

Burden of
ASTHMA
in Wisconsin



2007

Suggested Citation:
Wisconsin Department of Health and Family Services, Division of Public Health, Bureau of Environmental
and Occupational Health. Burden of Asthma in Wisconsin—2007
PPH 45055 (Rev. 10/07)

Burden of
ASTHMA
in Wisconsin
2007



Wisconsin Department of Health and Family Services
Division of Public Health
Bureau of Environmental and Occupational Health
One West Wilson Street
Room 150
Madison, WI 53702

<http://dhfs.wisconsin.gov>

Funded by the Wisconsin Department of Health and Family Services through
US Centers for Disease Control and Prevention Cooperative Agreement Award
Number U59/CCU524190-03 - Addressing Asthma from a Public Health Perspective.

*From the Secretary of the
Wisconsin Department of Health and Family Services*

Asthma is a chronic inflammatory lung disease and a major health burden in Wisconsin, affecting the quality of life for people with asthma and their families. While there is no cure for asthma, the condition can be controlled with appropriate medical care and effective patient self-management. In response to the burden of asthma in the state, the Wisconsin Department of Health and Family Services (DHFS) conducts asthma surveillance to document and understand the ways that asthma affects the residents of our state. By summarizing the rates of asthma-related adverse health outcomes, charting the distribution of asthma within our population, and identifying how asthma is managed and what its associated costs are, DHFS seeks to provide the information that our statewide stakeholders need in order to monitor asthma in our state and what interventions are most likely to reduce the burden of asthma in Wisconsin.

This document represents an update of *The Burden of Asthma in Wisconsin*, our 2004 summary of asthma surveillance data in Wisconsin. Like its predecessor, *The Burden of Asthma in Wisconsin - 2007* represents the cumulative efforts of a range of statewide partners to comprehensively describe the current state of the burden of asthma in Wisconsin. This report will serve as the foundation for future asthma surveillance activities in Wisconsin, and will be an essential tool for local and statewide planning efforts to address asthma as a continuing public health issue in Wisconsin. It is hoped that the information in this report will help guide individuals and a broad spectrum of organizations in Wisconsin working to improve the lives of people with asthma.



Kevin R. Hayden,
Secretary

Table of Contents

List of Figures	vii
List of Tables	x
Executive Summary	xi
Key Findings	xiii
Introduction	I
Who Has Asthma in Wisconsin?	3
<i>Prevalence in Adults (≥ 18 years old)</i>	9
<i>Risk Factors Associated with Elevated Asthma Prevalence in Adults</i>	13
<i>Prevalence in Children (≤ 17 years old)</i>	10
<i>Prevalence in Public Middle and High School Students</i>	12
<i>Exposure to Secondhand Smoke Among Public Middle and High School Students</i>	15
Asthma Management and Quality of Life	16
<i>Asthma Control – Symptoms and Severity of Asthma</i>	16
<i>Symptoms in Adults</i>	18
<i>Asthma Attacks or Episodes in Adults</i>	20
<i>Asthma Attacks or Episodes in Children</i>	21
<i>Health-Related Quality of Life in Adults with Asthma</i>	22
<i>Health-Related Quality of Life in Children with Asthma</i>	23
Asthma Management in Wisconsin Schools	25
Health Care Utilization	27
<i>Flu Shots among Adults with Asthma</i>	27
<i>Asthma Management Plans in Adults with Asthma</i>	27
<i>Medication Usage among Adults with Asthma</i>	28
<i>Asthma Office Visits among Adults with Asthma</i>	29
<i>Asthma Urgent Care Visits among Adults with Asthma</i>	30
<i>Inpatient Hospitalizations</i>	31
<i>Emergency Department Visits</i>	40
<i>The Medicaid Population</i>	46
Mortality	51
Progress Towards Healthy People 2010 Goals	57
Work-Related Asthma	60
Discussion	63
References	65
Technical Notes	68
<i>Report Terminology</i>	68
<i>Rate Calculations</i>	68
<i>Determination of Statistical Significance</i>	69
<i>Acronyms</i>	70

Appendices 71

Appendix A. Data Sources 71

Appendix B. Detailed Data Tables 75

Appendix C. Table of County-Specific Data 76

Appendix D. 2006 National Center for Health Statistics (NCHS) Urban-Rural Classification 78

Appendix E. Population Distribution of Wisconsin 80

Appendix F. Behavioral Risk Factor Surveillance Survey Optional Modules 81

Appendix G. Useful Asthma Links and Resources 85

Acknowledgements 86

List of Figures

Figure 1.	Current, Former, and Lifetime Asthma Prevalence by Year, Wisconsin Adults, 1999-2005.....	4
Figure 2.	Lifetime Asthma Prevalence by Year in Wisconsin and U.S. Adults, 2000-2005	5
Figure 3.	Lifetime and Current Asthma Prevalence by Sex and Year, Wisconsin Adults, 2001-2005.....	5
Figure 4.	Lifetime and Current Asthma Prevalence by Race and Ethnicity, Wisconsin Adults, 2002-2005.....	6
Figure 5.	Lifetime and Current Asthma Prevalence by Age Group, Wisconsin Adults, 2004-2005.....	6
Figure 6.	Current Asthma Prevalence by Education Level, Wisconsin Adults, 2004-2005.....	8
Figure 7.	Current Asthma Prevalence by Household Income Level, Wisconsin Adults, 2004-2005.....	8
Figure 8.	Current Asthma Prevalence by Smoking Status, Wisconsin Adults, 2004-2005.....	9
Figure 9.	Current Asthma Prevalence by Overweight/Obesity Status and Sex, Wisconsin Adults, 2004-2005.....	9
Figure 10.	Lifetime and Current Asthma Prevalence by Year, Wisconsin Children, 2002-2005.	11
Figure 11.	Lifetime and Current Asthma Prevalence, Wisconsin and U.S. Children, 2003.	11
Figure 12.	Lifetime Asthma Prevalence by Sex, Wisconsin Children, 2005.....	12
Figure 13.	Lifetime Asthma Prevalence Among Wisconsin Public Middle and High School Students, 2004 and 2006.....	13
Figure 14.	Lifetime Asthma Prevalence Among Wisconsin Public Middle and High School Students by Sex, 2004 and 2006.....	14
Figure 15.	Lifetime Asthma Prevalence Among Wisconsin Public Middle and High School Students by Race and Ethnicity, 2004 and 2006.....	14
Figure 16.	Lifetime Asthma Prevalence Among Wisconsin Public High School Students by Sex, 2005.....	15
Figure 17.	Lifetime Asthma Prevalence Based on Residence with Smoker and Days Spent in Same Room with Smoker, Wisconsin Public Middle and High School Students, 2005.....	15
Figure 18.	Frequency of Asthma Symptoms in the past 30 Days among Adults with Current Asthma, Wisconsin, 2002-2005.....	18
Figure 19.	Percent of Adults with Current Asthma Experiencing No Symptoms in the past 30 Days by Sex, Wisconsin, 2002-2005.....	19
Figure 20.	Number of Days had Trouble Sleeping among Adults with Asthma Symptoms in the past 30 Days, Wisconsin, 2002-2005.....	19
Figure 21.	Percent of Adults with Current Asthma who Experienced an Asthma Attack in the Past Year by Sex, Age Group and Race ^a , Wisconsin, 2002-2005.....	20
Figure 22.	Percent of Children with Current Asthma who Experienced an Asthma Attack in the Past Year, Wisconsin and U.S., 2003.....	21
Figure 23.	Percent of Public Middle and High School Students with Lifetime Asthma who Experienced an Asthma Attack in the Past Year, Wisconsin, 2004-2006.	21
Figure 24.	Percent of Public Middle and High School Students with Lifetime Asthma who Experienced an Asthma Attack in the Past Year by Sex, Wisconsin, 2006.....	22
Figure 25.	Perceived Health Status among Adults with Current Asthma and Adults without Asthma, Wisconsin, 2004-2005.....	22
Figure 26.	Number of Activity Limited Days in the Past Year Due to Asthma, Wisconsin Adults with Current Asthma, 2002-2005.....	23
Figure 27.	Perceived Health Difficulties among Children with Current Asthma, Wisconsin and U.S., 2003.....	23
Figure 28.	Perceived Family Burden among Children with Current Asthma, Wisconsin and U.S., 2003.....	24
Figure 29.	Number of Days of School Missed in the Past 30 Days by Asthma Status, Wisconsin Public Middle and High School Students, 2006.....	24
Figure 30.	Flu Vaccine among Wisconsin Adults with Current Asthma by Age Group, 2004-2005.....	27

List of Figures

Figure 31. Asthma Management Plans in Adults with Current Asthma, Wisconsin, 2005.....	28
Figure 32. Frequency of Asthma Medication Usage in the Past 30 Days to Prevent Asthma Attacks among Adults with Current Asthma, Wisconsin, 2005.....	28
Figure 33. Frequency of Asthma Medication Usage in the Past 30 Days to Stop an Asthma Attack among Adults with Current Asthma, Wisconsin, 2005.....	29
Figure 34. Routine Health Care Visits for Asthma in the Past Year among Adults with Current Asthma by Sex and Race, Wisconsin, 2002-2005.....	30
Figure 35. Urgent Health Care Visits for Asthma in the Past Year among Adults with Current Asthma, Wisconsin, 2002-2005.....	30
Figure 36. Urgent Health Care Visits for Asthma in the Past Year among Adults with Current Asthma by Sex and Race, Wisconsin, 2002-2005.....	31
Figure 37. Distribution of the Primary Payor for Asthma Hospitalizations, Wisconsin Residents, 2005.....	33
Figure 38. Age-Adjusted Asthma Hospitalization Rates per 10,000, Wisconsin Residents, 1990-2005.....	34
Figure 39. Age-Adjusted Asthma Hospitalization Rates per 10,000, Wisconsin (2000-2005) and the United States (2000-2004).....	35
Figure 40. Age-Adjusted Asthma Hospitalization Rates per 10,000 by Principal and Underlying Diagnosis, Wisconsin Residents, 2000-2005.....	36
Figure 41. Age-Adjusted Asthma Hospitalization Rates by Race and Year, Wisconsin, 2000-2005.....	37
Figure 42. Average Daily Asthma Hospitalizations among Wisconsin Residents by Month of Admission, 2005.....	38
Figure 43. Age-Adjusted Asthma Hospitalization Rates per 10,000 by County and Comparison to the Overall State Rate, 2003-2005.....	39
Figure 44. Asthma-Related Emergency Department Visits in the Past Year among Adults with Current Asthma by Sex, Race and Overall, Wisconsin, 2002-2005.....	40
Figure 45. Number of Asthma-Related Emergency Department Visits in the Past Year among Adults with Current Asthma, Wisconsin, 2002-2005.....	41
Figure 46. Average Daily Asthma Emergency Department Visits among Wisconsin Residents by Month of Visit, 2005.....	42
Figure 47. Age-Adjusted Asthma Emergency Department Visit Rates per 10,000, Wisconsin (2002-2005) and the United States (2002-2004).....	43
Figure 48. Asthma Emergency Department Visit Rates per 10,000 by Age and Sex, Wisconsin, 2005.....	44
Figure 49. Age-Adjusted Asthma Emergency Department Visit Rates per 10,000 by County and Comparison to the Overall State Rate, 2003-2005.....	45
Figure 50. Percent of Medicaid Recipients with Asthma Ambulatory Visits by Year and Age Group, Wisconsin, 2003-2005.....	47
Figure 51. Percent of Medicaid Recipients with Asthma Ambulatory Visits by Sex, Wisconsin, 2003-2005.....	47
Figure 52. Distribution of Ambulatory Visits for Asthma by Provider Type among Medicaid Recipients, Wisconsin, 2005.....	48
Figure 53. Percent of Medicaid Recipients with Asthma Emergency Department Visits by Year and Age Group, Wisconsin, 2003-2005.....	48
Figure 54. Modified HEDIS Measure: Use of Appropriate Medications for People with Persistent Asthma by Age Group, Wisconsin Medicaid Recipients, 2003-2005.....	50
Figure 55. Asthma Mortality by Year, Underlying and Contributing Cause of Death, Wisconsin Residents, 2000-2005.....	51

List of Figures

Figure 56. Age-Adjusted Asthma Mortality Rates by Year, Wisconsin Residents, 2000-2005, and U.S. Age-Adjusted Asthma Mortality by Year, 2000-2004.....	52
Figure 57. Age-Adjusted Asthma Mortality Rates by Year, Wisconsin Residents 1990-2005. 1990-1998 Coded with ICD-9, and 1999-2005 Coded with ICD-10.....	53
Figure 58. Asthma Death Counts and Age-Adjusted Asthma Mortality Rates by Year and Sex, Wisconsin Residents, 2000-2005.....	54
Figure 59. Six Year Age-Adjusted Asthma Mortality Rates by Race, Wisconsin Residents, 2000-2005.....	55
Figure 60. Classification of Wisconsin Counties using the 2006 NCHS Urban-Rural Classification.....	79

