFSS) survey. Thus, the percentages listed in the following tables and graphs are not comparable with those for the statewide population presented earlier in this report.

Asthma Universe

In 2010, out of 417,003 individuals continuously enrolled for at least 11 months in a Minnesota Public Health Care Program, 38,835 (9%) met the "universal asthma" definition. The percentage of enrollees with asthma ranged from a low of 8% among Minnesota Care enrollees to a high of 13% among enrollees in GAMC.

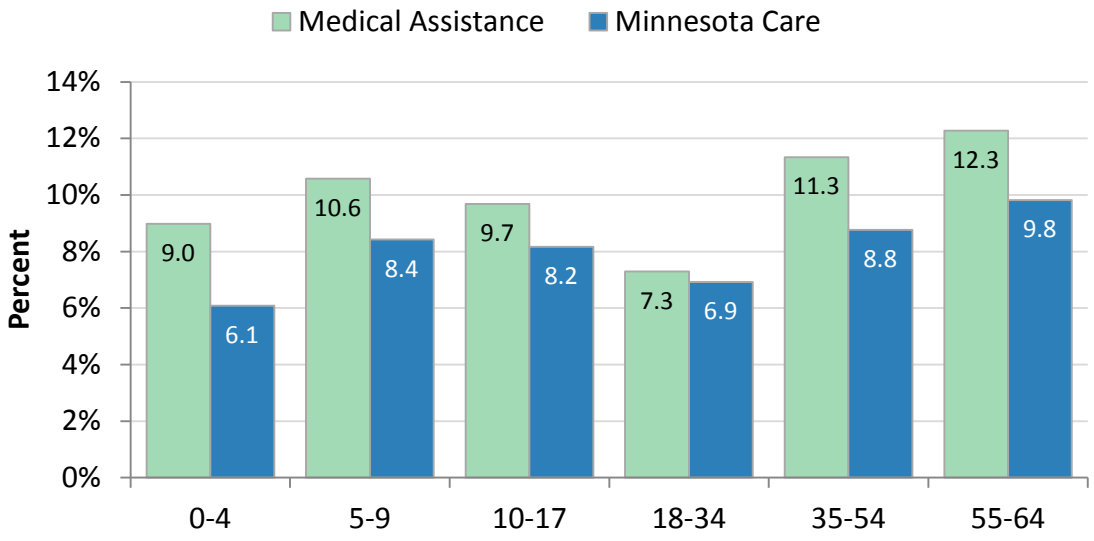
Table 11. Number and percentage of enrollees with "universal asthma" by public health care program, Minnesota

	2008		2009		2010	
	#	%	#	%	#	%
Medical Assistance	24,473	9.3%	28,097	9.6%	31,124	9.7%
MNCare	5,653	7.5%	6,384	8.0%	7,711	8.1%
GAMC	664	12.5%	857	12.8%	---	---

Source: Minnesota Department of Human Services Data Warehouse, 2008-2010

As shown in the graph below, the prevalence of universal asthma is higher among enrollees in Medical Assistance than in Minnesota Care.

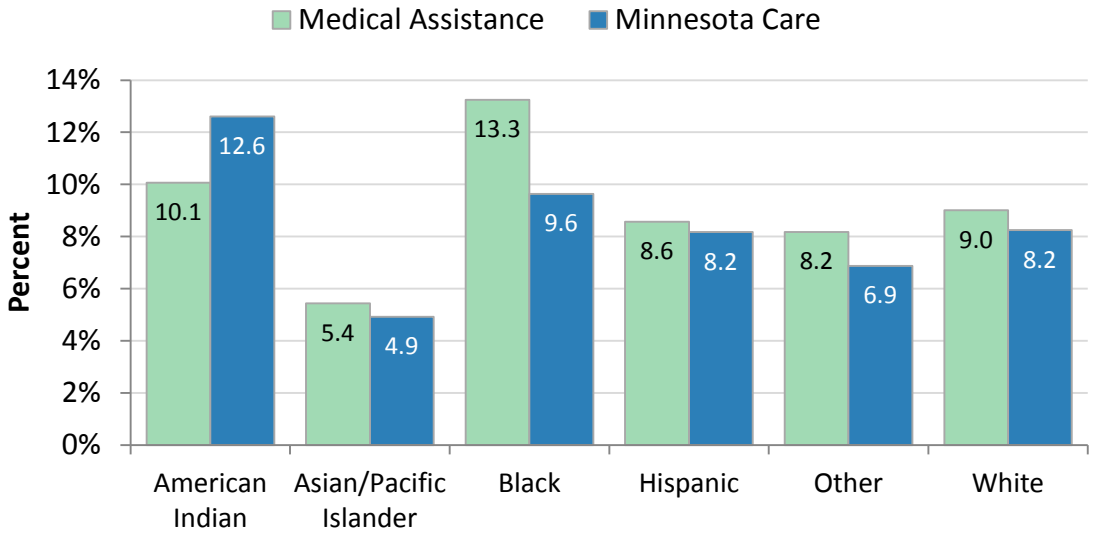
Figure 29. Percentage of enrollees with universal asthma by program and age group, Minnesota



Source: Minnesota Department of Human Services Data Warehouse, 2010

The prevalence of asthma also differs by race/ethnicity and program. Among enrollees in Medical Assistance, blacks have the highest prevalence of universal asthma. Among enrollees in MinnesotaCare, American Indians have the highest prevalence of universal asthma.

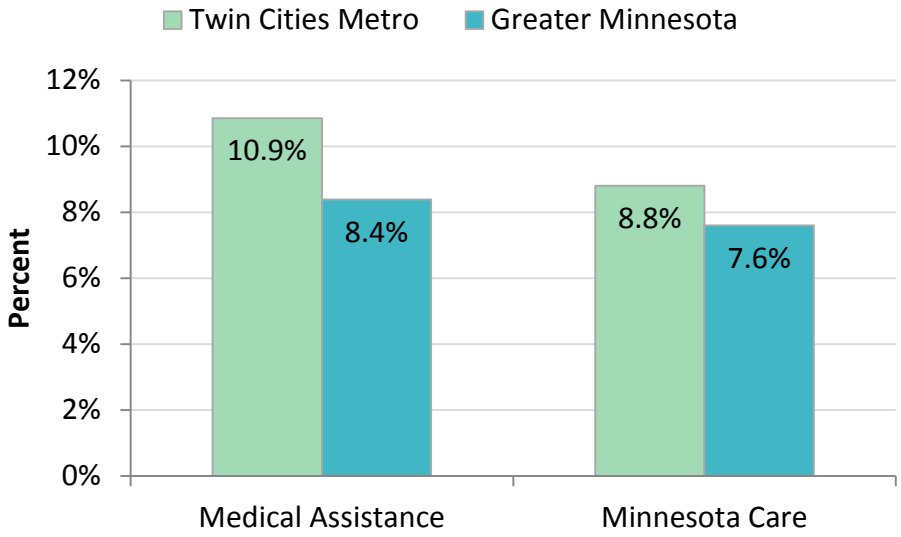
Figure 30. Percentage of enrollees with universal asthma by program and race/ethnicity, Minnesota



Source: Minnesota Department of Human Services Data Warehouse, 2010

Universal asthma prevalence is higher among residents of the seven-county Twin Cities metropolitan area than among residents of Greater Minnesota in both the Medical Assistance and Minnesota Care programs.

Figure 31. Percentage of enrollees with universal asthma by program and region, Minnesota



Source: Minnesota Department of Human Services Data Warehouse, 2010

Persistent Asthma

In 2010, 22,992 enrollees in Minnesota Public Health Care Programs met the persistent asthma definition. The percentage of enrollees with persistent asthma ranged from a low of 5% among Medical Assistance and Minnesota Care enrollees to a high of 10% among enrollees in GAMC.

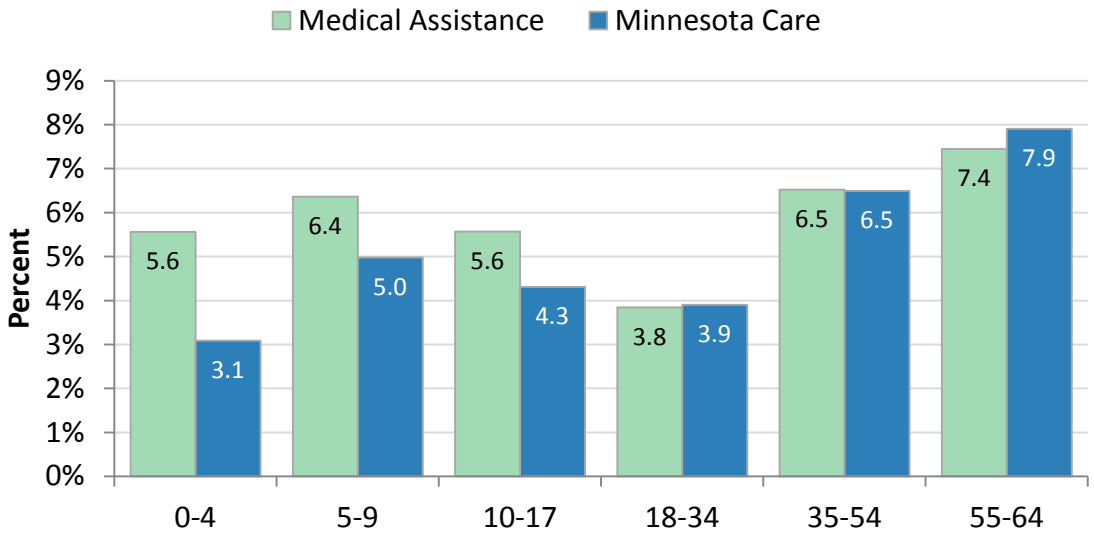
Table 12. Percentage of enrollees with persistent asthma by public health care program, Minnesota

	2008		2009		2010	
	#	%	#	%	#	%
Medical Assistance	14,393	5.4%	16,455	5.6%	17,923	5.6%
MNCare	3,785	5.0%	4,335	5.5%	5,069	5.3%
GAMC	521	9.8%	667	10.0%	---	---

Source: Minnesota Department of Human Services Data Warehouse, 2008-2010

Among children, the prevalence of persistent asthma is higher for enrollees in Medical Assistance than Minnesota Care. There is little difference in persistent asthma prevalence between programs among enrollees age 18 and older.

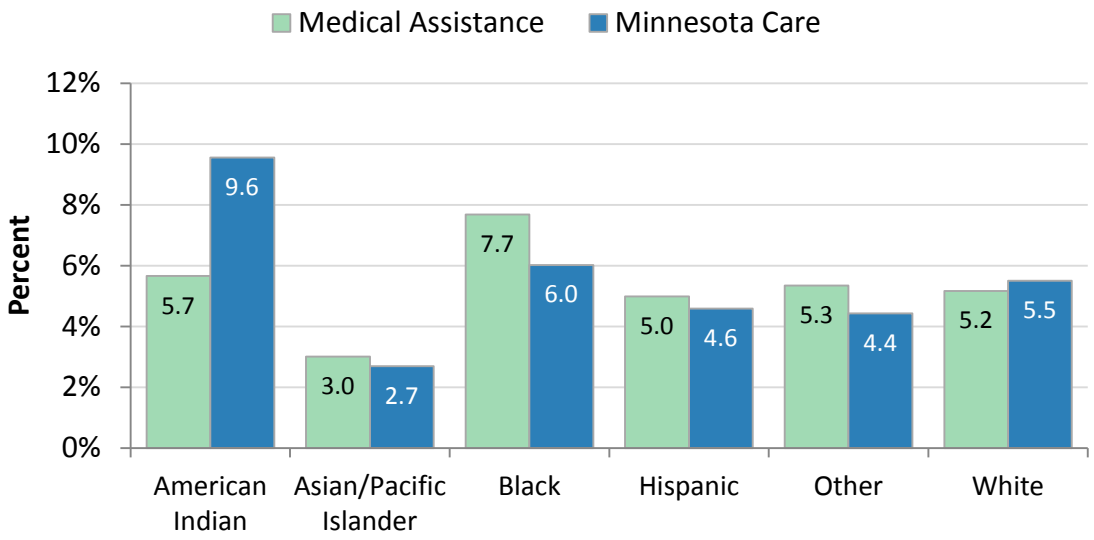
Figure 32. Percentage of enrollees with persistent asthma by program and age group, Minnesota



Source: Minnesota Department of Human Services Data Warehouse, 2010

As with universal asthma, among enrollees in the Medical Assistance, blacks have the highest prevalence of persistent asthma. In Minnesota Care, the prevalence of persistent asthma is highest among American Indians.

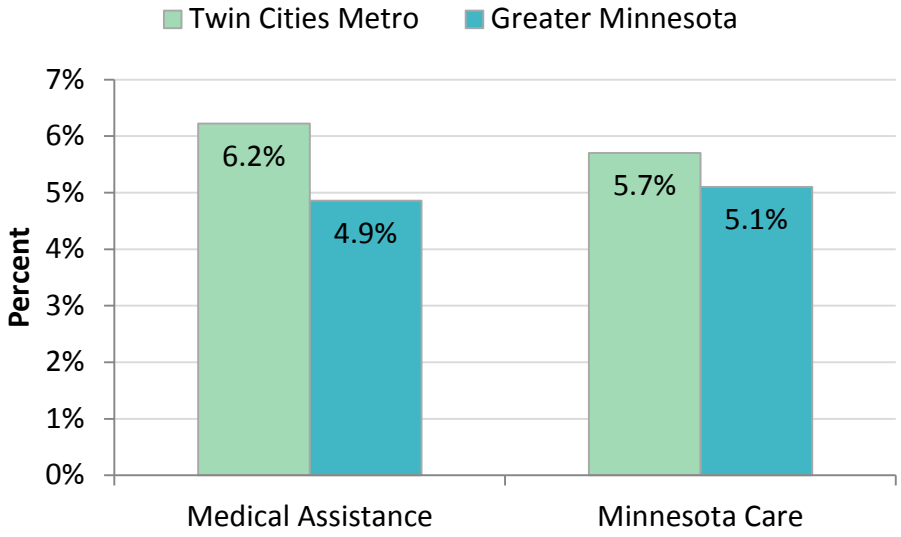
Figure 33. Percentage of enrollees with persistent asthma by program and race/ethnicity, Minnesota



Source: Minnesota Department of Human Services Data Warehouse, 2010

As with universal asthma, the prevalence of persistent asthma is higher among residents of the seven-county Twin Cities metropolitan area than among those living in Greater Minnesota, although the difference for Minnesota Care is small.

Figure 34. Percentage of enrollees with persistent asthma by program and region, Minnesota



Source: Minnesota Department of Human Services Data Warehouse, 2010

ASTHMA IN HENNEPIN COUNTY

Data on the prevalence of asthma among children and adults living in Hennepin County, the most populous county in the state, are available from the 2010 Survey of the Health of All of the Population and the Environment (SHAPE).

In 2010, 9.2% of children and 6.7% of adults living in Hennepin County reported that they currently had asthma. Asthma prevalence among children and adults in Minneapolis appears to be higher than that for children and adults in suburban Hennepin County; however, the differences between Minneapolis and suburban Hennepin County are not statistically significant (i.e., they are within the margin of error).

Table 13. Percentage of children and adults with asthma, Hennepin County, Minnesota

	Children		Adults	
	Ever diagnosed asthma* % (95% CI)	Current asthma# % (95% CI)	Ever diagnosed asthma* % (95% CI)	Current asthma# % (95% CI)
Hennepin County	13.2 (11.1-15.3)	9.2 (7.4-12.0)	14.4 (13.1-15.7)	6.7 (5.8-10.1)
Minneapolis	14.5 (10.7-18.3)	11.4 (7.9-14.9)	15.7 (13.8-17.6)	7.7 (6.2-12.9)
Suburban Hennepin Co.	12.6 (10.0-15.2)	8.2 (6.0-10.4)	13.7 (12.0-15.4)	6.2 (5.0-9.4)

Source: Hennepin County SHAPE, 2010

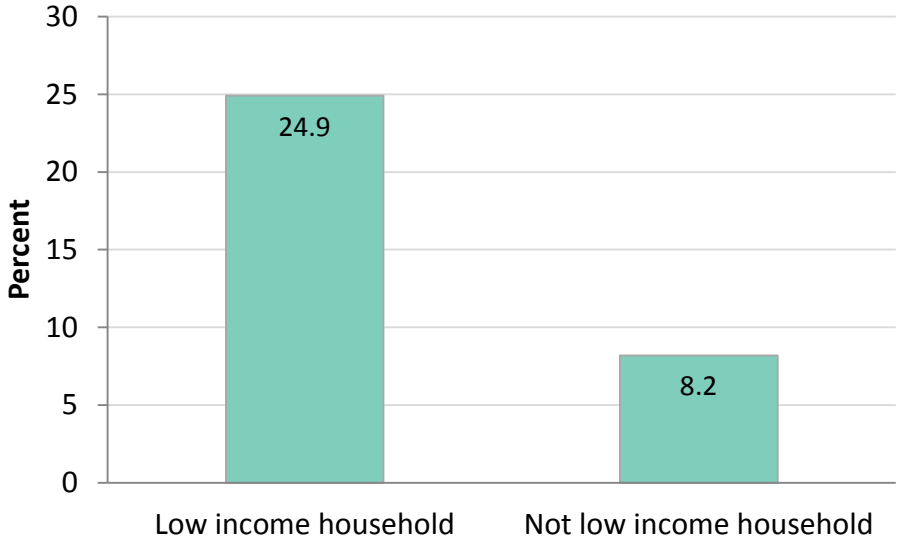
*Responded Yes to "Has a doctor or other health professional told you that you have asthma?"

#Responded Yes to above and Yes to "Do you still have asthma?"

Among all Hennepin County children with asthma, 64.8% were reported to have had an asthma attack in the past year and 15.4% went to the emergency room or urgent care in the past year because of an asthma attack.

As shown in the graph below, children from low income households were more likely than children from households that were not low income to seek care at an emergency room or urgent care center due to an asthma attack. This difference is statistically significant.

Figure 35. Percentage of children with asthma who went to emergency room or urgent care because of an asthma attack by income status, Hennepin County, Minnesota

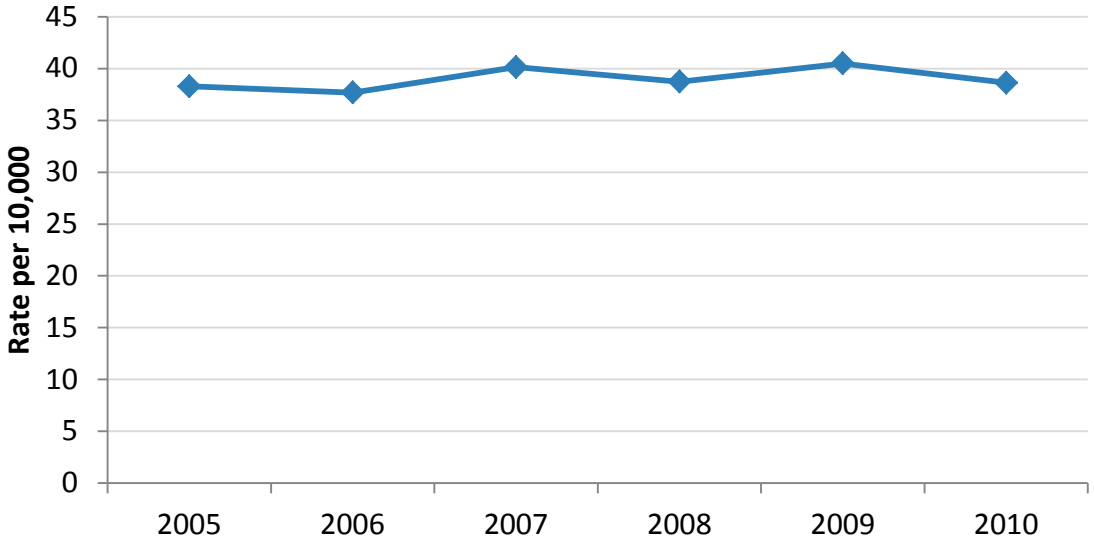


Source: Hennepin County SHAPE, 2010

ASTHMA EMERGENCY DEPARTMENT VISITS

The goal of asthma management is to decrease the likelihood of asthma exacerbations, which in turn should decrease the need for an emergency department (ED) visit or hospitalization. Thus, factors associated with asthma exacerbations, such as respiratory infections, are also risk factors for ED visits and hospitalizations. In 2010, there were 19,974 emergency department visits for asthma in Minnesota. This includes patients who went to the ED and were subsequently admitted to the hospital. In 2010, 17% of all ED visits for asthma resulted in admission to a hospital. Rates of asthma ED visits in Minnesota have been relatively stable since 2005.

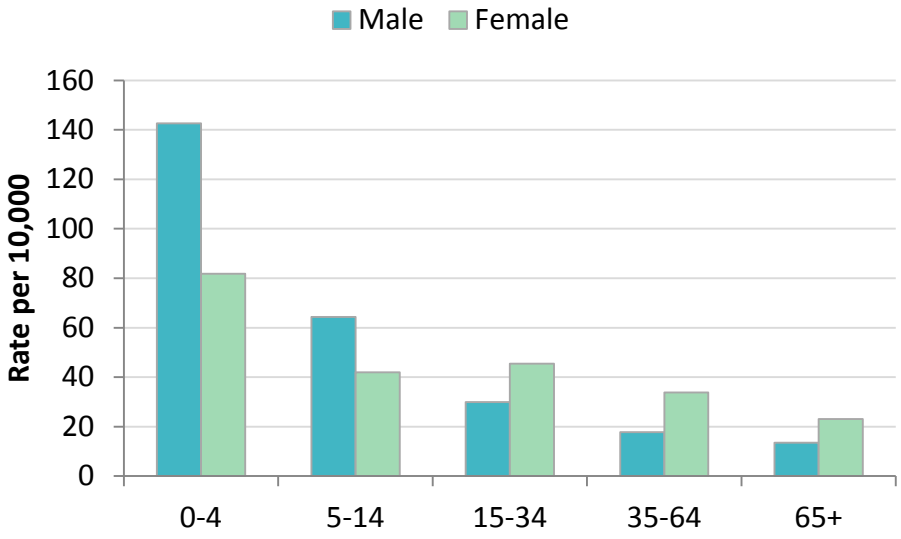
Figure 36. Age-adjusted rates of asthma ED visits by year, Minnesota



Source: Minnesota Hospital Association, 2005-2010

Rates of asthma ED visits are higher among children than adults. Males under the age of 5 have the highest rates, nearly double that for females under 5 years.

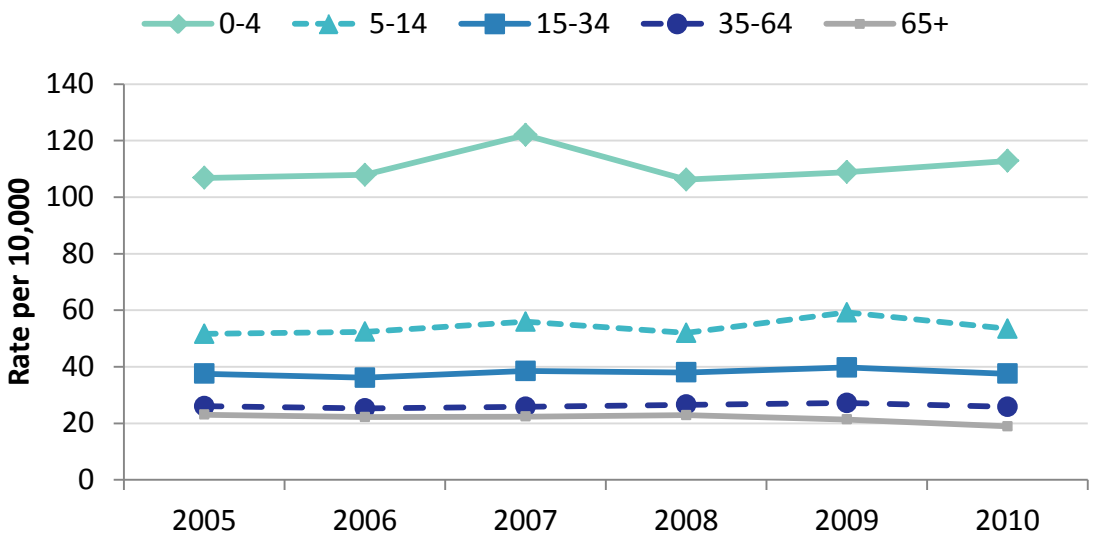
Figure 37. Asthma ED visits by age group and sex, Minnesota



Source: Minnesota Hospital Association, 2010

Children under age 5 have the highest rate of asthma ED visits compared to all other age groups.