List of Tables

Table 1.	Lifetime Asthma Prevalence by National Center for Health Statistics (NCHS) Urban/Rural Classification, Wisconsin Adults, 2002-2005.....	7
Table 2.	Lifetime and Current Prevalence Childhood Asthma Questions, 2002-2005 Behavioral Risk Factor Surveillance Survey (BRFSS) and 2003 National Survey of Children's Health (NSCH).....	10
Table 3.	Asthma Questions on the 2005 Wisconsin Youth Risk Behavioral Survey (YRBS) and 2004 and 2006 Wisconsin Youth Tobacco Survey (YTS).....	13
Table 4.	National Asthma Education and Prevention Program Recommended Key Clinical Activities for Quality Asthma Care.....	16
Table 5.	National Asthma Education and Prevention Program Guidelines Stepwise Approach to Classifying and Treating Asthma in Adults and Children Older than 5 Years of Age.....	17
Table 6.	Asthma Management in Wisconsin Public Middle and High Schools according to School Principals, 2002 and 2004.....	26
Table 7.	Number of Asthma Hospitalizations, Average Length of Stay (LOS), Average Charge per Asthma Hospitalization, and Total Asthma Hospitalization Charges by Sex, Race, Ethnicity and Age, Wisconsin Residents, 2005.....	33
Table 8.	Annual and Average (2000-2005) Age-Specific Asthma Hospitalization Rates and Overall Age-Adjusted Asthma Hospitalization Rates, Wisconsin, 2000-2005.....	36
Table 9.	Annual and Average (2000-2005) Age-Adjusted Asthma Hospitalization Rates by Sex, Race, and Ethnicity, Wisconsin, 2000-2005.....	38
Table 10.	Number of Asthma Emergency Department (ED) Visits, Average Charge per Asthma ED visit, and Total Asthma ED Visit Charges by Sex, Age and Primary Payor Group Wisconsin Residents, 2005.....	42
Table 11.	Annual and Average (2000-2005) Age-Specific Asthma Mortality Rates and Total Age-Adjusted Asthma Mortality Rates, Wisconsin, 2000-2005.....	55
Table 12.	Six Year Age-Adjusted Asthma Mortality Rates by National Center for Health Statistics (NCHS) Urban/Rural Classification, Wisconsin, 2000-2005.....	56
Table 13.	Wisconsin, US and Healthy People 2010 Target Asthma Hospitalization Rates, 1998-2005.	58
Table 14.	Wisconsin, US and Healthy People 2010 Target Asthma Emergency Department Rates, 1995-2005.....	58
Table 15.	Wisconsin, US and Healthy People 2010 Target Asthma Mortality Rates, 1999-2005.....	59
Table 16.	Asthma Hospitalizations with Worker's Compensation as the Primary Payor by Year, Wisconsin, 2000-2005.....	62
Table 17.	Annual Number of Asthma Hospitalizations among Wisconsin Residents, 1990-2005.....	75
Table 18.	Annual Number of Asthma Emergency Department Visits among Wisconsin Residents, 2002-2005.....	75
Table 19.	Hospitalization and Emergency Department Visit Rates and County Ranks, Wisconsin Counties, 2003-2005.....	76
Table 20.	Classification rules used to assign counties to the six urbanization levels of the 2006 NCHS Urban-Rural Classification.....	78
Table 21.	Wisconsin and US Census Data by Sex, Age Group, Race and Ethnicity, 2000.....	80

Executive Summary

Asthma is a chronic lung condition characterized by ongoing airway inflammation associated with increased airway responsiveness to a variety of stimuli. Inflammation causes reversible airway obstruction, which results in symptoms such as episodic wheezing, chest tightness, cough and shortness of breath. A variety of factors are known to trigger asthma episodes (attacks), including allergens (pollen, dust mites and mold), viral infections, irritants (chemicals, tobacco smoke and air pollution) and other factors such as exercise, cold air and stress. Results from the 2005 Behavioral Risk Factor Surveillance Survey (BRFSS) indicate that 13 percent of adults and children in Wisconsin have been diagnosed with asthma.

Like many chronic conditions, appropriate asthma care requires routine health care visits, pharmacological treatment to effectively manage and control symptoms, and an environment that minimizes exposure to asthma triggers. Uncontrolled asthma can lead to emergency department visits, inpatient hospitalizations and, on rare occasion, death.

The purpose of this report is to describe the distribution of asthma and adverse asthma-related health outcomes in Wisconsin. This report is an updated version of *Burden of Asthma in Wisconsin 2004*. Data from these reports are used to design and prioritize intervention and prevention efforts to reduce the burden of asthma on our population and improve the lives of those living with asthma.

This report was updated from 2004 to include the most recent years of asthma surveillance data available. Asthma prevalence estimates in adults and children were updated using data from the 2003 through 2005 BRFSS. New data on asthma in children, including information on quality of life, were included from the 2003 National Survey of Children's Health (NSCH). The BRFSS adult asthma module was used to provide additional information on asthma symptoms, asthma prescription usage, and physician office visits for adults with asthma. This update also includes new information on the use of asthma management plans in adults from the 2005 BRFSS, and data on work-related asthma from the 2003 BRFSS. Data on asthma-related hospitalizations, emergency department visits and deaths were updated to include events from 2003 through 2005, as were data on Wisconsin's Medicaid population.

In 2005, more than 5,500 Wisconsin residents were hospitalized for asthma and more than 22,000 Wisconsin residents sought emergency room care for asthma. The burden of asthma is not equally shared in the population; certain minorities, age groups, and geographic regions are disproportionately affected. Among racial groups, African Americans have the highest prevalence of asthma (19 percent in 2002-2005), are hospitalized at five times the rate of whites (36.6 versus 7.1 hospitalizations per 10,000 population in 2005), and have a 3.5 times higher rate of asthma mortality than whites (41.2 versus 12.0 deaths per million population in 2000-2005). Native Americans also have higher asthma hospitalization rates than whites (11.7 versus 7.1 hospitalizations per 10,000 population in 2005).

Across age categories, children under the age of five have the highest hospitalization rate (29.6 per 10,000 population, 2005) and hospital ED visit rate (93.7 per 10,000 population, 2005) in Wisconsin. By sex in Wisconsin, males are more severely impacted by asthma during childhood, while females are disproportionately affected after puberty. A disproportionate burden of asthma among females vs. males is reflected in lifetime asthma prevalence (16.8 percent vs. 9.3 percent, 2005), hospital ED visits (44.1 vs. 37.5 per 10,000 population, 2005), inpatient hospitalizations (11.9 vs. 8.5 per 10,000 population, 2000-2005) and mortality (15.4 vs. 10.3 per 1,000,000 population, 2000-2005).

Milwaukee County is the most populous and urbanized county in the state, ranks second among counties for asthma hospitalization rate (21.0 per 10,000 population, 2003-2005), and has the highest hospital ED visit rate (96.3 per 10,000 population, 2003-2005). Forest County in northeastern Wisconsin has the highest inpatient hospitalization rate (21.7 per 10,000 population, 2003-2005). Menominee County, which is largely comprised of Native Americans, has the third highest hospitalization rate (20.9 per 10,000 population, 2003-2005) and the second highest ED rate in the state (73.4 per 10,000 population in 2003-2005).

Medical management of asthma in the state continues to fall short of National Asthma Education and Prevention Program (NAEPP) Guidelines (CDC, 2003). While about 75 percent of Wisconsin adults with asthma reported experiencing symptoms in the past 30 days, only 52 percent reported having a routine health care visit for their asthma in the past twelve months, and only 40 percent reported taking a prescription medication daily to prevent an asthma attack. Among adults with asthma, 15 percent reported at least one ED visit in the past 12 months, and 20 percent reported limits in their ability to conduct routine activities in the past year. The disproportionate burden of asthma and lack of adherence to treatment guidelines suggest that opportunities exist to enhance the care and health of people with asthma.

Prevalence

Adults

- Lifetime asthma prevalence in Wisconsin adults reached its highest value of 13 percent in 2005, up from 10 percent in 1999.
- Since 2004, adult females have had a statistically higher lifetime and current asthma prevalence than adult males.
- Among Wisconsin adults from 2002-2005, the lifetime prevalence of asthma is nearly twice as high in non-Hispanic African Americans as in non-Hispanic whites.
- Adults whose annual household income was less than \$15,000 have statistically higher current asthma prevalence than those whose household income is greater than \$25,000.
- Weight is correlated with asthma prevalence, particularly among females. Overweight and obese females are almost twice as likely to have current asthma as non-overweight/obese females (14.8 percent vs. 8.1 percent).

Children

- Wisconsin children reached all-time high lifetime (12.9 percent) and current (8.5 percent) asthma prevalence values in 2005.
- Wisconsin boys have higher lifetime asthma prevalence than girls (16.7 percent vs. 8.9 percent in 2005).
- Self-reported asthma prevalence is elevated among secondary students attending public schools. Approximately 16 percent of public middle school students and 18 percent of public high school students reported having been diagnosed with asthma in 2004 and 2006.
- Non-Hispanic African American public middle and high school students reported higher lifetime asthma prevalence values in comparison to non-Hispanic white students (25.3 percent vs. 16.8 percent in 2006).

Asthma Management and Quality of Life

- Significantly more adults with self-reported current asthma perceive their health status as fair or poor compared to adults without asthma.
- From 2002 to 2005, nearly 17 percent of adults with current asthma reported experiencing daily symptoms of asthma in the last 30 days.
Of those individuals with current asthma who reported experiencing asthma symptoms in the last 30 days, 44 percent reported that their asthma symptoms made it difficult to stay asleep on one or more nights during the last 30 days.

Asthma Attacks or Episodes

- Data from 2002 to 2005 show that nearly 51 percent of Wisconsin adults with current asthma reported having asthma attacks during the past year.
- Adult females with asthma were significantly more likely to report experiencing asthma attacks in the past year than adult males with asthma (57 percent vs. 39 percent).
- In 2003, nearly 48 percent of Wisconsin children with current asthma reported experiencing an asthma attack in the previous year.

Missed Activity

- From 2002 to 2005, 20 percent of adults with current asthma reported being unable to carry out their usual activities because of their asthma one or more days during the last month.
- In 2006, students that reported having been diagnosed with asthma reported missing more days of school in the last 30 days than other students.

Health Care Utilization

Physician Office Visits

- From 2002 to 2005, 52 percent of adults reporting current asthma also reported having a routine visit for their asthma in the last 12 months. Adult females were more likely to have office visits than adult males, and adult African Americans were more likely to report routine health care visits for asthma in the past year compared to adult whites.

Hospitalizations

- In 2005, there were a total of 5,541 hospitalizations in Wisconsin for which asthma was the principal diagnosis, costing an average of \$8,251 per hospitalization.
- Over the past ten years there has been a general decline in Wisconsin asthma hospitalization rates. Rates peaked in 1993 with 13.8 hospitalizations and decreased to a low of 9.6 hospitalizations per 10,000 in 2002.
- Children aged 0-4 years had the highest asthma hospitalization rate at 29.9 per 10,000, from 2000-2005.
- Asthma hospitalization rates in Wisconsin are nearly six times higher in African Americans than whites (42.4 vs. 7.4 per 10,000 from 2000 to 2005).
- Forest (21.7), Milwaukee (20.9), and Menominee (20.9) Counties experienced the highest county-specific rates of asthma hospitalizations per 10,000 population in Wisconsin from 2003-2005.
- Hospitalizations and emergency department (ED) visits in which asthma was identified as the primary diagnosis appear to vary seasonally, with the highest number of visits occurring in early spring and fall.

Emergency Department Visits

- In 2005, there were 22,115 ED visits for asthma, costing over \$17 million.
- The overall Wisconsin rate of asthma ED visits per 10,000 population remained steady from 41.9 in 2002 to 40.9 in 2005.
- By age, Wisconsin children 0-4 have the highest asthma ED visit rates at 94 visits per 10,000 in 2005.
- The five counties with the highest rates of asthma ED visits (per 10,000 population) for 2003-2005 were Milwaukee (96.3), Menominee (73.4), Jackson (63.4), Clark (60.7) and Racine (49.0).
- An average of 4.4 percent of Medicaid recipients from 2003 to 2005 had an ambulatory care visit for asthma. Medicaid recipients with ambulatory care visits for asthma averaged approximately two visits for asthma during each measurement year.

- An average of one percent of all Medicaid recipients had an ED visit for asthma from 2003-2005. Asthma was the primary diagnosis in approximately 3.3 percent of all ED visits among Medicaid recipients.
- Approximately 76 percent of Wisconsin Medicaid recipients 5 to 56 years old with persistent asthma received appropriate medication for long-term control of asthma from 2003 to 2005.

Mortality

- Between 2000 and 2005 asthma was the underlying cause of death in an average of 74 deaths per year in Wisconsin. Additionally, an average of 163 death certificates per year during this six-year period listed asthma as a contributing cause of death.
- There has been a general decline in asthma mortality in Wisconsin from 21.3 deaths per million in 1990 to 13.9 deaths per million in 2005.
- The asthma mortality rate among African Americans was about 3.4 times higher than the rate in the white population (41.2 vs. 12.0 per million) from 2000-2005.
- In 2002-2005, asthma mortality rates were higher in females than in males.

Other Findings

- Data from the BRFSS and Wisconsin Asthma Union Survey indicate that 5-14 percent of adults with asthma have work-related asthma.
- While most public secondary schools allow students with asthma to carry and administer their own asthma medications, roughly half do not provide asthma training to staff or educate students with asthma about asthma management.





Introduction

Asthma is a chronic lung disease affecting about 13 percent of adults and 12 percent of children in the United States (CDC, 2004). It is characterized by ongoing airway inflammation that can result in episodic events of wheezing, shortness of breath, coughing, and chest tightness. Individuals with asthma have increased airway reactivity, often in response to stimuli such as environmental allergens and irritants, viral infections and cold air. During an asthma attack or episode the airways that carry oxygen to the lungs become swollen, inflamed and produce excess mucus. The result is narrowing of the airways, which makes breathing difficult. The exact cause of asthma is unknown, but it is thought to be caused by both environmental and genetic factors (Pearce et al., 1998).

The United States Department of Health and Human Services (DHHS) has recognized asthma as a public health priority in their Healthy People 2010 national health plan (available at: <http://www.healthypeople.gov/>). DHHS has developed eight goals related to asthma, including:

- Reduce asthma deaths
- Reduce hospitalizations for asthma
- Reduce hospital emergency department visits for asthma
- Reduce activity limitations among persons with asthma
- Reduce the number of school or work days missed by persons with asthma due to asthma
- Increase the proportion of persons with asthma who receive formal patient education, including information about community and self-help resources, as an essential part of the management of their condition
- Increase the proportion of persons with asthma who receive appropriate asthma care according to the National Asthma Education and Prevention Program (NAEPP) guidelines
- In at least 25 states, establish a surveillance system for tracking asthma death, illness, disability, impact of occupational and environmental factors on asthma, access to medical care, and asthma management

Asthma was identified as a statewide health status priority as a chronic disease and as an environmental and occupational health issue in Wisconsin's statewide public health plan, Healthiest Wisconsin 2010 (available at: <http://dhfs.wisconsin.gov/statehealthplan/>).

This document includes a specific objective related to asthma:

- By 2010, reduce the asthma hospitalization rate to 8.5 per 10,000 population from the 2000 baseline asthma hospitalization rate of 10.6 per 10,000

In efforts largely funded by the Centers for Disease Control and Prevention (CDC), the Wisconsin Department of Health and Family Services (DHFS) seeks to comprehensively address the burden of asthma through surveillance, partnerships and interventions. Wisconsin was first awarded a CDC grant (Addressing Asthma from a Public Health Perspective) to reduce the burden of asthma in the state in 2001. In 2003, the Wisconsin Asthma Plan (WAP, available at: <http://dhfs.wisconsin.gov/eh/Asthma/WARP.htm#Plan>) was adopted to provide the blueprint for addressing asthma as a public health priority, and it lists the prioritized goals, objectives, and activities recommended for statewide action to reduce the burden of asthma in Wisconsin (WAC, 2003). The first comprehensive data report on asthma in Wisconsin was published in 2004 (Burden of Asthma in Wisconsin – 2004). Wisconsin has secured funding from the CDC through 2009.

This updated surveillance report will be used by a wide variety of stakeholders as a guide to focus asthma interventions and policies. It will also help direct the revision of the Wisconsin Asthma Plan in 2009. The Burden of Asthma report will be updated on an ongoing basis, and will be used to measure our progress on improving the health of individuals with asthma in Wisconsin.



Who Has Asthma in Wisconsin?

Asthma is a complex chronic disease with varying degrees of severity and intermittent symptoms. These characteristics make it difficult to determine the number of people living with asthma (known as prevalence). In addition, unlike many infectious and chronic diseases, there are no registries that track the number of individuals living with asthma. Therefore, the best method for determining the prevalence of asthma is through health surveys (Boss et al., 2001). Prevalence helps us understand the impact of asthma on Wisconsin's residents and our health care system. In addition, prevalence allows us to identify which populations are disproportionately affected and where prevention and intervention efforts should be directed.

One of the most important surveys for addressing asthma prevalence is the Behavioral Risk Factor Surveillance System (BRFSS). This is a state-based random-digit-dialed telephone survey of the non-institutionalized, civilian, adult (18 and over) population. The survey is cooperatively administered by the Centers for Disease Control and Prevention (CDC), the 50 states, the District of Columbia, and three U.S. territories (see Appendix A). The CDC has included questions on asthma prevalence on the BRFSS since 1999.

Currently there are two questions on the BRFSS core module that are asked every year by all states. In addition, there are adult and childhood asthma optional modules, which states may elect to include. The adult module is used to obtain information on factors associated with asthma such as symptoms, medication usage, doctor visits, asthma attacks and hospitalizations. The child module is used to obtain child asthma prevalence estimates.

The core questions allow for three types of prevalence estimates: lifetime, current and former prevalence.

Lifetime prevalence is estimated based on respondents who answer yes to the following question:

“Have you ever been told by a doctor, nurse, or other health professional that you had asthma?”

Current prevalence estimates are based respondents who answer yes to the lifetime prevalence question and yes to the following question:

“Do you still have asthma?”

Former prevalence estimates are based on respondents who answer yes to the lifetime prevalence question and no to the “still” question.

Because asthma is a disease that can occur, regress and reoccur, it is important to measure both lifetime and current asthma prevalence (Pearce et al., 1998). In particular, a childhood diagnosis of asthma may not affect an individual as an adult. Many children have been known to go through long periods without symptoms or requiring medication, and the disease may appear to resolve itself as they mature into adulthood.

While the BRFSS is a useful means of estimating the prevalence of asthma, it does have limitations. BRFSS data only represent the non-institutionalized, civilian population that has access to a landline telephone and probably underestimates the actual prevalence of asthma in the population. Responses are self-reported by respondents and may be subject to recall bias. In addition, individuals with symptoms of asthma who may never have been diagnosed by a physician or healthcare provider are not counted.

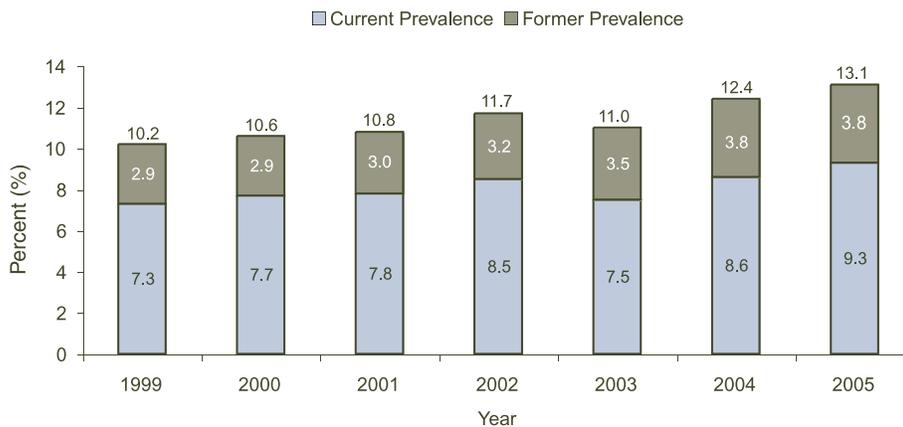
Wisconsin has used the BRFSS to gather information on asthma prevalence in adults and children since 1999 and 2002, respectively. This section will present data from the BRFSS to examine the characteristics of asthma in Wisconsin's adults and children. Demographic factors including age, sex, race/ethnicity, and region of residence will be examined. In addition, factors known to be associated with asthma such as obesity, smoking behaviors, educational level and income will be compared between individuals with asthma and those without asthma.

To allow for more accurate comparison of estimates, most prevalence rates are displayed with 95 percent confidence intervals. Confidence intervals provide an expression of the uncertainty associated with prevalence estimates (see Technical Notes for more details on calculation of confidence intervals).

Prevalence in Adults (= 18 years old)

Lifetime and current prevalence calculations were created to distinguish between (a) individuals who have been diagnosed with asthma but do not feel they have it currently, and (b) those who do report currently having asthma. To illustrate the difference between current, former and lifetime asthma prevalence in Wisconsin adults, BRFSS data from 1999 to 2005 are presented in Figure 1. The data show a fairly steady increase in current, former and lifetime asthma prevalence in Wisconsin adults from 1999 to 2005, with the exception of 2003. Lifetime asthma prevalence in Wisconsin adults reached its highest value of 13 percent in 2005, up from 10 percent in 1999.

Figure 1. Current, Former, and Lifetime Asthma Prevalence by Year, Wisconsin Adults, 1999-2005*.

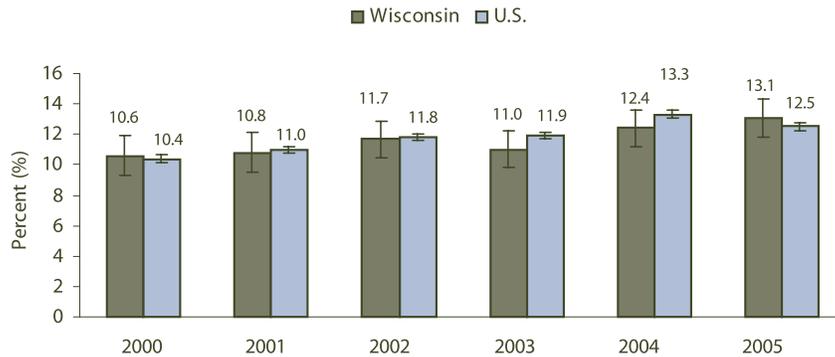


Data Source: 1999-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

*The asthma questions on the 1999 and 2000 BRFSS were worded slightly differently ("Did a doctor ever tell you that you have asthma?"), so estimates from these years are not directly comparable with estimates from 2001 through 2005.

Compared to national BRFSS estimates, Wisconsin adults have slightly lower lifetime asthma prevalence every year except 2005 (Figure 2). This difference, however, is not statistically significant. National estimates show a slow, significant increase in lifetime asthma prevalence among U.S. adults.

Figure 2. Lifetime Asthma Prevalence by Year in Wisconsin and U.S. Adults, 2000-2005*.

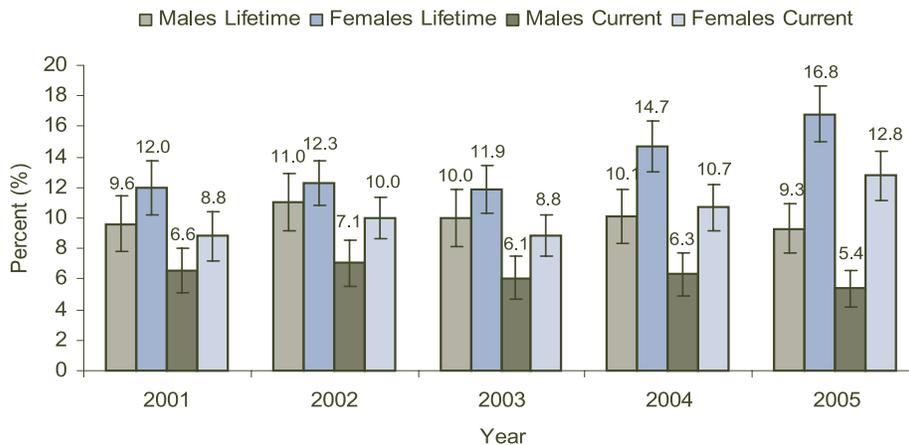


Data Source: 2000-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services and 2000-2005 Behavioral Risk Factor Surveillance System Online Prevalence Data

*The asthma question on the 2000 BRFSS was worded slightly differently (“Did a doctor ever tell you that you have asthma?”), so estimates from this year is not directly comparable with estimates from 2001 through 2005.

Figure 3 depicts lifetime and current asthma prevalence by sex in Wisconsin adults from 2001 to 2005. Both lifetime and current asthma prevalence have significantly increased for females, but have remained relatively stable for males. The higher lifetime and current asthma prevalence in females than males has become more evident in the last five years. Nationally, females have had a historically higher prevalence of asthma (ALA, 2005; Arif et al., 2003)

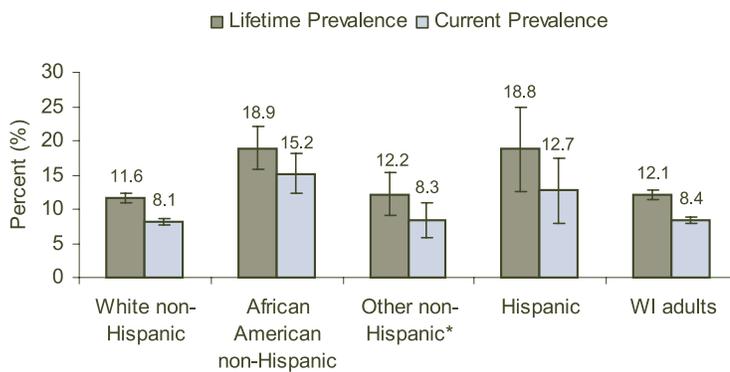
Figure 3. Lifetime and Current Asthma Prevalence by Sex and Year, Wisconsin Adults, 2001-2005.



Data Source: 2001-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

In order to estimate asthma prevalence among racial and ethnic groups for Wisconsin adults, results from 2002-2005 were combined. This was necessary because of the low number of sampled minority respondents in the BRFSS. Non-Hispanic African Americans have statistically significantly higher current and lifetime asthma prevalence than non-Hispanic white adults (Figure 4). Among Wisconsin adults from 2002-2005, non-Hispanic African Americans have a one and a half to two times higher current and lifetime prevalence of asthma than non-Hispanic whites. In the United States, non-Hispanic African Americans are known to have higher rates of asthma than other race groups (Rhodes et al., 2001). In Wisconsin, individuals of Hispanic origin appear to have a higher asthma prevalence than non-Hispanic whites; however, this difference is not statistically significant.

Figure 4. Lifetime and Current Asthma Prevalence by Race and Ethnicity, Wisconsin Adults, 2002-2005.

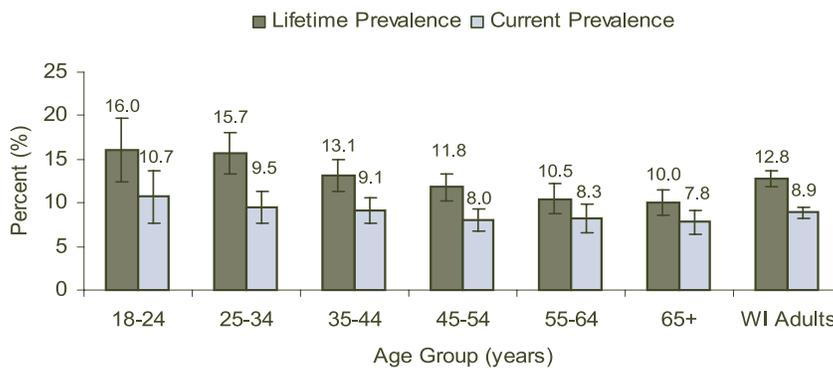


Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

*The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives, multiracial respondents, and individuals that reported being of other races. These groups were combined due to low number of sampled respondents.