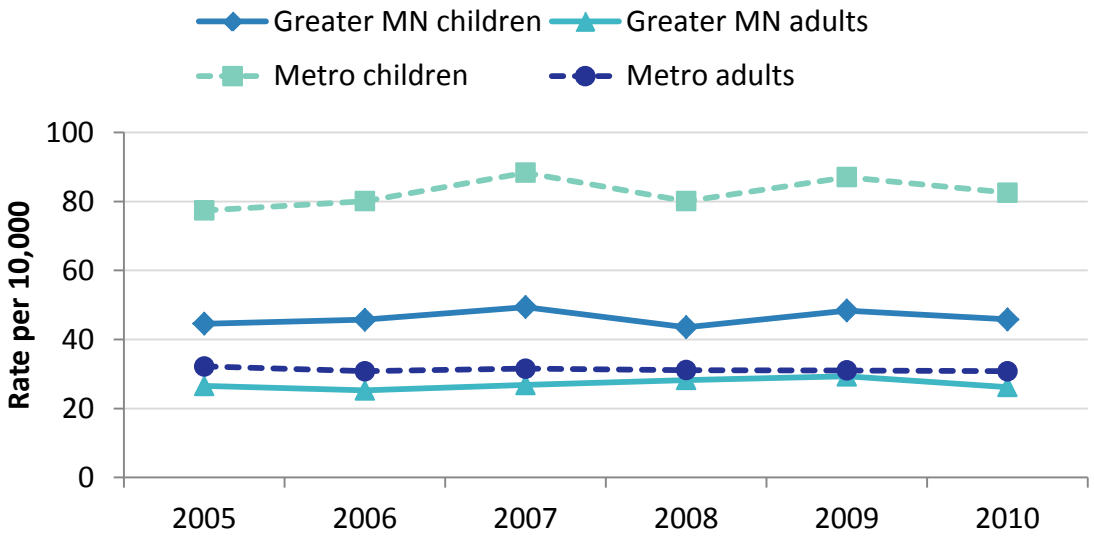
Figure 38. Asthma ED visit rates by age group and year, Minnesota



Source: Minnesota Hospital Association, 2005-2010

Rates of asthma ED visits are consistently higher among children (ages 0-17) living in the Twin Cities metropolitan area than children living in Greater Minnesota. In 2010, the rate for children living in the Twin Cities metro area was 80% higher than the rate for children in Greater Minnesota. There is little difference in rates between adults living in the Twin Cities metro area and adults living in Greater Minnesota.

Figure 39. Asthma ED visit rates by region of residence, age group and year, Minnesota

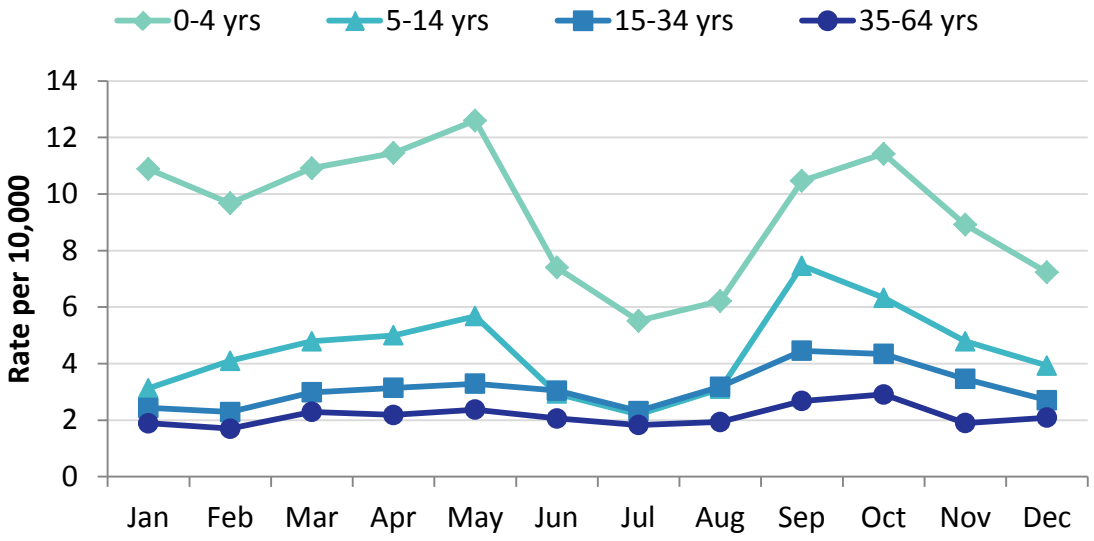


Source: Minnesota Hospital Association

Rates of asthma ED visits follow seasonal patterns. Typically, the highest rates occur during the fall with a smaller elevation in the spring. However, as shown in the graph below, in 2010 this pattern differed for children under age 5, who had a higher rate in the spring than the fall.

In 2010, there were 19,974 ED visits for asthma across all ages in Minnesota, ranging from a low of 1,180 in July to a high of 2,209 in October. The fall and spring peaks in ED visits are more pronounced in the younger age groups. (Note that persons aged 65 and older are not included in the graph because of the difficulty of distinguishing asthma from COPD in this age group.)

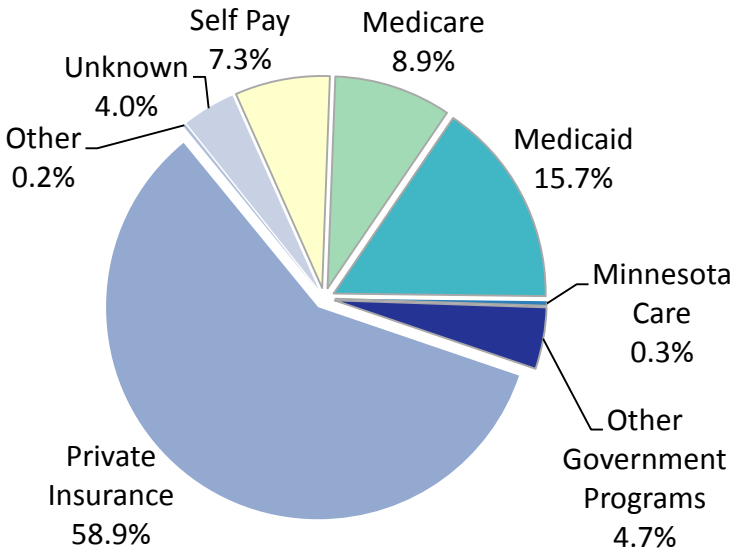
Figure 40. Asthma ED visit rates by month and age group, age 0-64, Minnesota



Source: Minnesota Hospital Association, 2010

The primary payer for the majority of asthma ED visits is private insurance, followed by Medicaid, Medicare and self-pay.

Figure 41. Asthma ED visits by primary payer, Minnesota

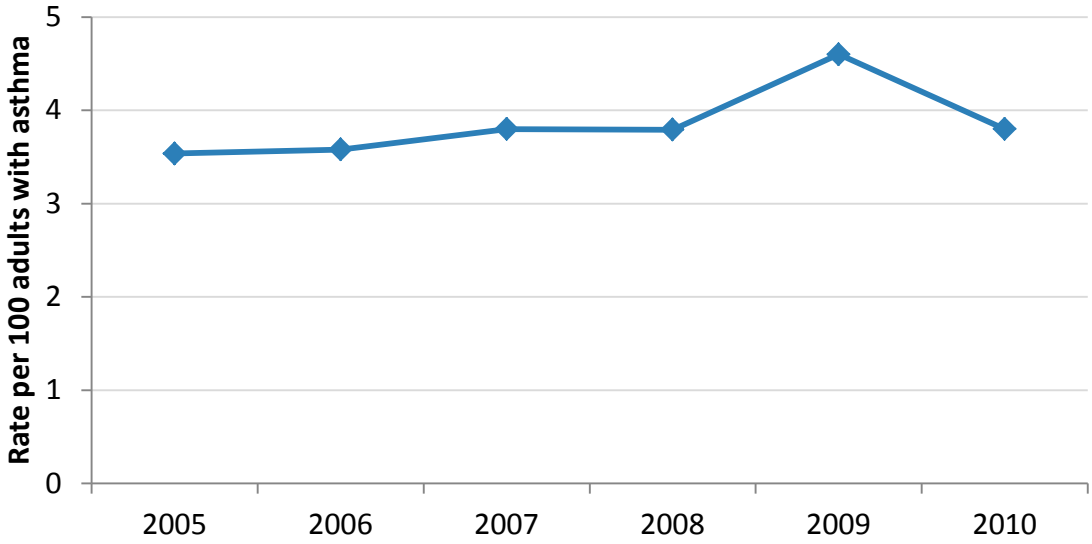


Source: Minnesota Hospital Association, 2010

Risk-Based Rates of ED Visits

The graph below shows rates of asthma ED visits by year when the percentage of adults with asthma in Minnesota for each year is taken into account. (Note: corresponding rates for children are not available for recent years).

Figure 42. Estimated rate of asthma ED visits per 100 adults with asthma, Minnesota



Source: Minnesota Hospital Association, 2005-2010; BRFSS, 2005-2010

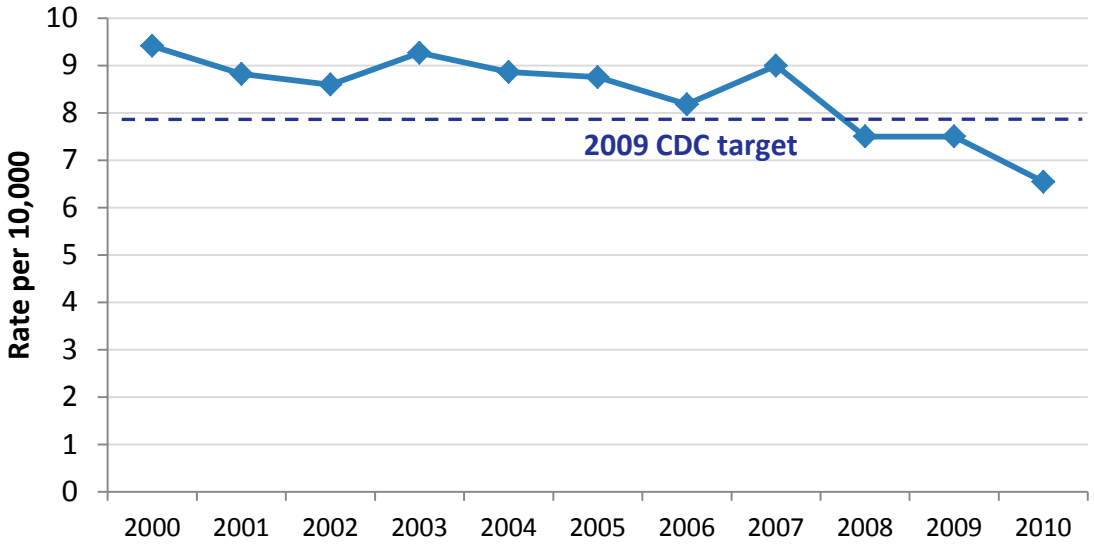
ASTHMA HOSPITALIZATIONS

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

In 2010, there were more than 3,500 asthma hospitalizations among Minnesota residents, for an overall age-adjusted rate of 6.5 hospitalizations per 10,000 population. In comparison, the 2008 U.S. rate was more than double that at 14.4 hospitalizations per 10,000 population (National Hospital Discharge Survey, 2008).

Asthma hospitalization rates in Minnesota have steadily declined since 2000, reaching the CDC target of a 16% drop in asthma hospitalization rates between 2000 and 2009.

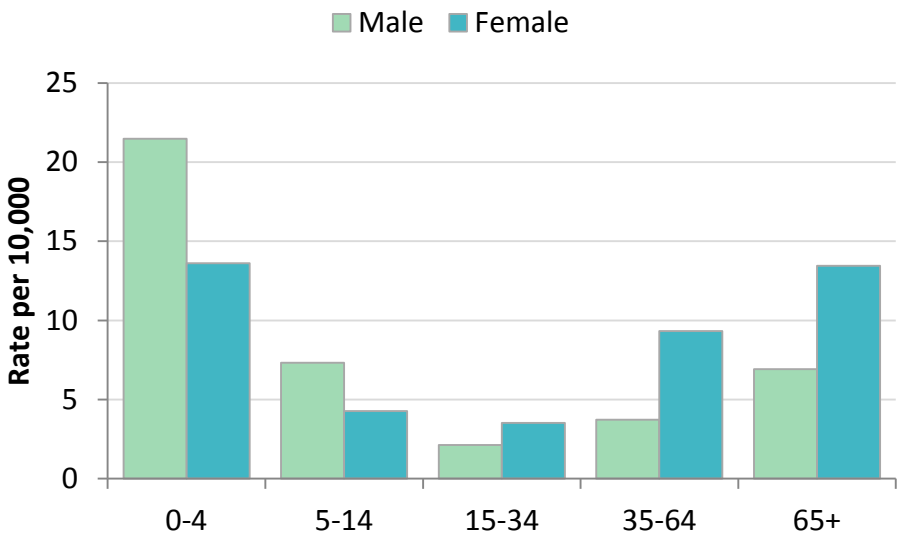
Figure 43. Age-adjusted asthma hospitalization rates by year, Minnesota



Source: Minnesota Hospital Association, 2000-2010

Asthma hospitalizations are highest among children under the age of 5 (males and females combined). Among children, asthma hospitalization rates are higher for boys than girls, while among adults, rates are higher for women than men. The highest hospitalization rates in 2010 occurred in males under 5 years, at 21.5 hospitalizations per 10,000 population.