Current and lifetime asthma prevalence (aggregated from 2004-2005) were both slightly higher in younger adult age groups; differences by age group were not statistically significant (Figure 5).

Figure 5. Lifetime and Current Asthma Prevalence by Age Group, Wisconsin Adults, 2004-2005.



Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Table I provides lifetime asthma prevalence from 2002 to 2005 based on the National Center for Health Statistics (NCHS) urban/rural classification (see Appendix D for definition). Some studies have suggested that asthma prevalence is higher in urban areas when compared to more rural areas. While overall differences are small (and not statistically significant), Wisconsin does appear to have a higher asthma prevalence in the most urban area of the state compared to suburban and small urban areas. Milwaukee County, the only large central metro county in Wisconsin, has the highest asthma prevalence value (13.6 percent).

Table I. Lifetime Asthma Prevalence by National Center for Health Statistics (NCHS) Urban/Rural Classification, Wisconsin Adults, 2002-2005.

2006 NCHS Urban/Rural Classification	2002 -2005 Lifetime Prevalence (95% Confidence Interval)
Large Central Metro (Milwaukee County) – Central counties in metro areas of 1 million or more population	13.6 (12.0 – 15.2)
Large Fringe Metro –Outlying (suburban) counties in metro areas of 1 million or more population	11.4 (9.8 – 13.0)
Medium Metro – Counties in metro areas of 250,000 - 999,999 population	13.5 (11.9 – 15.1)
Small Metro – Counties in metro area of 50,000 -249,999 population	12.1 (10.8 – 13.4)
Micropolitan –Counties in an area with an urban cluster of 10,000- 49,999 population	11.0 (9.5 – 12.5)
Noncore – Nonmicropolitan	10.7 (9.4 – 12.0)
Wisconsin – Total Population	12.1 (11.5 – 12.7)

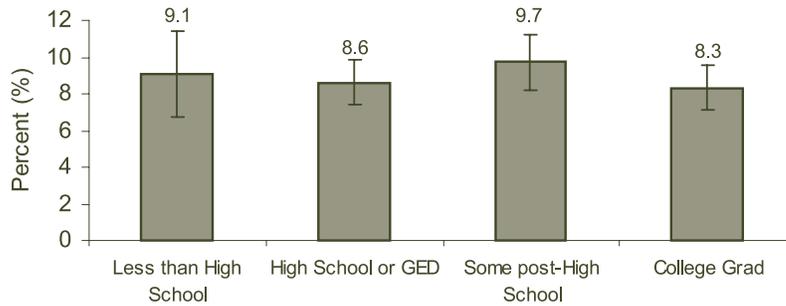
Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Risk Factors Associated with Elevated Asthma Prevalence in Adults

Studies have suggested that factors such as education, income level, tobacco use and body weight have been associated with asthma in adults (Cesaroni et al., 2003; Akerman et al., 2005). The 2004 and 2005 BRFSS were combined to investigate those risk factors among Wisconsin adults with current asthma.

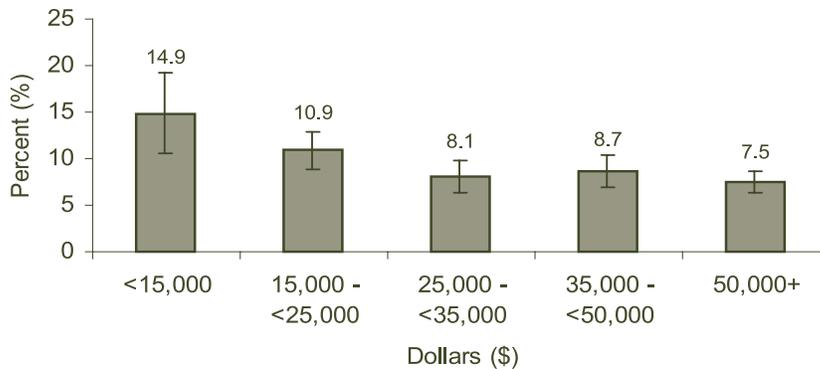
There was no statistically significant difference in current asthma prevalence aggregated from 2004-2005 by education level for Wisconsin adults (Figure 6). However, current asthma prevalence in adults appears to be inversely associated with income level. Overall trends show a decrease in current asthma prevalence with an increase in income. Adults whose annual household income was less than \$15,000 have a statistically higher current asthma prevalence than those whose household income is greater than \$25,000 (Figure 7).

Figure 6. Current Asthma Prevalence by Education Level, Wisconsin Adults, 2004-2005.



Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Figure 7. Current Asthma Prevalence by Household Income Level, Wisconsin Adults, 2004-2005.



Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Smoking status does not appear to be strongly associated with increased current asthma prevalence among Wisconsin adults (Figure 8). Smokers had a current asthma prevalence of 7.8 percent versus 9.2 percent for non-smokers (including former smokers). The difference in prevalence by smoking status is not statistically significant.

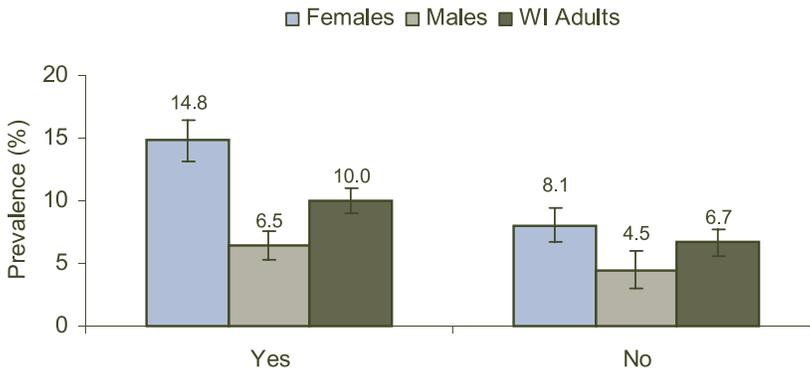
Figure 8. Current Asthma Prevalence by Smoking Status, Wisconsin Adults, 2004-2005.



Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Being overweight or obese, defined as a body mass index (BMI) of greater than or equal to 25, appears to be statistically correlated with current asthma prevalence in Wisconsin adults (Figure 9). Overall, overweight and obese adults in Wisconsin had a current asthma prevalence of 10 percent, while non-overweight/obese individuals had a prevalence of 6.7 percent. When stratified by sex, females appear to have a stronger correlation between body weight and asthma prevalence. In Wisconsin, overweight and obese females are almost twice as likely to have current asthma as non-overweight/obese females (14.8 percent vs. 8.1 percent).

Figure 9. Current Asthma Prevalence by Overweight/Obesity Status and Sex, Wisconsin Adults, 2004-2005.



Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Prevalence in Children (= 17 years old)

Asthma is the most common chronic disease in childhood, affecting approximately 6.2 million children under 18 years of age in the United States (ALA, 2006). Asthma can be particularly difficult for children and their families as it may limit the child’s ability to play, learn and sleep and can require costly interventions (Williams, 2006). Nationally, the prevalence of asthma among children has been increasing, and is higher than prevalence in adults (NHLBI, 1999).

To determine the prevalence of asthma among Wisconsin children, the BRFSS childhood asthma module and the National Survey of Children’s Health (NSCH) were used. Both surveys assess childhood asthma prevalence by asking an adult respondent about the asthma status of children living in the household. The BRFSS childhood asthma module was implemented in Wisconsin in 2002, and includes questions about lifetime and current asthma prevalence. The NSCH was a one-time survey conducted in 2003.

From 2002 to 2004, adult respondents in the BRFSS were asked about the asthma status of all children living in the household. In 2005, the design of the childhood asthma prevalence module in the BRFSS was changed. Instead of asking about the asthma status of all children in the household, one particular child was chosen at random and questions were asked regarding that child. The lifetime and current prevalence questions asked in the BRFSS regarding children are now similar to those asked of adults (Table 2). Due to the change in survey design, results from the 2002-2004 BRFSS childhood asthma module are not directly comparable to those from 2005 and after. The 2005 BRFSS childhood prevalence module and the NSCH have the same design and contain the same questions about asthma prevalence.

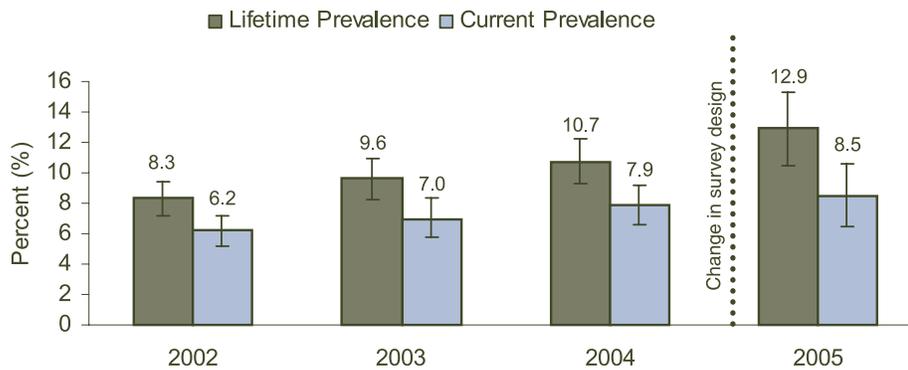
Table 2. Lifetime and Current Prevalence Childhood Asthma Questions, 2002-2005 Behavioral Risk Factor Surveillance Survey (BRFSS) and 2003 National Survey of Children’s Health (NSCH).

Years	Child Population	Lifetime Prevalence Question	Current Prevalence Question
2002-2004 BRFSS	All children (17 or younger) living in household	How many of these children have ever been diagnosed with asthma?	Does this child/How many of these children still have asthma?
2005-present BRFSS and 2003 NSCH	One randomly selected child (17 or younger) in the household	Has a doctor, nurse or other health professional ever said that the child has asthma?	Does the child still have asthma?

The random child selection design of the 2005 childhood BRFSS and 2003 NSCH allowed for collection of demographic characteristics such as sex and race/ethnicity of the selected child which were previously not available on the BRFSS.

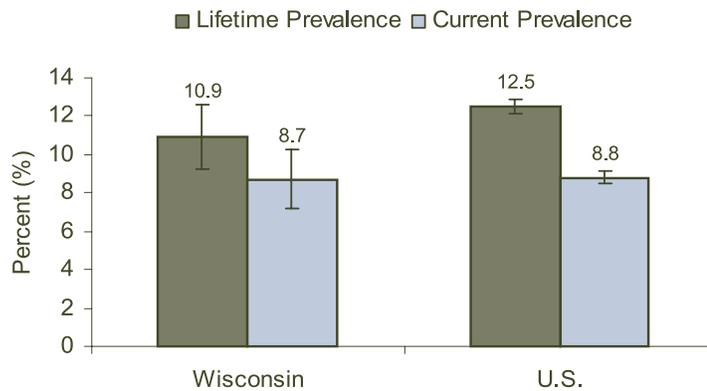
Data from the 2002-2004 BRFSS show that like adults, Wisconsin children have experienced a gradual increase in lifetime and current asthma prevalence (Figure 10). Though the 2005 BRFSS data are not directly comparable to previous years, Wisconsin children reached all-time high lifetime (12.9 percent) and current (8.5 percent) asthma prevalence values in 2005. The 2003 NSCH (with the same design as the 2005 BRFSS), estimated a lifetime asthma prevalence of 10.9 percent in Wisconsin children (Figure 11). Wisconsin children appear to have a slightly lower (not significant) lifetime and similar current asthma prevalence compared to children in the U.S.

Figure 10. Lifetime and Current Asthma Prevalence by Year, Wisconsin Children, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

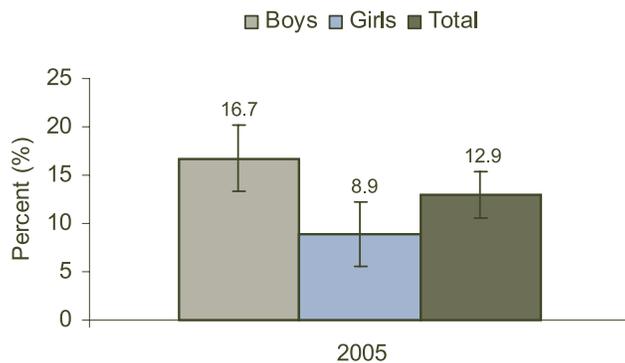
Figure 11. Lifetime and Current Asthma Prevalence, Wisconsin and U.S. Children, 2003.



Data Source: 2003 National Survey of Children's Health, Bureau of Maternal and Child Health, Health Resources and Services Administration, U.S. Department of Health and Human Services

Wisconsin boys have higher lifetime asthma prevalence than girls (Figure 12). This mirrors national data, and is opposite of the trend found in adults where females have a higher prevalence than males (see Figure 3). Although race/ethnicity of the children has been asked on the NSCH and on the BRFSS since 2005, there are currently not enough data available to analyze prevalence in children by race/ethnicity. Because of Wisconsin's relatively small minority population, several years of data collected under a uniform protocol will be required to provide a reliable estimate of the prevalence of asthma by race/ethnicity in children. Data from the Youth Tobacco Survey (YTS) on race/ethnicity and asthma prevalence are sufficient for such an analysis to be conducted for public middle and high school students; these data are detailed in the next section.