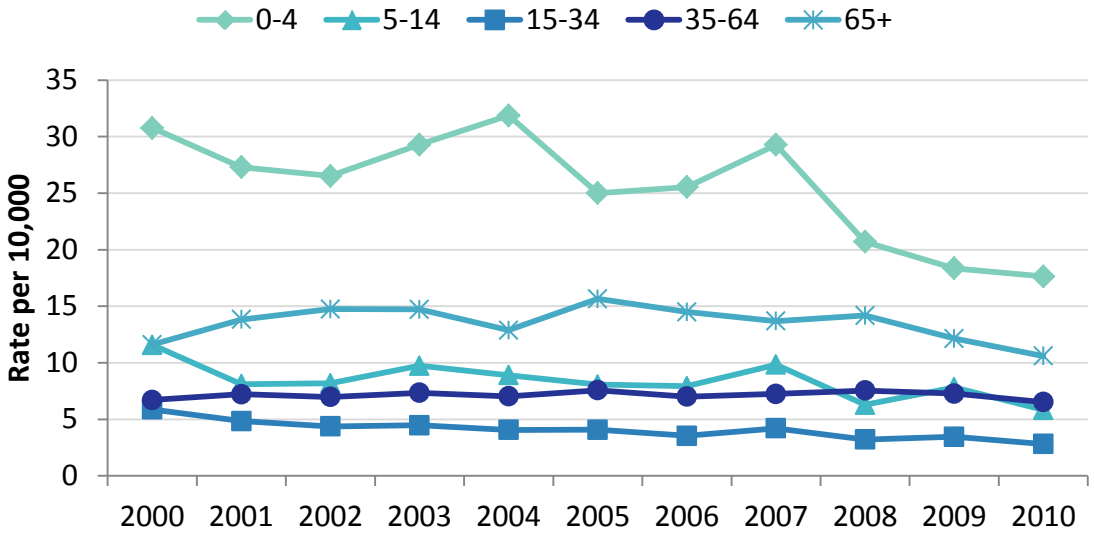
Figure 44. Asthma hospitalization rates by age group and sex, Minnesota



Source: Minnesota Hospital Association, 2010

Trends in asthma hospitalization rates over 2000-2010 differ by age group. Rates have decreased among residents under age 35; while rates remained relatively stable among residents ages 35-64. Rates in the 65 and older age group increased through the mid-2000's and have since declined.

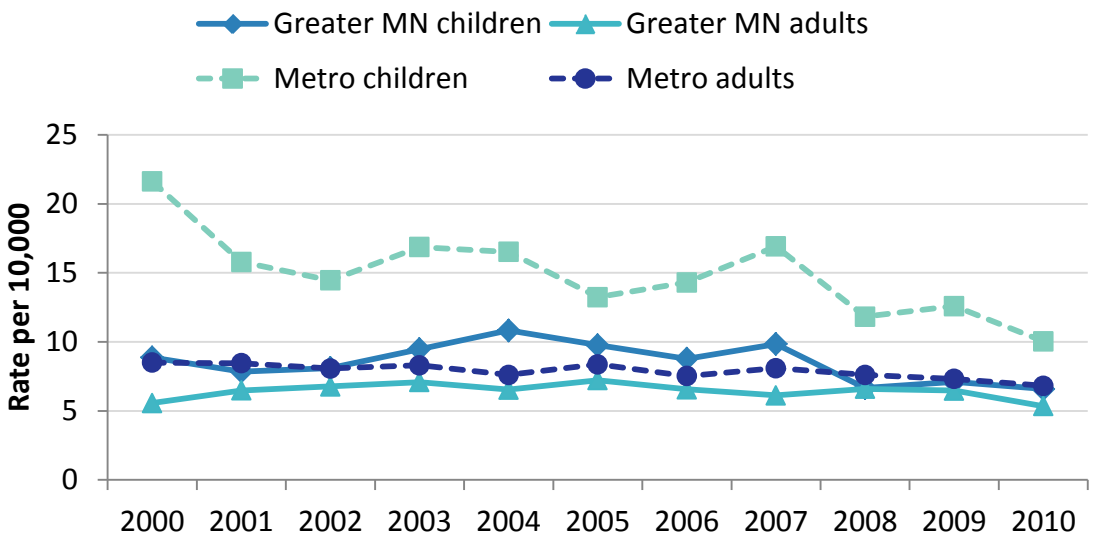
Figure 45. Asthma hospitalization rates by age group and year, Minnesota



Source: Minnesota Hospital Association, 2000-2010

Asthma hospitalization rates among children (0-17 years) in the seven-county Twin Cities metro area have decreased dramatically since 2000; however, they remain the highest in the state. Hospitalization rates for adults in the Twin Cities metro area are also declining, while rates for adults in Greater Minnesota have remained stable. Asthma hospitalization rates among children in Greater Minnesota increased through 2004 and have since declined. In 2010, the asthma hospitalization rate for metro area children was 50% higher than that for children in greater Minnesota, and the rate for metro area adults was 30% higher than that for adults in greater Minnesota.

Figure 46. Asthma Hospitalization Rates by Region and Age, Minnesota



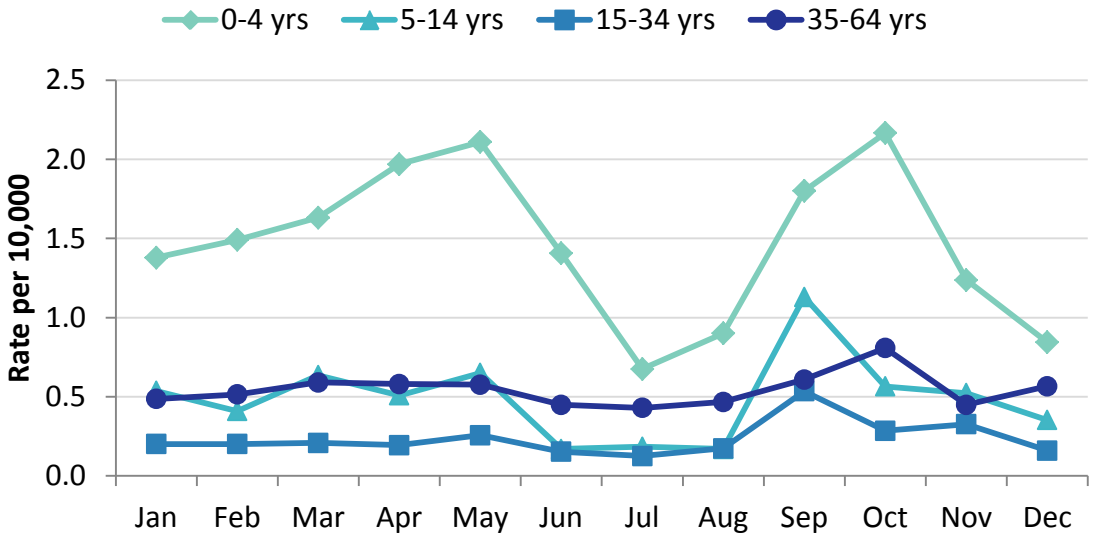
Source: Minnesota Hospital Association, 2000-2010

Asthma hospitalization rates follow seasonal patterns with the greatest number of hospitalizations occurring in the fall months and a smaller peak in the spring. The lowest rates are generally seen in June and July.

In 2010, there were 3,553 hospitalizations across all ages in Minnesota, ranging from a low of 199 in July to a high of 386 in October. The peaks in hospitalization rates described above are especially pronounced in the youngest age group (0-4 years old). 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 COPD in this age group.)

A major contributor to the fall increase in asthma hospitalizations is thought to be increasing rates of respiratory infections associated with children going back to school. Other possible contributing factors include pollen and mold.

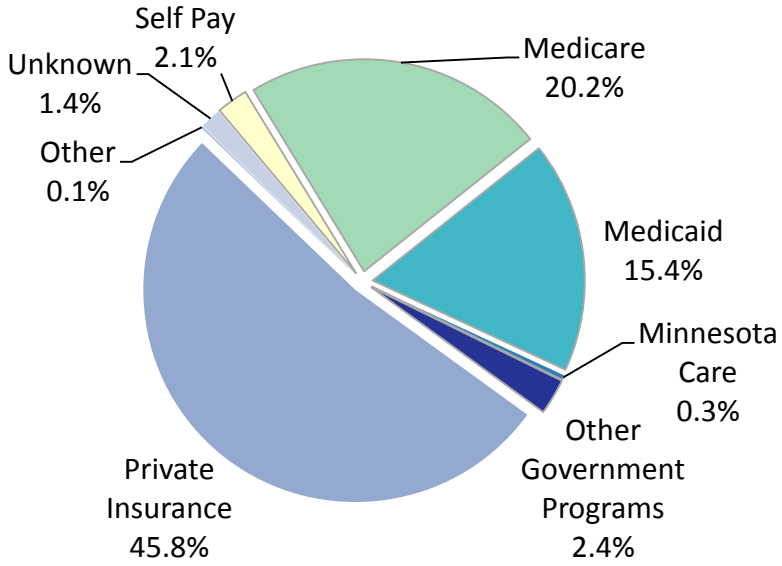
Figure 47. Asthma hospitalization rates by month and age group, Minnesota



Source: Minnesota Hospital Association, 2010

The primary payer for the majority of asthma hospitalizations is private insurance, followed by Medicare and Medicaid.

Figure 48. Asthma hospitalizations by payer, Minnesota

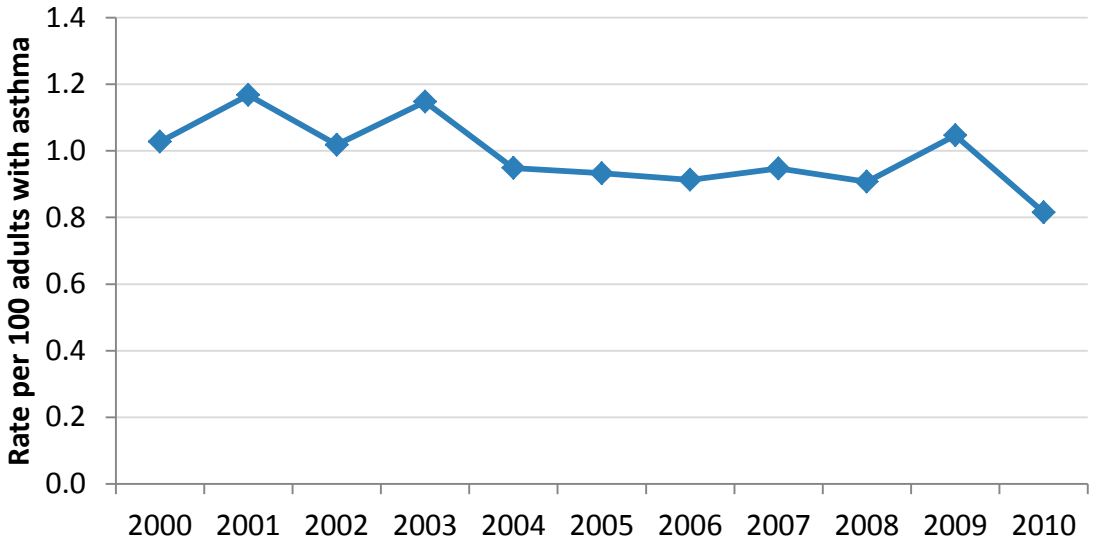


Source: Minnesota Hospital Association, 2010

Risk-Based Asthma Hospitalization Rates

When the percentage of adults with asthma in Minnesota is taken into account, rates of asthma hospitalizations show an overall decline since 2000. (Note: Corresponding rates for children are not available).

Figure 49. Estimated asthma hospitalization rate per 100 adults with current asthma, Minnesota



Sources: Minnesota Hospital Association, 2000-2010; BRFSS, 2000-2010

ASTHMA MORTALITY

Asthma deaths should be preventable with a timely and proper asthma diagnosis and appropriate care. Known risk factors for asthma death include: a history of severe exacerbations, two or more hospitalizations or more than three emergency department visits in the past year and excessive use of short-acting beta-agonists, low socioeconomic status and inner city residence. Severe exacerbations associated with asthma deaths are not limited to individuals with severe asthma.[8]

Asthma mortality rates are highest among Minnesota residents age 65 and older. In 2010, there were 73 deaths among Minnesota residents for which asthma was classified as the underlying cause of death. Fifty-eight percent of these deaths occurred in persons aged 65 and older. However, distinguishing asthma from other chronic respiratory conditions is difficult in this age group. In addition, the likelihood of errors in reporting cause of death on death certificates increases with age.