Figure 12. Lifetime Asthma Prevalence by Sex, Wisconsin Children, 2005.



Data Source: 2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Prevalence in Public Middle and High School Students

The Youth Risk Behavioral Survey (YRBS) and Youth Tobacco Survey (YTS) are two surveys administered to public middle and high school students in Wisconsin to assess health-risk behaviors and attitudes regarding tobacco use (see Appendix A). Both of these surveys include questions about asthma prevalence, and are helpful in providing additional information about asthma in Wisconsin's youth. Unlike the BRFSS, in which adult respondents answer questions on behalf of children and adolescents in their household, questions in the YRBS and YTS are answered by students directly (self-reported). In addition to providing information on prevalence of asthma in the student population, these surveys allow prevalence to be examined based on various demographic and behavioral variables. While the information provided by these surveys is valuable, the results can only be considered representative of the public middle and high school population-not of all Wisconsin youth.

The YRBS is administered by the Wisconsin Department of Public Instruction (with guidance from CDC) every other year to Wisconsin public high school students to monitor health risk behaviors of students. In 2005, two asthma-related questions were included in the YRBS to assess lifetime asthma prevalence and to determine asthma attack rates, respectively (Table 3).

The YTS is a comprehensive measure of youth awareness, attitudes and behaviors about tobacco use in Wisconsin. This survey is coordinated by the CDC and is administered by DHFS Tobacco Prevention and Control Program. The survey is conducted annually in Wisconsin public middle schools and biennially in Wisconsin public high schools. In 2004 and 2006, the YTS was administered to both middle and high school students, and included the same two asthma questions from the 2005 YRBS (Table 3). Data from both the 2003 YRBS and YTS were presented in the 2004 Burden of Asthma Report.

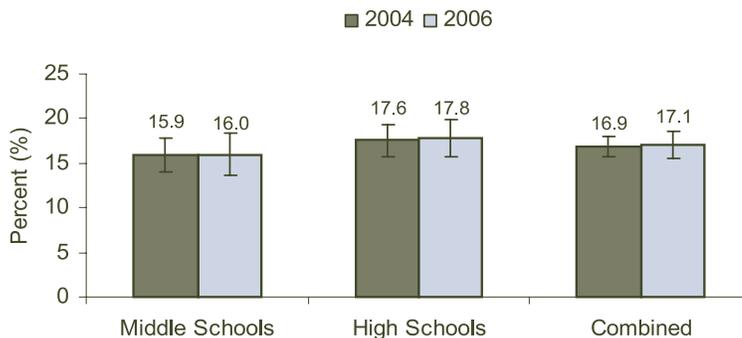
Table 3. Asthma Questions on the 2005 Wisconsin Youth Risk Behavioral Survey (YRBS) and 2004 and 2006 Wisconsin Youth Tobacco Survey (YTS).

Lifetime Prevalence	Have you ever been told by a doctor, nurse or other health professional that you have asthma?
Asthma Attacks	During the past 12 months, have you had an episode of asthma or an asthma attack?

A small portion of students in each survey responded inconsistently to the two asthma questions. Results presented here are only from students who responded consistently to both questions. This may result in more conservative asthma prevalence estimates. The same procedure was used for the 2004 Burden of Asthma Report, making results comparable.

Data from the YTS indicated that lifetime asthma prevalence in public middle and high school students was largely unchanged from 2004 to 2006 (Figure 13). Approximately 16 percent of middle school students and 18 percent of high school students reported having been diagnosed with asthma in 2004 and 2006. These results are consistent with the 2003 YTS, where 16 percent of middle school students reported being diagnosed with asthma (high school students were not surveyed in 2003) (Burden of Asthma 2004). Self-reported estimates here are higher than prevalence estimates from the BRFSS. This could be partly due to the difference in survey design (self-report vs. adult respondent), or could be due to slightly different populations (all children vs. public middle and high school children). Results did not differ significantly by grade level among public middle and high school students (data not shown).

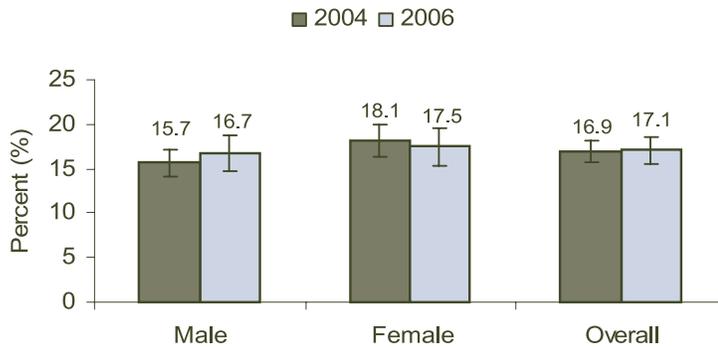
Figure 13. Lifetime Asthma Prevalence Among Wisconsin Public Middle and High School Students, 2004 and 2006.



Data Source: 2004 and 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services

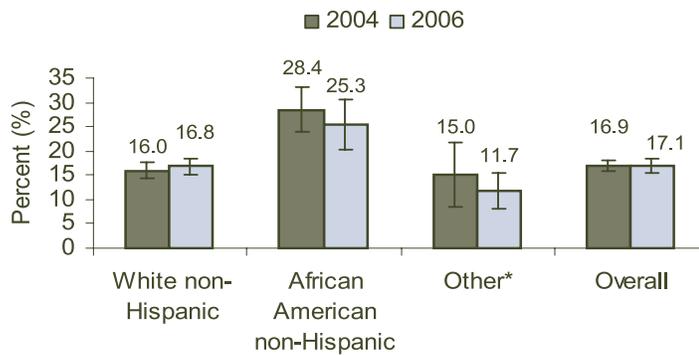
By sex, a slightly higher percentage of public middle and high school females than males reported having been diagnosed with asthma in 2004 and 2006 (Figure 14). This difference was not significant. Non-Hispanic African American public middle and high school students reported having significantly higher lifetime asthma prevalence values compared to non-Hispanic white students in 2004 and 2006 (Figure 15).

Figure 14. Lifetime Asthma Prevalence Among Wisconsin Public Middle and High School Students by Sex, 2004 and 2006.



Data Source: 2004 and 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services

Figure 15. Lifetime Asthma Prevalence Among Wisconsin Public Middle and High School Students by Race and Ethnicity, 2004 and 2006.

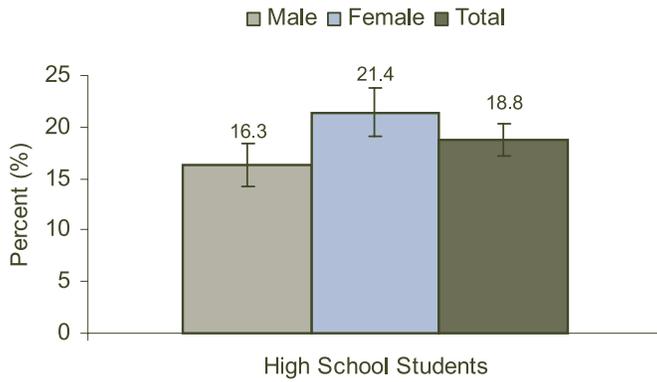


Data Source: 2004 and 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services

*The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives, Hispanics and Latinos. These groups were combined due to low number of sampled respondents.

The 2005 YRBS for public high school students showed that 18.8 percent of students reported having been diagnosed with asthma (Figure 16). This was similar to what was seen in the high school YTS in 2004 and 2006 (Figure 13). In addition, females also reported slightly higher lifetime asthma prevalence than males (not statistically significant).

Figure 16. Lifetime Asthma Prevalence Among Wisconsin Public High School Students by Sex, 2005.



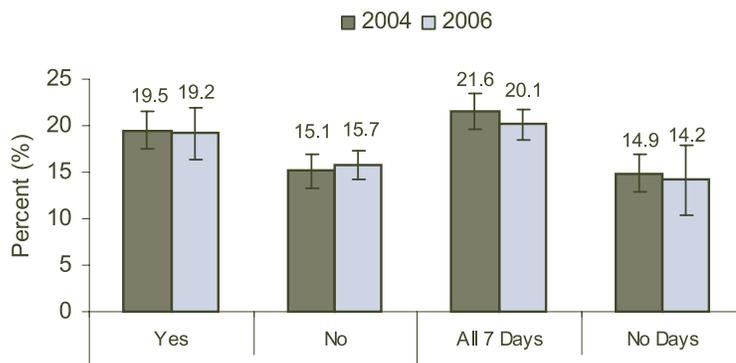
Data Source: 2005 Youth Risk Behavioral Survey, Wisconsin Department of Public Instruction

Exposure to Secondhand Smoke Among Public Middle and High School Students

Exposure to environmental tobacco smoke has been known to be associated with adverse asthma-related health outcomes (Weisel, 2002). Information regarding exposure to environmental tobacco smoke among public middle and high school students is available from the YTS.

Data from 2004 and 2006 indicate that public middle and high school students who reported living with a smoker also reported a higher lifetime prevalence of asthma than those who indicated that they did not live with a smoker (Figure 17). Additionally, students who reported spending time during all of the last seven days in the same room with a smoker reported a higher prevalence of asthma than those who reported spending no time in the last seven days in the same room with a smoker.

Figure 17. Lifetime Asthma Prevalence Based on Residence with Smoker and Days Spent in Same Room with Smoker, Wisconsin Public Middle and High School Students, 2005.



Data Source: 2004 and 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services



Asthma Management and Quality of Life

The goal of asthma therapy is to control and manage day and nighttime symptoms and to minimize activity limitations and asthma attacks so that individuals with asthma can maintain a healthy quality of life. In addition, effectively managing an individual's asthma will help prevent adverse clinical events such as emergency department visits, inpatient hospitalizations, and death. This section uses data from the Behavioral Risk Factor Surveillance Survey (BRFSS) and the National Survey of Children's Health (NSCH) to measure asthma control and quality of life among Wisconsin residents with asthma.

Asthma Control—Symptoms and Severity of Asthma

The National Asthma Education and Prevention Program (NAEPP) has established a core set of ten key clinical activities deemed essential for quality asthma care from physicians (CDC, 2003). They include activities relating to four essential components of asthma management: assessment and monitoring, controlling factors contributing to asthma severity, pharmacotherapy, and education for partnership in care (Table 4). Each component of care is expressed in terms of several key activities.

Table 4. National Asthma Education and Prevention Program Recommended Key Clinical Activities for Quality Asthma Care.

Component of Care	Key Clinical Activities
Assessment and Monitoring	<ul style="list-style-type: none"> -Establish asthma diagnosis -Classify severity of asthma -Schedule routine follow-up care -Assess for referral to specialty care
Control of Factors Contributing to Asthma Severity	<ul style="list-style-type: none"> -Recommend measures to control asthma triggers -Treat or prevent comorbid conditions
Pharmacotherapy	<ul style="list-style-type: none"> -Prescribe medications according to severity -Monitor use of β2-agonist drugs
Education for Partnership in Care	<ul style="list-style-type: none"> -Develop a written asthma management plan -Provide routine education on patient self-management

Data Source: National Asthma Education and Prevention Program Key Clinical Activities for Quality Asthma Care, 2003 (http://www.guideline.gov/summary/summary.aspx?doc_id=3734)

Because individuals with asthma have varying degrees of severity and symptoms, it is important to have an asthma classification system and recommendations for treatment. To assess and monitor asthma, NAEPP recommends establishing a diagnosis and classifying severity according to the NAEPP's Guidelines for the Diagnosis and Management of Asthma (NHLBI, 1997 and 2002). These guidelines use symptoms and lung function to classify an individual's asthma severity prior to beginning pharmaceutical treatment. An individual's severity classification determines treatment options (Table 5). These guidelines are currently under revision and will likely be published in late 2007. The revised guidelines will likely have less emphasis on classification of asthma and concentrate more on control. Future burden reports will reflect changes in the guidelines.

Table 5. National Asthma Education and Prevention Program Guidelines Stepwise Approach to Classifying and Treating Asthma in Adults and Children Older than 5 Years of Age.

Classification	Clinical Features before Treatment		
	Symptoms - Day	Lung Function: PEF or FEV ₁ PEF Variability	Daily Medications Required for Long Term Control
Step 4 – Severe Persistent	Continual	≤ 60% > 30%	Preferred treatment: – High-dose inhaled corticosteroids AND – Long-acting inhaled beta2-agonists
	Frequent		
Step 3 – Moderate Persistent	Daily	> 60% - <80% > 30%	Preferred treatment: – Low-to-medium dose inhaled corticosteroids and long-acting inhaled beta2-agonists
	>1 night/week		
Step 2 – Mild Persistent	>2 times/week, but <1time/day	≥ 80% 20-30%	Preferred treatment: – Low -dose inhaled corticosteroids
	>2 nights/month		
Step 1 – Mild Intermittent	≤2 days/week	≥ 80% < 20%	No daily medication needed
	≤2 nights/month		

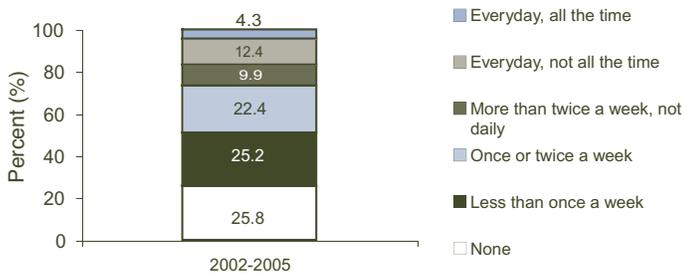
Data Source: National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma, 2002 (<http://www.nhlbi.nih.gov/guidelines/asthma/asthsumm.htm>)

*Individuals should be assigned to the most severe step in which any feature occurs.

Symptoms in Adults

The BRFSS Adult Asthma History Module provides one source of data for examining symptoms of asthma in Wisconsin adults (see Appendix F for survey questions). Only individuals who report currently having asthma are asked questions about their symptoms (see page 3 for definition of current asthma). Data from 2002 to 2005 were combined to increase the sample size and obtain more reliable estimates. Nearly 17 percent of adults with current asthma reported experiencing daily symptoms of asthma in the last 30 days (Figure 18). Using the guidelines in Table 5, about 10 percent of these adults would be classified as having mild persistent asthma and 17 percent would likely have moderate or severe persistent asthma. Note that severity level according to NAEPP guidelines is assessed prior to treatment and is therefore not strictly applicable to BRFSS survey responses. These estimates do not take into account that some respondents may be using medications to control their asthma symptoms. The classification may be higher (more severe) if it were applied before treatment.

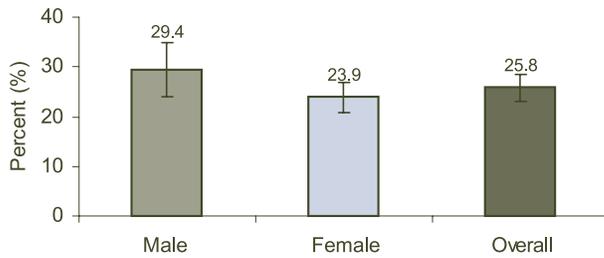
Figure 18. Frequency of Asthma Symptoms in the past 30 Days among Adults with Current Asthma, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Males with current asthma were more likely to report experiencing no symptoms of asthma in the past 30 days compared to females with current asthma. This sex difference was not statistically significant (Figure 19).

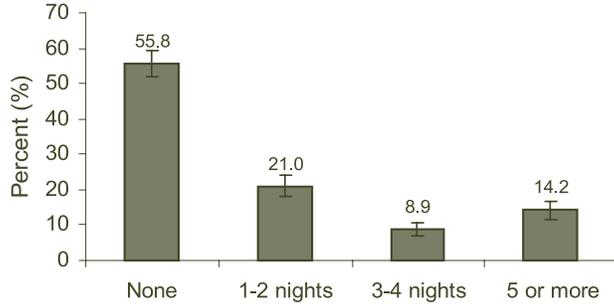
Figure 19. Percent of Adults with Current Asthma Experiencing No Symptoms in the past 30 Days by Sex, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Of those individuals with current asthma who reported experiencing asthma symptoms in the last 30 days, 44 percent reported that their asthma symptoms made it difficult to stay asleep one or more nights during the last 30 days (Figure 20). Fourteen percent reported having difficulty sleeping five or more nights in the last 30 days.

Figure 20. Number of Days had Trouble Sleeping among Adults with Asthma Symptoms in the past 30 Days, Wisconsin, 2002-2005.

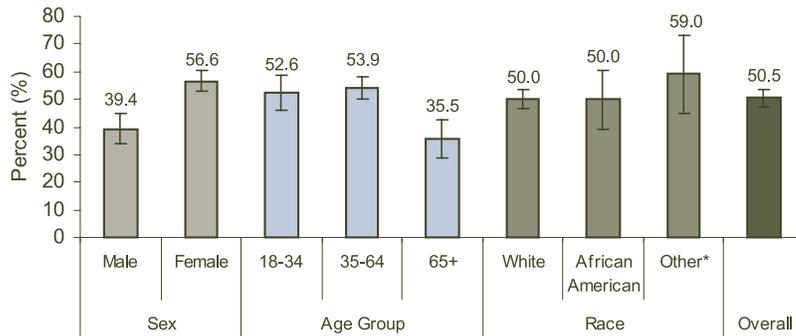


Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Asthma Attacks or Episodes in Adults

Asthma attacks (episodes) can be triggered by a broad range of allergens and irritants. Some common allergens include dust mites, pet dander and mold; irritants may include chemical vapors, tobacco smoke and air pollution. Asthma attacks can be an important indicator of asthma control and may lead to inpatient hospitalization and emergency department visits. With proper care and asthma management, asthma attacks can be limited or prevented. Data aggregated from 2002 to 2005 show that nearly 51 percent of Wisconsin adults with current asthma reported having asthma attacks during the past year (Figure 21). Adult females were significantly more likely to report experiencing asthma attacks in the past year than adult males (57 vs. 39 percent). Younger adults were also more likely to report asthma attacks than older adults (53 vs. 36 percent). There were essentially no differences in reported frequency of asthma attacks in Wisconsin adults with asthma by race.

Figure 21. Percent of Adults with Current Asthma who Experienced an Asthma Attack in the Past Year by Sex, Age Group and Race^a, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

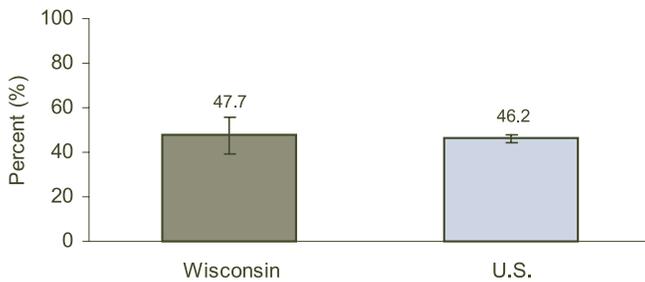
^aRace groups include both Hispanic and non-Hispanic individuals.

*The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives, multiracial respondents, and individuals that reported being of other races. These groups were combined due to low number of sampled respondents.

Asthma Attacks or Episodes in Children

According to data from the NSCH, nearly 48 percent of Wisconsin children (under 18 years of age) and 46 percent of U.S. children with current asthma reported experiencing an asthma attack in the previous year (Figure 22).

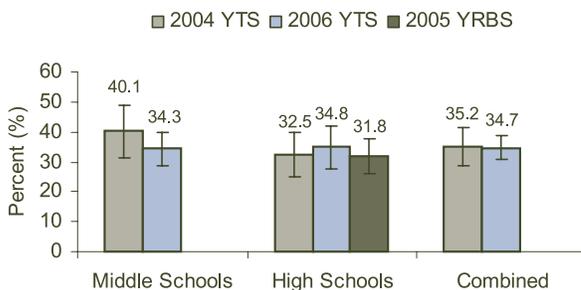
Figure 22. Percent of Children with Current Asthma who Experienced an Asthma Attack in the Past Year, Wisconsin and U.S., 2003.



Data Source: 2003 National Survey of Children’s Health, Bureau of Maternal and Child Health, U.S. Department of Health and Human Services

As previously mentioned, data on asthma attacks in public middle and high school students are available from the Youth Tobacco Survey (YTS) and the Youth Risk Behavioral Survey (YRBS). Of those respondents who reported ever being diagnosed with asthma, about 35 percent reported having experienced an asthma attack in the last year (Figure 23). The frequencies of asthma attacks among students in public middle and high schools were similar. Note that the population examined in this case is all students reporting having ever been diagnosed with asthma (lifetime asthma), not those with current asthma as described above. As such, this estimate may be slightly diluted when compared with estimates from the BRFSS or NSCH that explore asthma attacks among individuals with current asthma only.

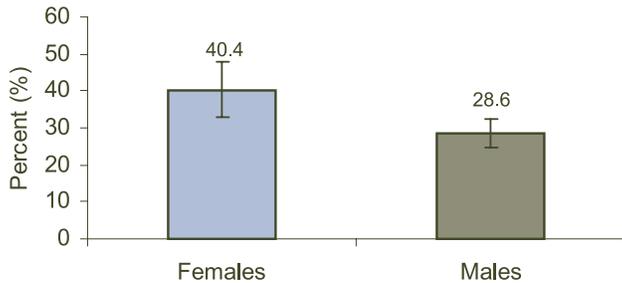
Figure 23. Percent of Public Middle and High School Students with Lifetime Asthma who Experienced an Asthma Attack in the Past Year, Wisconsin, 2004-2006.



Data Source: 2004 and 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services and 2005 Youth Risk Behavioral Survey, Wisconsin Department of Public Instruction

Public middle and high school females with asthma were slightly more likely to report having asthma attacks in the past year than their male counterparts (Figure 24). This difference was not statistically significant.

Figure 24. Percent of Public Middle and High School Students with Lifetime Asthma who Experienced an Asthma Attack in the Past Year by Sex, Wisconsin, 2006.

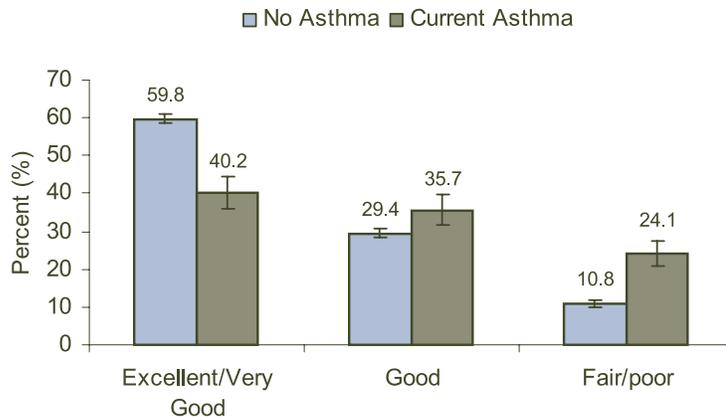


Data Source: 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services

Health-Related Quality of Life in Adults with Asthma

Questions on quality of life are increasingly used by clinicians in combination with clinical and physiologic measures to get a more complete picture of the overall health status of individuals with asthma. Combined data from the 2004 and 2005 BRFSS indicates that significantly more adults with self-reported current asthma perceive their health status as fair or poor compared to adults without asthma (Figure 25). Conversely, significantly more adults without asthma perceived their health as excellent or very good compared to adults with current asthma. A national study on the 2000 BRFSS found that U.S. adults with current asthma were more likely to report having poor or fair health than adults without asthma (Ford et al., 2003).

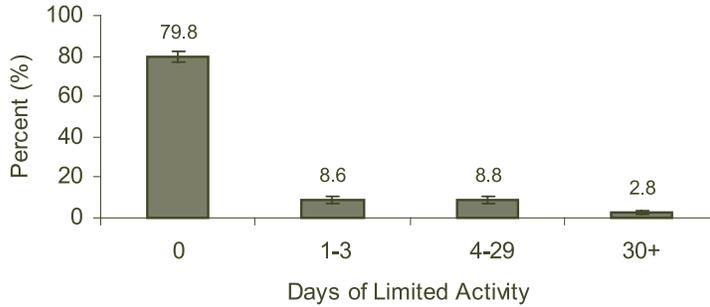
Figure 25. Perceived Health Status among Adults with Current Asthma and Adults without Asthma, Wisconsin, 2004-2005.



Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

When adults with current asthma were asked how many days in the last year they were unable to carry out their usual activities because of their asthma, 20 percent reported experiencing one or more days of limited activity (BRFSS Adults Asthma History Module, 2002-2005) (Figure 26). From 2002 to 2005 significantly more adult females with current asthma reported experiencing one or more days of limited activity in the past year than adult males with current asthma (24 vs. 14 percent) (data not shown).

Figure 26. Number of Activity Limited Days in the Past Year Due to Asthma, Wisconsin Adults with Current Asthma, 2002-2005.

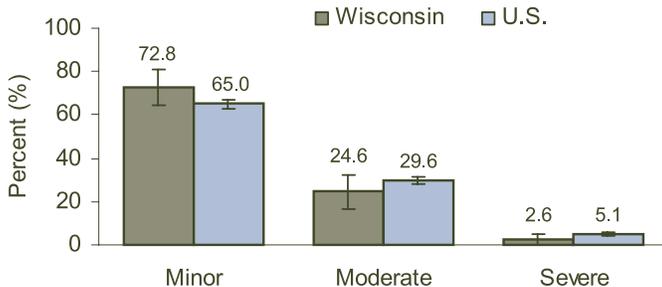


Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Health-Related Quality of Life in Children with Asthma

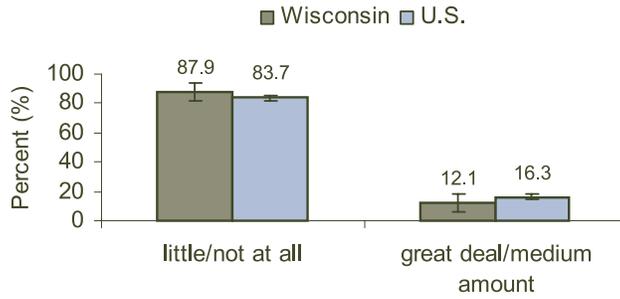
In the 2003 NSCH, caregivers of children with current asthma were asked how they would describe the health difficulties caused by their child’s asthma. Approximately 27 percent of Wisconsin caregivers compared to 35 percent of U.S. caregivers described their children’s asthma as causing moderate or severe health difficulties (Figure 27). In addition, when these same caregivers were asked how much of a burden their child’s asthma was on the family, 12 percent of Wisconsin and 16 percent of U.S. caregivers felt the asthma affected the family a great deal or medium amount (Figure 28).

Figure 27. Perceived Health Difficulties among Children with Current Asthma, Wisconsin and U.S., 2003.