Asthma Deaths in Older Minnesotans

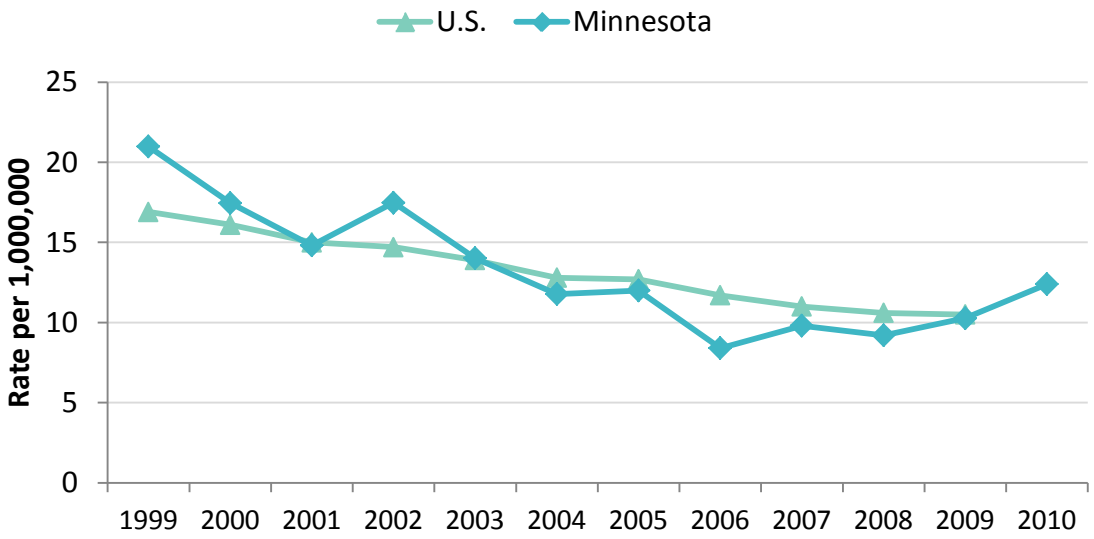
In the 2002 Strategic Plan for Addressing Asthma in Minnesota, the data and surveillance work group recommended that the MDH Asthma Program conduct an asthma mortality review to address the high rates of asthma deaths among seniors. There were concerns that the classification of asthma as the underlying cause of death in many of these deaths was not accurate. In the "Asthma Deaths in Older Minnesotans" study, an expert panel reviewed records for Minnesota residents age 55 and older whose deaths had been classified as due to asthma. The major finding of this review was that many of the deaths were probably not due to asthma, and that inconsistent reporting on the death certificates had resulted in the underlying cause of death being coded as asthma.[14]

In this report, we present asthma mortality rates among seniors according to the CDC and Healthy People 2010 guidelines, with the caveat that many of these deaths may not in fact have been due to asthma. We have also included data on Chronic Lower Respiratory Disease (CLRD), a category that includes both COPD and asthma, and reflects the overall burden of chronic respiratory disease in this age group.

Asthma deaths among young people in Minnesota are relatively rare. Between 1999 and 2010, there were 36 deaths among Minnesota residents under the age of 20.

Age-adjusted asthma mortality rates in Minnesota declined steadily through 2006, driven by declines in the 65 and older age group, but increased between 2008 and 2010. The age-adjusted asthma mortality rate for 2010 was 12.4 asthma deaths per 1,000,000 population.

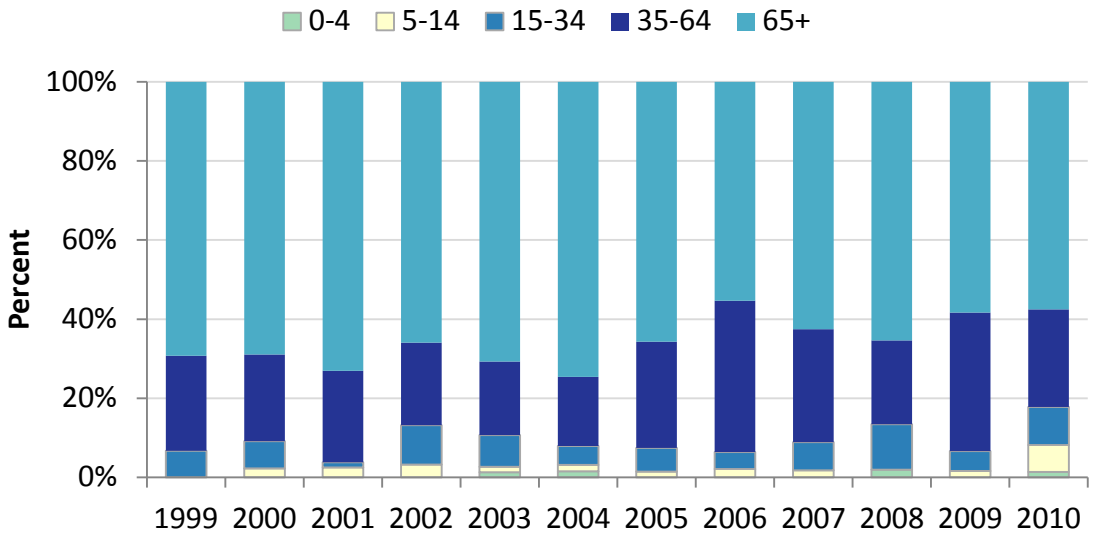
Figure 50. Age-adjusted asthma mortality rates, Minnesota and U.S.



Sources: Minnesota Center for Health Statistics, 1999-2010; CDC, 1999-2009

As shown in the graph below, the percentage of all deaths among residents ages 65 and older has declined since 1999.

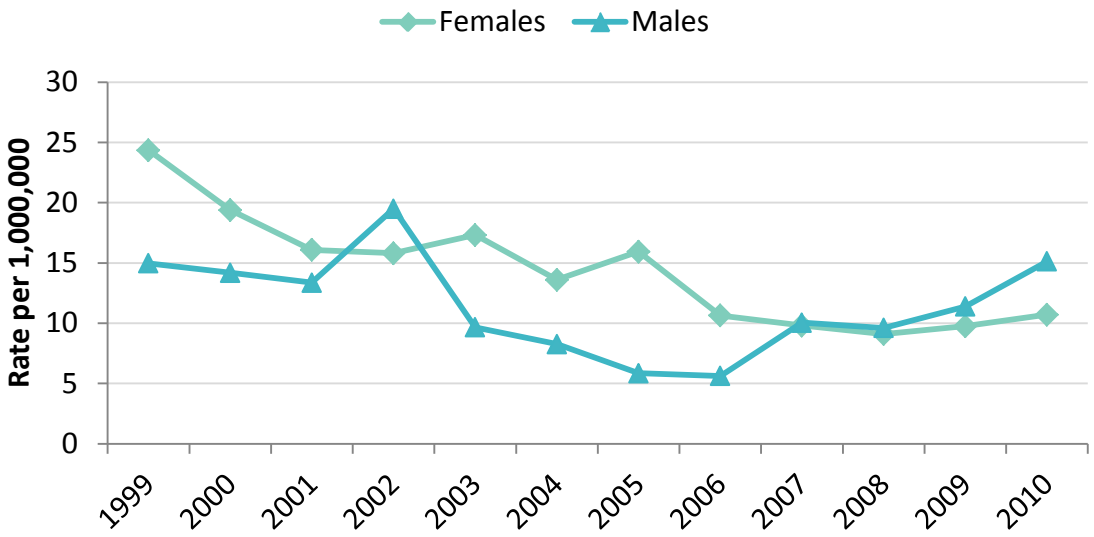
Figure 51. Percentage of asthma deaths by age group, Minnesota



Source: Minnesota Center for Health Statistics, 1999-2010

Asthma mortality rates for both males and females declined through the mid-2000s, however since then rates have increased in both sexes, with a greater increase among males. The 2010 age-adjusted rate was 15.1 per 1,000,000 for males and 10.7 per 1,000,000 for females.

Figure 52. Age-adjusted asthma mortality rates by sex, Minnesota

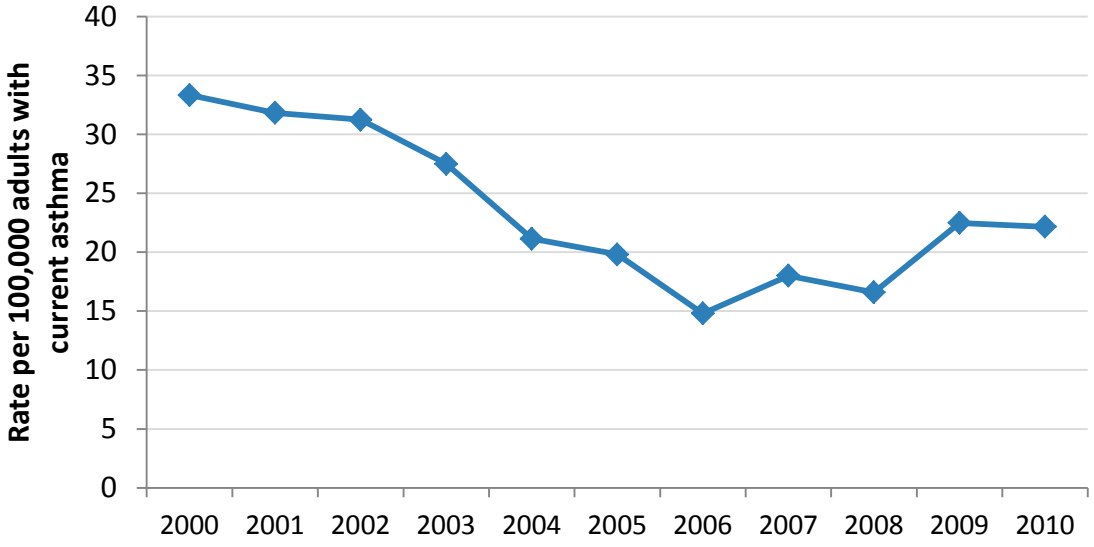


Source: Minnesota Center for Health Statistics, 1999-2010

Risk-based asthma mortality rates

When the percentage of adults with asthma in Minnesota is taken into account, asthma mortality rates still show a decline through the mid-2000s and an increase since 2008.

Figure 53. Estimated asthma mortality rate per 100,000 adults with current asthma, Minnesota

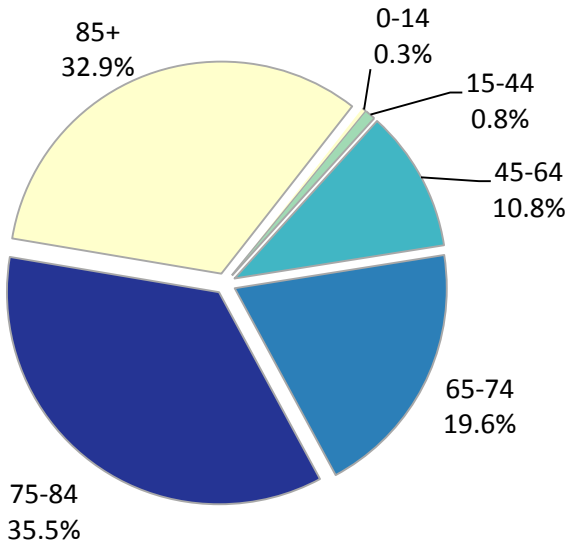


Sources: Minnesota Center for Health Statistics, 2005-2010; BRFSS, 2005-2010

Chronic Lower Respiratory Disease Mortality

Chronic lower respiratory disease (CLRD) deaths are most common among residents ages 75 and older.

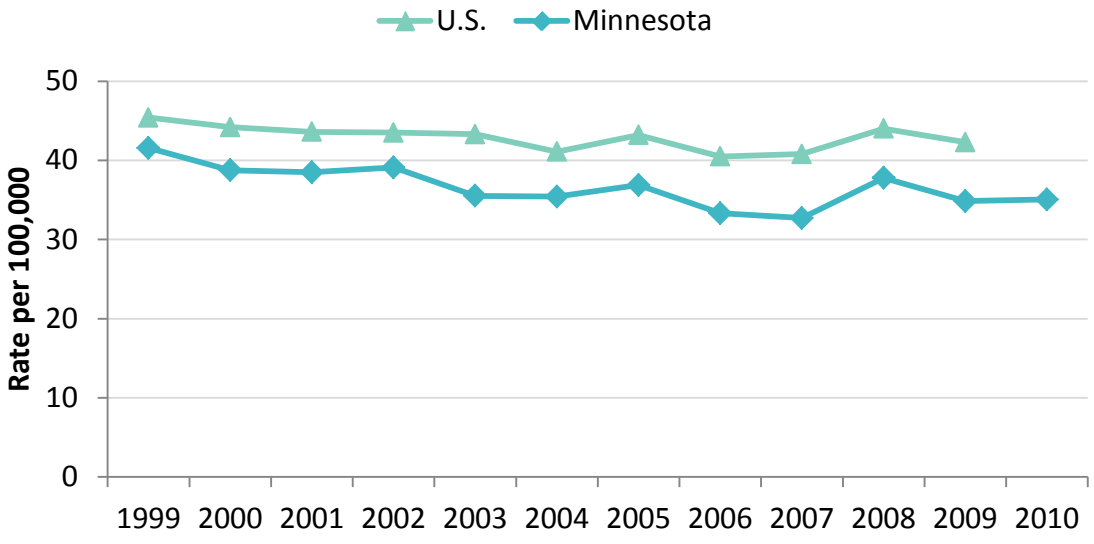
Figure 54. Chronic lower respiratory disease deaths by age group, Minnesota



Source: Minnesota Center for Health Statistics, 2010

In Minnesota, between 1999 and 2007 CLRD mortality rates declined and have risen slightly since then. US rates declined over the same period, to a lesser degree.

Figure 55. Age-adjusted chronic lower respiratory disease mortality rates, Minnesota and U.S.



Source: Minnesota Center for Health Statistics, 1999-2010; CDC, 1999-2009

HEALTHY PEOPLE 2010 GOALS

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 following are Healthy People 2010 goals relating to asthma, along with Minnesota's status on meeting these goals. Note that some of these targets have been revised by CDC since the publication of the 2008 Asthma in Minnesota report.