Data Source: 2003 National Survey of Children’s Health, Bureau of Maternal and Child Health, Health Resources and Services Administration, U.S. Department of Health and Human Services

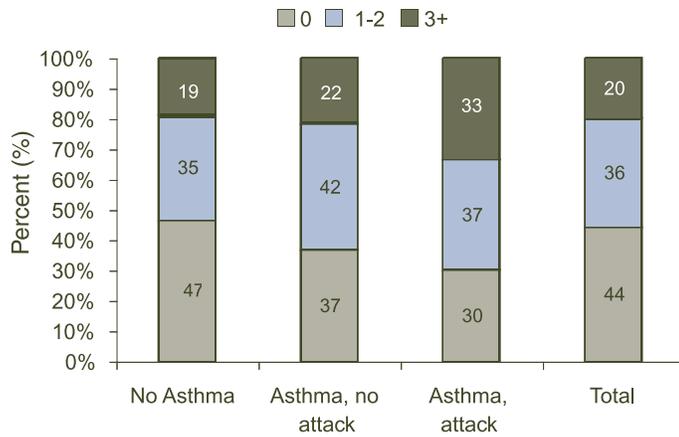
Figure 28. Perceived Family Burden among Children with Current Asthma, Wisconsin and U.S., 2003.



Data Source: 2003 National Survey of Children’s Health, Bureau of Maternal and Child Health, Health Resources and Services Administration, U.S. Department of Health and Human Services

In the 2006 Youth Tobacco Survey (YTS), public middle and high school students were asked how many days of school they missed in the last 30 days. Students who reported having been diagnosed with asthma reported missing more days of school in the last 30 days than other students. Moreover, students with asthma who also reported having asthma attacks in the last year missed more days of school than those with asthma who reported having had no attacks in the same period (Figure 29).

Figure 29. Number of Days of School Missed in the Past 30 Days by Asthma Status, Wisconsin Public Middle and High School Students, 2006.



Data Source: 2006 Youth Tobacco Survey, Bureau of Community Health Promotion, Division of Public Health, Wisconsin Department of Health and Family Services



Asthma Management in Wisconsin Schools

Asthma in school-aged children remains a public health concern in Wisconsin. Approximately 17 percent of public middle and high school children report having been diagnosed with asthma (Figure 13).

At the national level, asthma is one of the leading causes of school absenteeism; children miss an estimated 14 million days of school per year because of asthma (Mannino et al., 2002). Because children spend a significant amount of time at school, asthma control and management in the school environment can be tremendously helpful. Schools can assist by educating teachers and staff, and adopting policies and procedures to better serve students with asthma (CDC, 2004). Asthma-friendly schools will help reduce the number of missed school days and improve the learning environment for children with asthma.

Since 1999, Wisconsin has had a law ensuring that students with asthma are allowed to carry and self-administer their asthma medications in Wisconsin public schools (Burden of Asthma 2004). In 2006, this law was revised to ensure that students could carry and use asthma medications in both public and private schools. The expansion in the scope of this law is essential to ensure that all school-aged children have access to their medications when they are needed.

To help schools address asthma management, the Centers for Disease Control and Prevention (CDC) have developed a document titled “Strategies for Addressing Asthma Within a Coordinated School Health Program.” This document details six strategies that schools can consider to help students with asthma (CDC, 2004). These strategies include:

1. Establish management and support systems for asthma-friendly schools.
2. Provide appropriate school health and mental health services for students with asthma.
3. Provide asthma education and awareness programs for students and school staff.
4. Provide a safe and healthy school environment to reduce asthma triggers.
5. Provide safe, enjoyable physical education and activity opportunities for students with asthma.
6. Coordinate school, family, and community efforts to better manage asthma symptoms and reduce school absences among students with asthma.

Information to help schools measure their progress toward the implementation of these CDC strategies is available from the School Health Education Profile (SHEP). SHEP is a survey administered every two or four years by the Wisconsin Department of Public Instruction (DPI) to monitor the status of school health and physical education policies in middle and high schools. More information on SHEP is provided in Appendix A.

In 2002 and 2004, 674 of 884 randomly selected public middle and high school principals (response rate = 76 percent) completed the SHEP. They were asked to indicate if their school had implemented specific school-based asthma management activities. Results are presented in Table 6.

Table 6. Asthma Management in Wisconsin Public Middle and High Schools according to School Principals, 2002 and 2004.

	% Yes			
	Middle Schools		High Schools	
	2002	2004	2002	2004
Provide a full-time registered nurse, all day every day	13	9	22	32
Identify and track all students with asthma	84	90	84	77
Obtain and use an asthma action plan (or Individualized Health Plan) for all students with asthma	44	56	53	53
Assure immediate access to medications as prescribed by a physician and approved by parents (allow students to self-carry inhalers)	96	96	97	94
Provide intensive case management for students with asthma who are absent 10 days or more per year	33	35	34	33
Educate school staff about asthma	51	56	49	43
Educate students with asthma about asthma management	43	49	40	47
Teach asthma awareness to all students in at least one grade	27	22	31	21
Encourage full participation in physical education and physical activity when students with asthma are doing well	99	96	98	92
Provide modified physical education and physical activities as indicated by the student's Asthma Action Plan	77	83	78	85

Data Source: 2002 and 2004 School Health Education Profile, Wisconsin Department of Public Instruction

While the majority of public middle and high schools provide students immediate access to prescribed medications, only about half reported educating staff about asthma. Providing intensive case management for students with high asthma-related absence rates and working with students with asthma to obtain and use an asthma action plan are interventions that may be effective in addressing asthma in middle and high school children. These data also highlight the need for increased education among school staff and monitoring of students with asthma.



Health Care Utilization

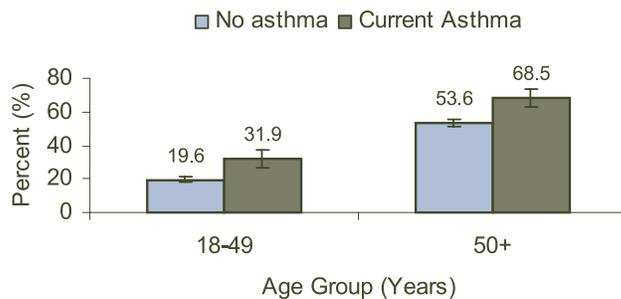
Asthma is a complex chronic disease with varying symptoms and severity that requires many levels of health care. This section will examine the various aspects of health care utilization for individuals with asthma, and includes data on flu shots, use of asthma management plans, physician office visits, urgent care visits, pharmaceutical usage, inpatient hospitalizations and emergency department visits.

Flu Shots among Adults with Asthma

The Centers for Disease Control and Prevention (CDC) recommend that all individuals 50 years of age and older and individuals who are at an increased risk of complications from influenza, including those with asthma, get an annual influenza (flu) vaccination (CDC, 2006). In recognition of the importance of treating and preventing comorbid conditions, the National Asthma Education and Prevention Program (NAEPP) advise that all individuals with asthma get an annual flu vaccine (Table 4) (CDC, 2003).

Data from the combined 2004 and 2005 BRFSS indicate that 32 percent of adults 18 to 49 years of age with current asthma had a flu vaccine in the last year. This is significantly higher than among adults of the same age without asthma (Figure 30). Adults 50 years of age and older with current asthma were significantly more likely than younger adults and older adults without asthma to report having received a flu vaccine.

Figure 30. Flu Vaccine among Wisconsin Adults with Current Asthma by Age Group, 2004-2005.

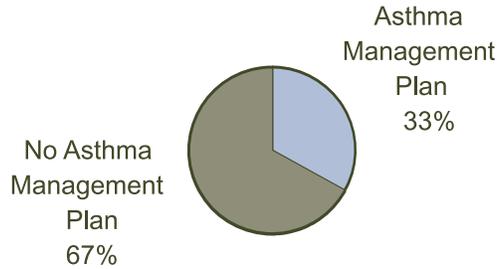


Data Source: 2004-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Asthma Management Plans in Adults with Asthma

An asthma management plan is a guide of recommendations for patients and providers in treating and controlling an individual's asthma. These plans include instructions on recognizing signs and symptoms of worsening asthma, identifying triggers, medication management, and advice on when to seek medical care (CDC, 2003). In the 2005 BRFSS, adults with current asthma were asked if they had ever been given an asthma management plan by their doctor or other health care provider. Only 33 percent of respondents indicated they had received an asthma management plan (Figure 31).

Figure 31. Asthma Management Plans in Adults with Current Asthma, Wisconsin, 2005.



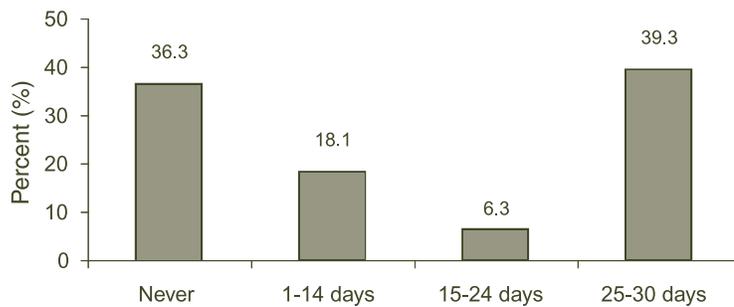
Data Source: 2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Medication Usage among Adults with Asthma

In their “Stepwise Approach to Classifying and Treating Asthma in Adults,” the NAEPP recommends treating asthma with medications for all severity levels of asthma except “mild intermittent asthma,” the mildest form of the disease (NHLBI, 2002). All individuals with persistent asthma should be prescribed daily long-term controller medications, such as inhaled corticosteroids, to prevent or limit asthma symptoms or attacks.

In the 2005 BRFSS, adults with current asthma were asked to report how many days in the last 30 days they took medication to prevent an asthma attack from occurring. In the survey, 39 percent reported taking medication between 25 to 30 days during the preceding 30-day interval (Figure 32). Thirty-six percent reported never taking medication over the same period, and about 24 percent reporting taking medication to prevent asthma attacks between one to 24 days during the last 30-day interval. Because no information about the severity of asthma is available to accompany this question, these data should be interpreted with some degree of caution. Some individuals may have mild asthma and may not require the use of controller medications.

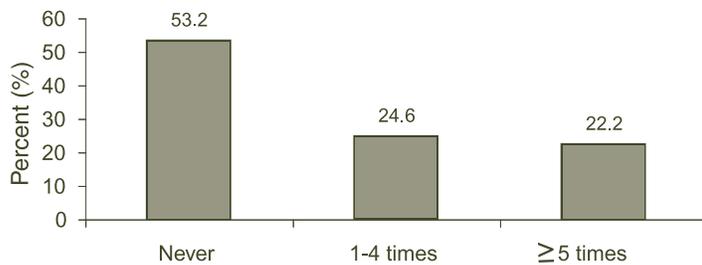
Figure 32. Frequency of Asthma Medication Usage in the Past 30 Days to Prevent Asthma Attacks among Adults with Current Asthma, Wisconsin, 2005.



Data Source: 2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

The NAEPP recommends that physicians monitor the use of quick relief medications (such as β 2-agonists) at every visit with their asthma patients. Frequent use of quick relief medications during asthma attacks is an indication that a patient’s asthma may be poorly controlled. In the BRFSS, adults with current asthma were asked how many times during the past 30 days they used a prescription asthma inhaler to stop an asthma attack. Twenty-two percent of adults with current asthma reported using their quick relief inhalers five or more times to stop an asthma attack in the last 30 days. Twenty-five percent reported using their quick relief inhalers one to four times during that interval, and the remaining 53 percent of adults with current asthma reported no use of quick relief medication in the past 30 days (Figure 33). No information about asthma severity in these respondents was available.

Figure 33. Frequency of Asthma Medication Usage in the Past 30 Days to Stop an Asthma Attack among Adults with Current Asthma, Wisconsin, 2005.



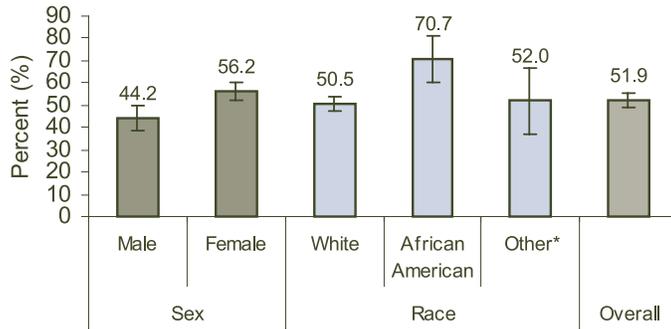
Data Source: 2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Asthma Office Visits among Adults with Asthma

Establishing routine health care visits with a medical provider is an essential part of asthma management. In their “Key Clinical Activities for Quality Asthma Care,” the NAEPP recommends that individuals with asthma be seen every one to six months for follow-up care depending on the severity of their asthma (CDC, 2003).

In the BRFSS from 2002 through 2005, adults with current asthma were asked, “During the past 12 months how many times have you seen a doctor, nurse or other health professional for a routine checkup for your asthma?” Overall, 52 percent reported having a routine visit for their asthma (Figure 34). Adult females with current asthma were significantly more likely to report having a routine health care visit for asthma in the last year than adult males with current asthma. Adult African Americans with current asthma were more likely to report routine health care visits for asthma in the past year than their white counterparts.

Figure 34. Routine Health Care Visits for Asthma in the Past Year among Adults with Current Asthma by Sex and Race^a, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

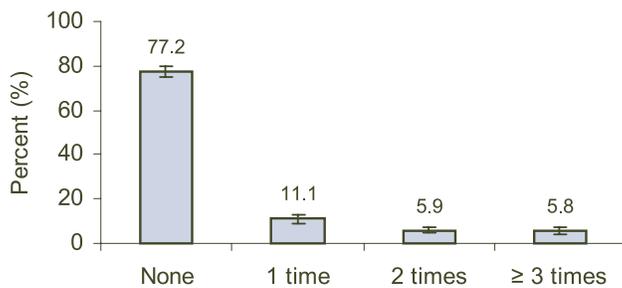
^aRace groups include both Hispanic and non-Hispanic individuals.