1. Reduce deaths from asthma

The ultimate goal should be zero deaths due to asthma. Minnesota has met the Healthy People 2010 targets for the 0-4, 35-64 and 65 and older age groups, but is still above the targets for the 5-14 and 15-34 age groups.

Table 14. Asthma mortality rates per 1,000,000 residents, Minnesota and U.S., and Healthy People goals

Age Group	Minnesota 2005-2010	US 2009	Healthy People 2010 Goal
0 to 4	0.9†	2.0	1.0
5 to 14	2.2†	2.8	1.0
15 to 34	3.0	4.5	2.0
35 to 64	8.1	10.9	9.0
≥ 65	55.5	38.8	60.0

†Rates based on fewer than 20 deaths per age group and may be unstable; interpret with caution.
*No target set for these age groups.
Source: Minnesota Center for Health Statistics; National Vital Statistics System-Mortality (NVSS-M)

2. Reduce hospitalizations for asthma

Minnesota has met the Healthy People 2010 targets for asthma hospitalizations for all age groups.

Table 15. Asthma hospitalizations rates per 10,000 residents, Minnesota and U.S., and Healthy People goals

Age Group	Minnesota 2010	U.S. 2007	Healthy People 2010 Goal
0 to 4	17.6	41.4	25.0
5 to 64†	5.0	11.1	7.7
≥ 65†	10.6	25.3	11.0

†Age-adjusted to the year 2000 standard population.
Sources: Minnesota Hospital Association; National Hospital Discharge Survey (NHDS)

3. Reduce emergency department visits for asthma

Minnesota has achieved the Healthy People 2010 target for asthma ED visits for the 5-64 age group, but remains above the targets for children under 5 and adults 65 and older.

Table 16. Asthma emergency department visit rates per 10,000 residents, Minnesota and U.S., and Healthy People goals

Age Group	Minnesota 2010	U.S. 2005-2007	Healthy People 2010 Goal
0 to 4	112.8	132.8	80.0
5 to 64†	35.5	57.0	50.0
≥ 65†	18.9	21.9	15.0

†Age-adjusted to the year 2000 standard population.

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

CONCLUSIONS

The burden of asthma in Minnesota is large with an estimated 392,000 Minnesotans having the disease. The good news is that the percentage of children and adults with asthma is lower than the national average and neither measure appears to be increasing. However, there are striking disparities in asthma prevalence among youth by race/ethnicity. According to the Minnesota Student Survey, American Indian and African/African American students are more likely than other students to have been diagnosed with asthma at some point in their lives. Disparities in asthma prevalence by race/ethnicity are also observed in Minnesota's publicly insured population.

In addition to diagnosed asthma, there may be substantial numbers of Minnesotans experiencing asthma symptoms who have not yet been diagnosed. Data from the Minnesota Youth Tobacco and Asthma Survey show that 1 in 10 Minnesota youth report asthma-like symptoms but do not have a provider diagnosis of asthma.

The data in this report indicate that there is room for improvement in asthma control among Minnesotans with asthma, as exemplified by the 59% of youth whose asthma falls into the not well-controlled or very poorly controlled categories and the 48% of all adults with asthma reporting an asthma attack in the past year. There is also room for improvement in self-management education for adults with asthma as evidenced by only three-quarters having received education about asthma symptoms and awareness.

Smoking rates have been declining since 2000 among all Minnesota residents regardless of asthma status, however people with asthma are just as likely to be smokers (having asthma doesn't make them more likely to quit). Among Minnesota youth, those with current asthma are just as likely as those without asthma to be smokers. They are more likely to report exposure to environmental tobacco smoke (i.e., secondhand smoke) than students without asthma. Reporting of exposures to environmental tobacco smoke is even higher among students with potential asthma (i.e., having asthma-like symptoms but no diagnosis of asthma).

Minnesota has met all of the Healthy People 2010 targets for asthma hospitalizations and rates of asthma hospitalizations among Twin Cities metro area residents continue to decline. However, Minnesota has not achieved Healthy People 2010 targets for asthma ED visits for young children and seniors. And, rates of asthma hospitalizations and ED visits for children living in the Twin Cities metropolitan area remain significantly higher than rates for children living in Greater Minnesota.

A continuing gap in asthma surveillance is the lack of data on rates of asthma-related hospitalizations and emergency department visits by race/ethnicity that would increase our understanding of disparities in the burden of asthma. Other gaps include the lack of data on asthma prevalence at the community or neighborhood level.

In summary, while the overall picture of asthma in Minnesota has improved since 2008, there continue to be notable disparities in asthma prevalence and morbidity.

REFERENCES

1. Akinbami LJ, Moorman JE, Bailey C, et al. Trends in asthma prevalence, health care use, and mortality in the United States, 2001-2010. NCHS data brief, 2012, No 94. Hyattsville, MD: National Center for Health Statistics.
2. Akinbami LJ, Moorman JE, Liu X. Asthma prevalence, health care use, and mortality: United States, 2005–2009. National Health Statistics Reports; 2011, No 32. Hyattsville, MD: National Center for Health Statistics.
3. Barnett SB and TA Nurmagambetov. Costs of asthma in the United States: 2002-2007. *J Allergy Clin Immunol* 2011;127:145-52.
4. Asthma care quality improvement: A resource guide for state action, Agency for Healthcare Research & Quality (AHRQ), 2006. http://www.ahrq.gov/qual/asthmacare/asthmatab1_3.htm
5. Boulet LP, Turcott H, Brochu A. Persistence of airway obstruction and hyperresponsiveness in subjects with asthma remission. *Chest* 1994;105(4):1024-31.
6. van der Toorn LM, Overbeek SE, et al. Airway inflammation is present during clinical remission of atopic asthma. *Am J Respir Crit Care Med* 2001;164(11):2107-13.
7. Vonk JM, Postma DS, et al. Childhood factors associated with asthma remission after 30 year follow up. *Thorax* 2004;59(11):925-9.
8. National Heart, Lung, and Blood Institute. Expert Panel Report 3 (EPR-3) Full report 2007: Guidelines for the diagnosis and management of asthma. Washington, DC, U.S. Department of Health and Human Services, 2007.
9. Juhn, YJ, H Kita, et al. Increased risk of serious pneumococcal disease in patients with asthma. *J Allergy Clin Immunol* 2008;122(4): 719-23.
10. Institute of Medicine. Clearing the air: asthma and indoor air exposures. Washington, DC, National Academy Press, 2000.
11. Ford, ES. The epidemiology of obesity and asthma. *J Allergy Clin Immunol* 2005;115(5): 897-909.
12. Balmes J, Becklake M, et al. American Thoracic Society statement: Occupational contribution to the burden of airway disease. *Am J Respir Crit Care Med* 2003;167:787-797
13. Gold DR and R Wright. Population disparities in asthma. *Annu Rev Public Health* 2005;26:89-113.
14. Brunner WM, Ross SK, Johnson JES. Review of the asthma mortality rate for Minnesota residents aged 55 years or older, 2004-2005: When death certificates deserve a second look. *Prev Chronic Dis* 2009;6(3):A92. http://www.cdc.gov/pcd/issues/2009/jul/08_0154.htm
15. Anderson RN and Rosenberg HM. Age standardization of death rates: implementation of the year 2000 standard. *Natl Vital Stat Rep* 1998; 47(3): 1-16, 20.

16. Schenker N and Gentleman J. On judging the significance of differences by examining the overlap between confidence intervals. *The American Statistician* 2001;55:182-186.

17. Centers for Disease Control and Prevention. Behavioral Risk Factor Surveillance System 2010 summary data quality report. Atlanta, Georgia, U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2011.

18. Minnesota Department of Health. Childhood respiratory health feasibility study: Inver Grove Heights and Eagan, Minnesota, 1991.

ACRONYMS

ACQ	Asthma Control Questionnaire
ACT	Asthma Control Test
ATAQ	Asthma Therapy Assessment Questionnaire
BRFSS	Behavioral Risk Factor Surveillance System
CDC	Centers for Disease Control and Prevention
CI	Confidence interval
CLRD	Chronic Lower Respiratory Disease
COPD	Chronic Obstructive Pulmonary Disease
EPR-3	Expert Panel Report 3
EPHT	Environmental Public Health Tracking
ETS	Environmental Tobacco Smoke
ICD	International Classification of Disease
MDH	Minnesota Department of Health
MHA	Minnesota Hospital Association
MNDHS	Minnesota Department of Human Services
MNYTAS	Minnesota Youth Tobacco and Asthma Survey
MSS	Minnesota Student Survey
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
NSCH	National Survey of Children's Health
NVSS	National Vital Statistics System
SHAPE	Survey of the Health of All 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 airways (inflammation).

Confidence Interval (CI) –a measure of the level of certainty of an estimate, e.g., Minnesota asthma hospitalization rate=8.7, 95% CI: 8.5-8.8. Wider confidence intervals indicate less precision in the estimate. The width of a confidence interval is also dependent on the size of the population. In surveys it is known as a margin of error. See also "Statistical Significance".

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 (in general or due to a specific cause) in a population, divided by the number of residents in that population for that time period.

Prevalence – the number of existing cases of a disease in a particular population at a particular time, typically expressed as a percent. 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) at a particular time.

Statistical significance – use of statistics to determine whether a true difference between two values (e.g., rates or percentages) is likely to exist. If a difference is statistically significant that means it is unlikely that the difference between the two values is due to chance. For example, the difference between the percentage of adults with asthma who report that they smoke (12%) and the percentage of adults without asthma who report that they smoke (15%) is not statistically significant and so it is likely not a real difference, but within the margin of error of the survey.

ASTHMA DEFINITIONS

	Survey Question	Questionnaire
Ever diagnosed asthma	Yes to "Has a doctor or nurse ever told you that you had asthma?"	BRFSS, MSS
Current asthma	Yes to "Has a doctor or nurse ever told you that you had asthma?" AND Yes to "Do you still have asthma?"	BRFSS
Current asthma	Yes to "Has a doctor or nurse ever told you or your parents that you have asthma?" AND Yes to "During the past 12 months, have you had wheezing, tightness in your chest or other symptoms of asthma? (Not counting times when you had a cold or the flu)"	MNYTAS
"Former" asthma	Yes to "Has a doctor or nurse ever told you or your parents that you have asthma?" AND No to "During the past 12 months, have you had wheezing, tightness in your chest or other symptoms of asthma? (Not counting times when you had a cold or the flu)"	MNYTAS
Potential asthma	No to "Has a doctor or nurse ever told you or your parents that you have asthma?" AND Yes to "During the past 12 months, have you had wheezing, tightness in your chest or other symptoms of asthma? (Not counting times when you had a cold or the flu)"	MNYTAS

TECHNICAL NOTES

Age-Adjusted Rates

Age-adjusted rates were calculated using the direct method with the U.S. 2000 population as the standard.

Calculation of Confidence Intervals

95% confidence intervals for age-adjusted rates were calculated using the methods listed below.

When the number of events was 100 or greater, 95% confidence intervals were based on the normal distribution:

Lower confidence limit = [age-adjusted rate – {1.96*SE(age-adjusted rate)}]
Upper confidence limit = [age-adjusted rate + {1.96*SE(age-adjusted rate)}]

Where the standard error for the age-adjusted rate = $\sqrt{\sum_i \boldsymbol{w_{si}^2} * \frac{\boldsymbol{R_i^2}}{\boldsymbol{D_i}}}$

$\boldsymbol{w_{si}}$ = standard weights
$\boldsymbol{R_{si}}$ = age-specific rate
D = number of events in age group i

When the number of events was less than 100, 95% confidence intervals were calculated using the Poisson distribution.[15]

Risk-Based Rates

Risk-based rates, or rates of ED visits, hospitalizations or asthma deaths per population with current asthma, were calculated using denominators from BRFSS (i.e., the number of adults in Minnesota with current asthma for each year).

Statistical Significance

Estimates from survey data used in this report (e.g., BRFSS, MNYTAS, SHAPE) were considered "significantly different" when the 95% confidence intervals did not overlap. Technically, this is not a statistical test, but is a commonly used method for comparing estimates. This method is more conservative than formal statistical testing.[16]

Terms such as "higher than" and "less than" are used to indicate statistically significant differences. Terms such as "similar" and "no difference" are used to indicate that the statistics being compared were not significantly different.

DATA SOURCES

Asthma Hospitalizations and ED Visits

Minnesota hospitals report hospital discharge data 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, representing 97% of all licensed beds in the state. The information is submitted using a standardized billing form. Asthma hospitalizations are defined as those discharges for which asthma is listed as the principal diagnosis (ICD-9-CM code 493.0-493.9). Asthma ED visits are those for which asthma is the 1st-listed diagnosis. In this report, ED visits include both those in which patients are treated and released from the ED, as well as those that result in admission to the hospital.

In 2005, MDH began receiving data on the hospitalizations of Minnesota residents in non-Minnesota hospitals, including North Dakota, South Dakota and Iowa hospitals. Data on Minnesota resident ED visits to North Dakota hospitals have been available since 2005.

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

Some of the limitations of the hospital discharge data include the fact that federal and sovereign hospitals (e.g., Veteran's Administration, Indian Health Service) do not submit data to MHA. Another crucial limitation of the hospital discharge data is the lack of information on the patient's race/ethnicity.

For more information on the Minnesota Hospital Association: http://www.mnhospitals.org .

Data on asthma hospitalizations in Minnesota are also available on the Minnesota Public Health Data Access website: https://apps.health.state.mn.us/mndata/ through the Minnesota Environmental Public Health Tracking (EPHT) program. This website allows users to query data on asthma hospitalizations and create maps by county of patient's residence.

Asthma Mortality

Death records for Minnesota residents who died of asthma are obtained from the Minnesota Center for Health Statistics at MDH. Asthma deaths are identified as those for which asthma is coded as the underlying cause of death. 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.

For more information on the Minnesota Center for Health Statistics: http://www.health.state.mn.us/divs/chs/.

Behavioral Risk Factor Surveillance System (BRFSS)

The Behavioral Risk Factor Surveillance System 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 annually among approximately 6,000 randomly-selected non-institutionalized adults age 18 years and older residing in Minnesota. Information on children from the BRFSS is provided by an adult in the household who is knowledgeable about the child's health. 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 (2010 Minnesota cooperation rate=86.2%; median for all states=76.9%).[17] 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.[18]

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 or Spanish (Spanish survey available since 2010), 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 geographical location other than the Twin Cities metropolitan area versus Greater Minnesota). 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.

For more information on BRFSS: http://www.cdc.gov/brfss

Minnesota Community Measurement

Minnesota Community Measurement is a non-profit organization that reports quality of care measurements by clinic, medical group and hospital for a number of chronic conditions, including asthma. The measurements are based on data MNCM obtains from health care claims, medical records and surveys, and are available on MNCM's HealthScores website: www.mnhealthscores.org.

Minnesota Health Care Programs

The Minnesota Department of Human Services (DHS) oversees the state’s public health care programs and kindly ran queries of the Minnesota Health Care Program data for use in this report. The analysis was limited to individuals under the age of 65 continuously enrolled in Medical Assistance (managed care or fee-for-service programs), General Assistance Medical Care or MinnesotaCare for 11 or more months in the year being studied.

For more information on MN Health Care Programs:
www.dhs.state.mn.us/main/dhs16_136855

Minnesota Student Survey

The Minnesota Student Survey is conducted every 3 years by the Minnesota Departments of Education, Health, Human Services and Public Safety among students in public schools (including charter schools and tribal schools), alternative schools and Area Learning Centers, and juvenile correction facilities. The survey includes students in grades 6, 9 and 12.

In 2010, 88% of school districts participated in the Minnesota Student Survey. Student participation differed by grade, with 79% of 6th graders, 75% of 9th graders and 59% of 12th graders participating in the survey. The total number of valid surveys in 2010 was 130,908.

For more information about the Minnesota Student Survey: http://www.health.state.mn.us/divs/chs/mss/.

Minnesota Youth Tobacco and Asthma Survey

The Minnesota Youth Tobacco and Asthma Survey is a school-based survey of tobacco use, secondhand smoke exposure and other factors. It is conducted by MDH every three years among a representative sample of students in grades 6-12. In 2011, the sample size was 3,446. For more information, see *"Teens and Tobacco in Minnesota, 2011 Update: Results from the Minnesota Youth Tobacco and Asthma Survey"* at: http://www.health.state.mn.us/divs/chs/tobacco/youth.html.

National Survey of Children's Health

The National Survey of Children's Health is a telephone survey of a representative sample of households with children under age 18. Approximately 1,800 interviews are conducted per state. The survey collects information on children's health and well-being. It was conducted in 2003-2004 and 2007-2008 by the Maternal and Child Health Bureau, U.S. Department of Health Resources and Services Administration and the CDC.

For more information about the National Survey of Children's Health: http://www.childhealthdata.org.

Survey of the Health of All the Population and the Environment (SHAPE)

Every 4 years, Hennepin County conducts a survey of the health of its residents, called the Survey of the Health of All the Population and the Environment (SHAPE). The SHAPE survey was conducted in 1998, 2002, 2006 and 2010. The first two surveys included only adults, while the 2006 and 2010 surveys included both adults and children. Reponses for children (age 0-17) are provided by the adult in the sampled household who is most knowledgeable about the child. In 2010, 7,001 adult surveys and 2,197 child surveys were completed.

For more information about SHAPE: http://www.co.hennepin.mn.us/SHAPE.

DETAILED DATA TABLES

Table 17. Lifetime and current asthma prevalence, Minnesota adults

	Lifetime asthma prevalence % (95% CI)	Current asthma prevalence % (95% CI)
2000	9.5 (8.2-10.8)	7.2 (6.1-8.3)
2001	10.1 (9.0-11.2)	6.6 (5.8-7.4)
2002	11.3 (10.2-12.4)	7.5 (6.6-8.4)
2003	10.5 (9.3-11.7)	6.8 (5.9-7.7)
2004	11.6 (10.5-12.7)	7.5 (6.6-8.4)
2005	11.8 (10.3-13.3)	8.4 (7.1-9.7)
2006	11.1 (9.8-12.4)	7.8 (6.8-8.8)
2007	10.9 (9.7-12.1)	7.7 (6.7-8.7)
2008	12.4 (11.0-13.8)	7.8 (6.7-8.9)
2009	9.6 (8.4-10.7)	6.6 (5.7-7.6)
2010	10.9 (9.5-12.3)	7.6 (6.4-8.8)

Source: Minnesota BRFSS, 2000-2010

Table 18. Current asthma prevalence by sex, age, residence and education, Minnesota adults

Sex	
Female	9.5%
Male	5.6%
Age group	
18-44	8.3%
45-64	7.2%
65+	6.2%
Residence	
Metro	8.2%
Non-Metro	7.0%
Education	
<High School	12.1%
High School	5.4%
Some College	10.1%
College Graduate	6.5%
Total	**7.6%**

Source: Minnesota BRFSS, 2010

Table 19. Asthma status by health status and selected risk factors, Minnesota adults

	Current Asthma	Never Diagnosed
Fair/poor health status*	19.1%	10.2%
Current smoker	11.8%	14.8%
Overweight	72.4%	62.4%
Obese	32.9%	24.7%
No leisure time physical activity	17.9%	19.1%
Flu shot past 12 months	57.4%	48.5%
Ever had pneumonia vaccine*	39.4%	24.7%

Source: Minnesota BRFSS, 2010

*Difference between estimates for current asthma and never diagnosed populations is statistically significant

Table 20. Percentage of students ever diagnosed with asthma by grade and county, Minnesota

	Grade 6 %	Grade 9 %	Grade 12 %
Aitkin	13.9	16.9	15.2
Anoka	16.1	18.8	19.0
Becker	10.4	15.7	14.8
Beltrami	17.9	17.8	19.3
Benton	15.2	21.5	18.9
Big Stone	4.0	14.5	13.3
Blue Earth	11.1	15.1	14.0
Brown	15.7	14.9	16.0
Carlton	13.2	13.6	20.6
Carver	16.1	18.8	20.2
Cass	11.3	16.8	16.9
Chisago	14.3	16.9	19.2
Clay	6.9	17.2	16.7
Clearwater	12.4	14.9	13.1
Cottonwood	11.0	9.9	11.0
Crow Wing	13.9	11.9	18.4
Dakota	15.6	17.5	19.4
Dodge	10.2	16.0	21.1
Douglas	12.6	16.5	15.6
Fillmore	10.4	15.8	15.3
Freeborn	10.3	15.3	15.6
Goodhue	12.1	12.5	17.1
Hennepin	17.4	19.6	21.1
Houston	16.1	20.9	14.9

Table 20. Percentage of students ever diagnosed with asthma by grade and county, Minnesota (continued)

	Grade 6 %	Grade 9 %	Grade 12 %
Hubbard	16.8	14.3	16.4
Itasca	13.8	18.3	19.8
Jackson	13.0	14.4	14.7
Kanabec	15.8	18.5	12.2
Kandiyohi	15.4	18.7	16.3
Kittson	10.5	18.0	5.1
Koochiching	17.4	11.5	14.5
Lac Qui Parle	14.3	17.3	19.5
Le Sueur	12.3	17.1	9.3
Lincoln	2.6	17.9	16.1
Lyon	10.7	14.5	18.0
McLeod	17.0	15.8	15.7
Mahnomen	12.5	13.0	12.5
Marshall	18.6	12.8	19.8
Martin	10.6	18.0	19.6
Meeker	11.2	12.1	10.9
Mille Lacs	14.6	16.4	17.2
Morrison	16.9	22.6	17.0
Mower	16.5	18.6	17.6
Nobles	13.8	14.7	12.2
Norman	18.6	8.0	11.1
Olmsted	17.3	18.7	21.0
Otter Tail	8.3	14.9	18.3
Pine	12.1	15.4	19.7
Polk	15.9	12.8	19.2
Ramsey	16.7	17.1	17.2
Red Lake	24.5	13.6	14.3
Redwood	11.3	11.6	17.6
Renville	14.8	15.3	15.3
Rice	12.8	14.4	19.8
Roseau	11.1	15.7	14.3
St. Louis	13.8	18.7	19.7
Scott	13.4	17.9	16.2
Sherburne	15.8	20.7	18.2
Sibley	16.1	16.7	12.8
Stearns	14.8	16.0	17.0
Steele	14.2	15.5	17.6

Table 20. Percentage of students ever diagnosed with asthma by grade and county, Minnesota (continued)

	Grade 6 %	Grade 9 %	Grade 12 %
Swift	20.2	19.8	18.2
Todd	10.4	14.8	15.6
Wabasha	15.4	18.5	17.1
Wadena	15.4	17.7	23.0
Washington	14.1	18.1	19.4
Watonwan	7.4	11.4	10.8
Wilkin	13.3	16.9	18.3
Winona	15.4	20.9	20.0
Wright	13.9	16.4	17.8
Yellow Medicine	17.1	15.9	6.9
No County Report	12.3	17.2	17.0
Total	**15.1**	**17.7**	**18.4**

Source: Minnesota Student Survey, 2010

Table 21. Percentage of Minnesota youth who have ever been diagnosed with asthma

Grade	
6	15.1%
9	17.7%
12	18.4%
Sex	
Female	16.7%
Male	17.3%
Race/Ethnicity*	
American Indian	23.7%
Black/African/African American	24.6%
Hispanic or Latino	17.0%
Asian American or Pacific Islander	13.0%
White	17.0%
Don't know	16.4%
Free/reduced lunch	
Yes	18.1%
No	16.7%
Region	
Twin Cities Metropolitan Area	17.9%
Greater Minnesota	15.9%

Source: Minnesota Student Survey, 2010

*Students could be included in more than one group

Table 22. Age-adjusted rates of asthma ED visits by county of patient residence, Minnesota

County	Number of ED Visits 2008-2010	Age-Adjusted Rate Per 10,000	95% Confidence Interval
Aitkin	196	50.9	(43.2 - 58.6)
Anoka	3,379	34.8	(33.6 - 36.0)
Becker	266	29.4	(25.7 - 33.0)
Beltrami	446	33.6	(30.4 - 36.8)
Benton	479	41.5	(37.7 - 45.3)
Big Stone	23	16.8	(10.3 - 26.0)
Blue Earth	479	26.5	(24.0 - 29.0)
Brown	225	29.6	(25.6 - 33.7)
Carlton	547	53.7	(49.1 - 58.3)
Carver	535	20.0	(18.3 - 21.8)
Cass	295	38.2	(33.6 - 42.7)
Chippewa	138	39.8	(33.0 - 46.7)
Chisago	882	56.9	(53.1 - 60.7)
Clay	493	28.2	(25.7 - 30.8)
Clearwater	63	24.0	(18.3 - 31.1)
Cook	68	49.5	(37.5 - 64.0)
Cottonwood	53	16.1	(11.9 - 21.2)
Crow Wing	834	47.6	(44.3 - 50.9)
Dakota	3,530	29.9	(28.9 - 30.9)
Dodge	115	19.5	(15.9 - 23.1)
Douglas	213	21.9	(18.9 - 24.9)
Faribault	73	18.6	(14.3 - 23.6)
Fillmore	92	15.6	(12.5 - 19.2)
Freeborn	470	54.3	(49.2 - 59.3)
Goodhue	659	50.3	(46.4 - 54.3)
Grant	44	27.5	(19.7 - 37.5)
Hennepin	18,197	54.5	(53.7 - 55.3)
Houston	11	2.0*	(1.0 - 3.7)
Hubbard	217	39.2	(33.7 - 44.7)
Isanti	287	26.0	(23.0 - 29.1)
Itasca	521	43.5	(39.6 - 47.3)
Jackson	51	17.5	(12.8 - 23.3)
Kanabec	330	73.5	(65.3 - 81.6)
Kandiyohi	362	29.7	(26.6 - 32.9)
Kittson	16	13.3*	(7.2 - 22.5)
Koochiching	246	72.8	(63.3 - 82.3)
Lac qui Parle	44	24.0	(16.9 - 33.0)
Lake	95	35.4	(28.4 - 43.6)
Lake of the Woods	18	18.9*	(10.8 - 30.6)

Table 22. Age-adjusted rates of asthma ED visits by county of patient residence, Minnesota (continued)

County	Number of ED Visits 2008-2010	Age-Adjusted Rate Per 10,000	95% Confidence Interval
Le Sueur	173	21.6	(18.3 - 24.8)
Lincoln	36	22.9	(15.8 - 32.2)
Lyon	186	25.0	(21.3 - 28.7)
McLeod	316	29.4	(26.1 - 32.7)
Mahnomen	38	23.7	(16.5 - 32.9)
Marshall	87	34.0	(27.0 - 42.3)
Martin	143	24.9	(20.6 - 29.1)
Meeker	139	20.9	(17.3 - 24.5)
Mille Lacs	640	84.9	(78.2 - 91.6)
Morrison	302	31.9	(28.2 - 35.5)
Mower	527	46.7	(42.6 - 50.7)
Murray	69	29.9	(23.0 - 38.2)
Nicollet	264	28.4	(24.9 - 31.9)
Nobles	117	18.6	(15.2 - 22.1)
Norman	29	17.2	(11.3 - 25.1)
Olmsted	1,206	28.3	(26.7 - 29.9)
Otter Tail	437	27.6	(24.9 - 30.4)
Pennington	139	34.6	(28.8 - 40.4)
Pine	458	55.5	(50.3 - 60.6)
Pipestone	46	16.7	(12.1 - 22.5)
Polk	300	35.0	(30.9 - 39.0)
Pope	70	20.9	(16.0 - 26.8)
Ramsey	8,204	55.8	(54.6 - 57.0)
Red Lake	22	19.3	(12.0 - 29.5)
Redwood	134	28.6	(23.6 - 33.7)
Renville	102	24.3	(19.4 - 29.1)
Rice	604	32.4	(29.8 - 35.0)
Rock	54	19.6	(14.6 - 25.9)
Roseau	208	45.5	(39.2 - 51.8)
St. Louis	2,306	41.3	(39.5 - 43.0)
Scott	1,440	36.7	(34.8 - 38.7)
Sherburne	740	27.8	(25.7 - 29.8)
Sibley	117	26.0	(21.2 - 30.7)
Stearns	1,141	26.1	(24.6 - 27.7)
Steele	410	38.0	(34.3 - 41.7)
Stevens	12	4.5*	(2.2 - 8.0)
Swift	74	24.5	(19.0 - 31.2)

Table 22. Age-adjusted rates of asthma ED visits by county of patient residence, Minnesota (continued)

County	Number of ED Visits 2008-2010	Age-Adjusted Rate per 10,000	95% Confidence Interval
Todd	85	12.6	(10.0 - 15.6)
Traverse	47	54.0	(39.0 - 72.8)
Wabasha	199	32.2	(27.6 - 36.8)
Wadena	165	41.2	(34.6 - 47.7)
Waseca	193	34.6	(29.7 - 39.6)
Washington	1,999	29.1	(27.8 - 30.4)
Watonwan	84	24.9	(19.7 - 31.0)
Wilkin	66	33.0	(25.3 - 42.4)
Winona	414	28.7	(25.7 - 31.6)
Wright	1,063	28.1	(26.4 - 29.8)
Yellow Medicine	92	32.3	(25.9 - 39.9)
Minnesota	**60,689**	**39.2**	**(38.9 – 39.5)**

Source: Minnesota Hospital Association, 2008-2010

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

Notes:

Data on ED visits for Minnesota residents seeking care in South Dakota, Iowa or Wisconsin is not currently available (with the exception of North Dakota, border state data on ED visits is not available through the current data sharing agreement). Thus, ED visit rates for counties in which residents are likely to go to South Dakota, Iowa or Wisconsin for care may be significantly underestimated.

Rates of ED visits for counties in which residents are likely to visit hospitals that do not submit data to the Minnesota Hospital Association (e.g., Veteran's Administration or Indian Health Service hospitals) may also be artificially low.

Table 23. Age-adjusted rates of asthma hospitalizations by county of patient residence, Minnesota

County	Number of Hospitalizations 2008-2010	Age-Adjusted Rate Per 10,000	95% Confidence Interval
Aitkin	32	5.9	(3.9 - 8.6)
Anoka	744	7.9	(7.3 - 8.5)
Becker	42	3.9	(2.8 - 5.3)
Beltrami	83	5.9	(4.6 - 7.3)
Benton	153	13.3	(11.2 - 15.4)
Big Stone	7	3.7*	(1.4 - 7.9)
Blue Earth	83	4.8	(3.8 - 6.0)
Brown	38	4.1	(2.9 - 5.8)
Carlton	107	9.7	(7.8 - 11.6)
Carver	112	4.3	(3.4 - 5.1)
Cass	60	6.2	(4.6 - 8.1)
Chippewa	24	6.5	(4.1 - 9.9)
Chisago	115	7.3	(5.9 - 8.6)
Clay	71	4.2	(3.3 - 5.3)
Clearwater	12	3.8*	(1.9 - 6.8)
Cook	12	6.5*	(3.1 - 11.9)
Cottonwood	14	3.0*	(1.6 - 5.2)
Crow Wing	126	6.2	(5.1 - 7.3)
Dakota	755	6.4	(5.9 - 6.8)
Dodge	24	3.8	(2.5 - 5.7)
Douglas	40	3.7	(2.6 - 5.1)
Faribault	18	3.5*	(2.0 - 5.8)
Fillmore	21	2.9	(1.7 - 4.5)
Freeborn	57	5.4	(4.1 - 7.1)
Goodhue	106	6.9	(5.6 - 8.3)
Grant	11	5.0*	(2.3 - 9.4)
Hennepin	3,469	10.3	(9.9 - 10.6)
Houston	≤5	**	(0.2 - 1.8)
Hubbard	12	1.6*	(0.8 - 3.0)
Isanti	75	6.7	(5.2 - 8.4)
Itasca	91	5.9	(4.7 - 7.3)
Jackson	16	4.5*	(2.5 - 7.5)
Kanabec	49	9.6	(7.0 - 12.8)
Kandiyohi	79	5.6	(4.4 - 7.1)
Kittson	≤5	**	(0.7 - 7.8)
Koochiching	15	3.8*	(2.0 - 6.5)
Lac qui Parle	27	10.6	(6.5 - 16.3)
Lake	15	5.8*	(3.1 - 9.7)
Lake of the Woods	9	5.1*	(2.2 - 10.1)

Table 23. Age-adjusted rates of asthma hospitalizations by county of patient residence, Minnesota (continued)

County	Number of Hospitalizations 2008-2010	Age-Adjusted Rate Per 10,000	95% Confidence Interval
Le Sueur	40	4.6	(3.2 - 6.3)
Lincoln	13	6.7*	(3.4 - 12.0)
Lyon	54	7.2	(5.4 - 9.4)
Mahnomen	10	4.8*	(2.3 - 8.8)
Marshall	15	5.3*	(2.9 - 9.1)
Martin	41	6.7	(4.7 - 9.3)
McLeod	82	6.9	(5.5 - 8.6)
Meeker	34	4.4	(3.0 - 6.2)
Mille Lacs	108	12.8	(10.4 - 15.3)
Morrison	70	6.9	(5.3 - 8.7)
Mower	91	7.3	(5.9 - 9.0)
Murray	10	3.3*	(1.4 - 6.4)
Nicollet	36	3.8	(2.6 - 5.3)
Nobles	33	4.7	(3.2 - 6.6)
Norman	≤5	**	(0.4 - 4.4)
Olmsted	235	5.5	(4.8 - 6.2)
Otter Tail	102	5.5	(4.3 - 6.6)
Pennington	25	5.4	(3.4 - 8.1)
Pine	62	6.7	(5.1 - 8.7)
Pipestone	22	6.2	(3.8 - 9.5)
Polk	64	6.5	(5.0 - 8.4)
Pope	32	7.9	(5.2 - 11.5)
Ramsey	1,414	9.6	(9.1 - 10.1)
Red Lake	≤5	**	(1.1 - 11.0)
Redwood	44	7.9	(5.6 - 10.8)
Renville	37	7.2	(5.0 - 10.1)
Rice	154	8.1	(6.8 - 9.4)
Rock	21	5.6	(3.4 - 8.7)
Roseau	18	3.5*	(2.1 - 5.6)
Scott	225	6.0	(5.2 - 6.8)
Sherburne	123	5.1	(4.2 - 6.1)
Sibley	24	5.0	(3.2 - 7.5)
St. Louis	463	7.7	(6.9 - 8.4)
Stearns	440	10.3	(9.3 - 11.2)
Steele	45	4.1	(3.0 - 5.5)
Stevens	29	9.9	(6.5 - 14.4)
Swift	26	7.3	(4.7 - 11.0)

Table 23. Age-adjusted rates of asthma hospitalizations by county of patient residence, Minnesota (continued)

County	Number of Hospitalizations 2008-2010	Age-Adjusted Rate Per 10,000	95% Confidence Interval
Todd	19	2.1*	(1.3 - 3.3)
Traverse	6	5.3*	(1.6 - 12.9)
Wabasha	32	4.6	(3.1 - 6.5)
Wadena	45	10.2	(7.3 - 13.7)
Waseca	29	4.8	(3.2 - 6.9)
Washington	337	4.9	(4.3 - 5.4)
Watonwan	10	2.3*	(1.1 - 4.3)
Wilkin	12	4.9*	(2.5 - 8.7)
Winona	37	2.4	(1.6 - 3.3)
Wright	197	5.4	(4.6 - 6.2)
Yellow Medicine	32	9.9	(6.7 - 14.3)
Minnesota	**11,740**	**7.3**	**(7.2 - 7.5)**

Source: Minnesota Hospital Association, 2008-2010

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

**Rate not calculated when the number of hospitalizations is less than or equal to 5.

Notes:

Data on hospitalizations for Minnesota residents seeking care in Wisconsin are not currently available. Thus, hospitalization rates for counties in which residents are likely to go to Wisconsin for care may be significantly underestimated.

Rates of hospitalizations for counties in which residents are likely to visit hospitals that do not submit data to the Minnesota Hospital Association (e.g., Veteran's Administration or Indian Health Service hospitals) may also be artificially low.

Table 24. Asthma ED visit rates* by age group, sex and year, Minnesota

	2005	2006	2007	2008	2009	2010
0-4	106.8	107.9	122.0	106.2	108.9	117.1
5-14	51.6	52.4	55.9	52.0	59.2	56.4
15-34	37.5	36.1	38.5	38.0	39.7	43.2
35-64	26.0	25.3	25.8	26.6	27.2	31.6
65+	23.1	22.2	22.3	22.9	21.3	24.1
Female	39.9	39.0	41.2	40.5	41.8	39.9
Male	35.1	35.0	37.5	35.5	37.5	35.1
Total	37.5	37.0	39.3	38.0	39.7	42.8

Source: Minnesota Hospital Association, 2005-2010

*Rate per 10,000 population

Table 25. Asthma hospitalization rates* by age group, sex and year, Minnesota

	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0-4	30.8	27.3	26.5	29.3	31.9	25.0	25.5	29.3	20.7	18.4	17.6
5-14	11.6	8.1	8.2	9.7	8.9	8.1	7.9	9.8	6.3	7.8	5.8
15-34	5.9	4.8	4.4	4.5	4.1	4.1	3.5	4.2	3.2	3.4	2.8
35-64	6.7	7.2	7.0	7.3	7.0	7.6	7.0	7.2	7.5	7.3	6.5
65+	11.6	13.8	14.7	14.7	12.9	15.6	14.5	13.7	14.2	12.1	10.6
Female	11.1	10.4	10.0	10.4	9.9	10.5	9.4	10.4	9.5	9.1	8.0
Male	7.7	7.2	7.1	8.0	7.6	7.0	7.2	7.6	6.4	6.3	5.4
Total	9.4	8.8	8.6	9.2	8.8	8.8	8.3	9.0	7.9	7.8	6.8

Source: Minnesota Hospital Association, 1998-2010

*Rate per 10,000 population

Table 26. Asthma deaths by age group, sex and race/ethnicity, Minnesota

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
0-4	0	0	1	1	0	0	0	1	0	1
5-14	2	3	1	1	1	1	1	0	1	5
15-34	1	9	6	3	4	2	4	6	3	7
35-64	18	19	14	11	18	18	16	11	21	18
65+	57	60	53	47	44	26	35	34	35	42
Female	51	49	54	44	53	33	32	30	33	36
Male	27	42	21	19	14	14	24	22	27	37
Hispanic	1	0	0	0	3	0	0	1	1	1
White*	75	83	59	57	58	37	49	48	44	54
Black*	1	5	8	5	4	6	6	2	11	10
American Indian*	0	0	3	0	0	0	1	1	0	1
Asian*	0	1	2	1	2	4	0	0	2	6
Other*	0	0	0	0	0	0	0	0	0	1
Total	78	91	75	63	67	47	56	52	60	73

*Not Hispanic

Source: Minnesota Center for Health Statistics, 2005-2010

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