*The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives, multiracial respondents, and individuals that reported being of other races. These groups were combined due to low number of sampled respondents.

Asthma Urgent Care Visits among Adults with Asthma

In the BRFSS from 2002 through 2005, adults with current asthma were asked, “During the last 12 months, how many times did you see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms?” Seventy-seven percent reported having no urgent care visits for asthma (Figure 35). Eleven percent of adults with current asthma reported having one urgent care visit in the last year, while 12 percent reported two or more such visits.

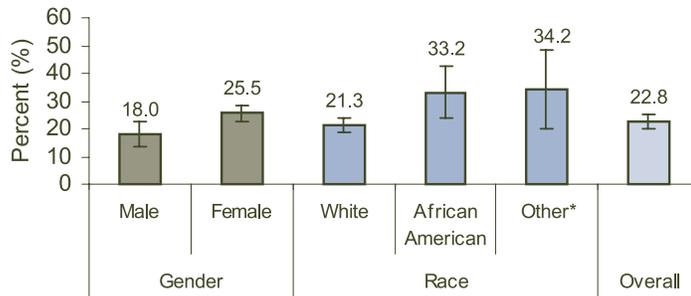
Figure 35. Urgent Health Care Visits for Asthma in the Past Year among Adults with Current Asthma, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Similar to routine health care visits for asthma, adult females with current asthma were more likely to report having any urgent care visits for asthma in the past year than adult males with current asthma (Figure 36). In addition, African Americans adults with current asthma were more likely to report having urgent care visits for asthma than white adults with current asthma. These results were not significant.

Figure 36. Urgent Health Care Visits for Asthma in the Past Year among Adults with Current Asthma by Sex and Race^a, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

^aRace groups include both Hispanic and non-Hispanic individuals.

*The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives, multiracial respondents, and individuals that reported being of other races. These groups were combined due to low number of sampled respondents.

Inpatient Hospitalizations

With proper treatment, symptom management and avoidance of triggers, most hospitalizations from asthma can be prevented. Asthma hospitalizations are an important surveillance endpoint because they help identify populations where prevention efforts can best be directed. Examination of hospitalization rates can also provide a useful estimate of the direct medical costs associated with poorly-managed asthma.

The National Hospital Discharge Survey estimated that there were 497,000 hospitalizations among U.S. residents (17 per 10,000 population) in 2004 for which asthma was the primary cause (DeFrances and Podgornik, 2006). The average length of stay for these hospitalizations was 3.2 days. Approximately 38 percent (190,000) of these hospitalizations were among individuals under 15 years of age. Inpatient hospitalizations due to asthma cost an estimated \$2.7 billion dollars in the United States in 2004 (NHLBI, 2004). Costs could be reduced and patients' health and quality of life improved through the use of clinic-based education, in-home education and environmental interventions (Hoppin et al., 2007). This section examines hospitalizations from asthma in Wisconsin from 1990 to 2005.

All of Wisconsin's acute care, non-federal hospitals are required to report hospital discharges to the state according to Chapter 153, Wisconsin Statutes. Though these data are collected for billing purposes, they include valuable surveillance information. Information on demographics, diagnosis, cost and payors are available in the dataset. Calculations of hospitalization counts and rates are based on the number of hospitalizations, not on the number of individuals represented in the database. An individual may have more than one hospitalization within a reporting period; therefore, the number of individuals with asthma hospitalizations cannot be directly captured in these calculations. In addition, data are based on individuals residing in Wisconsin who were seen at a Wisconsin hospital with a diagnosis of asthma (ICD-9CM codes 493.00 – 493.92). Individuals residing in another state who were seen at a Wisconsin hospital for asthma were excluded, as were Wisconsin residents receiving care in out-of-state hospitals. Therefore, rates are probably a slight underestimation of total asthma hospitalizations among Wisconsin residents.

Two types of diagnosis codes are given in hospital discharge records: principal diagnosis and underlying diagnosis. Principal diagnosis refers to the primary reason for which the patient was hospitalized. In addition, notations may be included for up to eight underlying diagnoses, which refer to related conditions which may have contributed to the patient's hospitalization. Most rates given in this section are based on asthma as the principal diagnosis. Deviations from this standard are appropriately noted.

In 2005 there were a total of 5,541 hospitalizations in Wisconsin for which asthma was the principal diagnosis (Table 7). Data on average length of stay, average charge per hospitalization and total charges by sex, race/ethnicity and age group are also illustrated in Table 7. Hospitalizations due to asthma appear to occur more frequently among females and require a longer average stay than those for males. Because of the increased number of female hospitalizations for asthma and longer length of stay, total hospital charges for asthma are almost two times greater for females compared to males. Over the last 15 years, the average length of stay for an asthma hospitalization has decreased from 3.8 days in 1990 (Burden of Asthma 2004) to 2.9 days in 2005.

The total direct cost associated with hospitalizations in 2005 for which asthma was the principal diagnosis was nearly \$46 million. The most common primary payor for the charges associated with individual hospitalizations was commercial insurance (Figure 37). When combined, Medicare and Medicaid were the primary payor for over 50 percent of asthma hospitalizations.

Table 7. Number of Asthma Hospitalizations*, Average Length of Stay (LOS), Average Charge per Asthma Hospitalization, and Total Asthma Hospitalization Charges by Sex, Race, Ethnicity and Age, Wisconsin Residents, 2005.

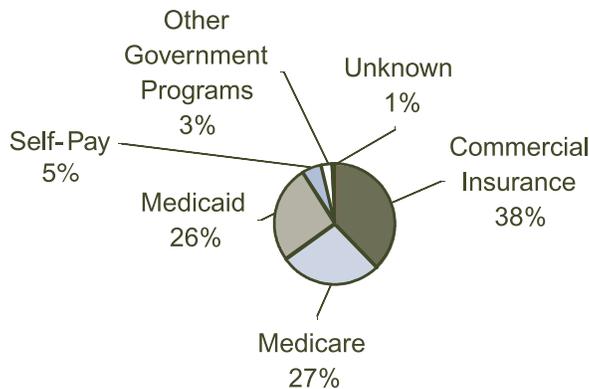
	Hospitalizations (#)	Average LOS (days)	Average Charge per Hospitalization (\$)	Total Hospitalization Charges (\$)
Gender				
Male	2,267	2.47	7,070	16,027,923
Female	3,274	3.25	9,069	29,691,491
Race**				
White	3,555	3.11	8,279	29,432,507
African American	1,244	2.63	8,997	11,192,869
Native American	61	2.28	5,631	343,491
Asian	43	3.23	8,799	378,350
Other	296	2.25	7,092	2,099,243
Ethnicity				
Hispanic	204	2.75	8,360	1,705,492
Non-Hispanic	4,902	2.97	8,373	41,045,392
Age (years)				
0-4	1,007	1.87	4,626	4,658,495
5-14	725	1.9	5,515	3,998,215
15-34	642	2.49	7,142	4,584,866
35-64	2,013	3.28	9,712	19,549,577
65+	1,154	4.14	11,203	12,928,261
Overall Wisconsin Population	5,541	2.93	8251	45,719,414

*Asthma listed as the principal diagnosis (ICD-9-CM 493.00 – 493.92)

**Race groups include both Hispanic and non-Hispanic individuals

Data Source: 2005 Inpatient hospitalization discharge file, Wisconsin Hospital Association Information Center, Inc.

Figure 37. Distribution of the Primary Payor for Asthma Hospitalizations*, Wisconsin Residents, 2005.

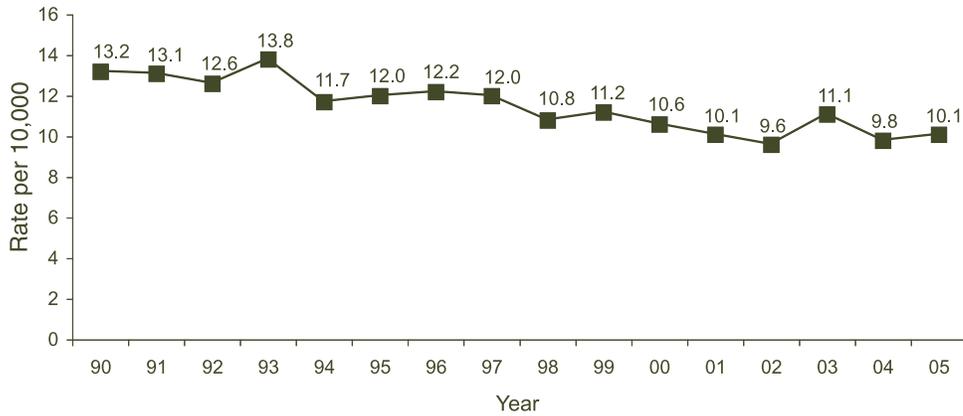


*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 - 493.92)

Data Source: 2005 Inpatient hospitalization discharge file, Wisconsin Hospital Association Information Center, Inc.

Figure 38 illustrates the age-adjusted hospitalization rate for asthma as the principal diagnosis from 1990 to 2005. Rates are adjusted to the 2000 United States population to remove differences in the age distribution over time. This allows for direct comparison of the change in rates over time by controlling for the fluctuations in the age distribution of the population. Over the last 15 years, the rate of asthma hospitalizations has slowly decreased, leveling off at around 10 hospitalizations per 10,000. Asthma hospitalization rates from 2000-2004 in Wisconsin remain below national rates (Figure 39).

Figure 38. Age-Adjusted* Asthma Hospitalization Rates per 10,000, Wisconsin Residents, 1990-2005.**

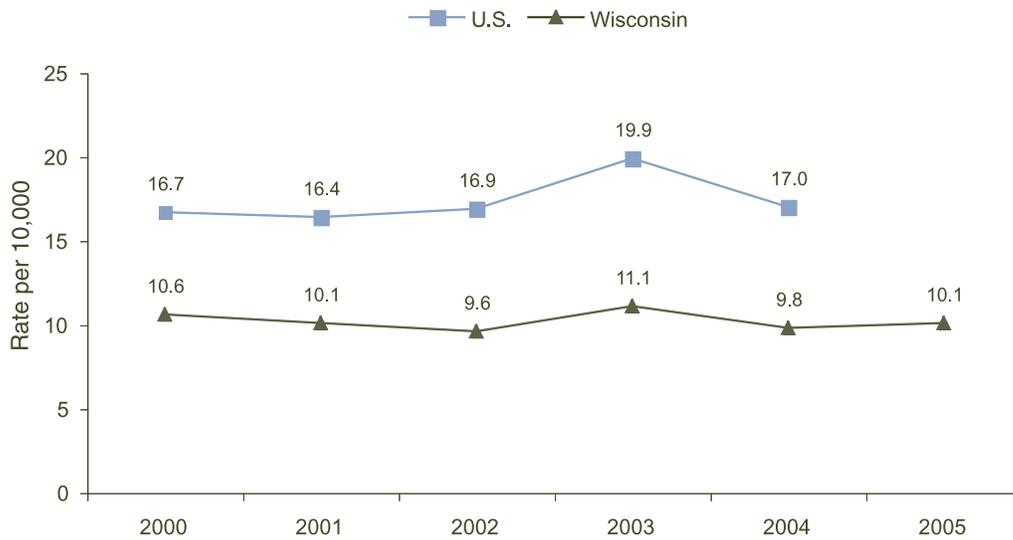


*Age-adjusted to the year 2000 US standard population.

**Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Figure 39. Age-Adjusted* Asthma Hospitalization Rates per 10,000, Wisconsin (2000-2005) and the United States (2000-2004).**



*Age-adjusted to the year 2000 US standard population.

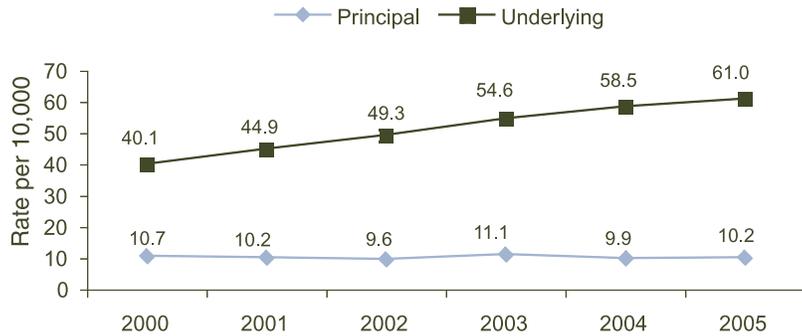
**Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

2000-2004 National Hospital Discharge Survey, Centers for Disease Control and Prevention

While asthma hospitalization rates for asthma as the principal diagnosis have been steadily decreasing, rates for asthma as an underlying diagnosis have been steadily increasing from 2000 to 2005 (Figure 40). Reasons for this increase are unknown, but may be due to an increase in prevalence, changes in billing or coding, or other factors. The most common principal diagnosis when asthma was an underlying diagnosis in 2005 was pneumonia. This indicates a reason for pneumonia vaccination in those with asthma.

Figure 40. Age-Adjusted* Asthma Hospitalization Rates per 10,000 by Principal and Underlying Diagnosis, Wisconsin Residents, 2000-2005.**



*Age-adjusted to the year 2000 US standard population.

**ICD-9-CM codes 493.00 – 493.92

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Among age groups, children aged 0-4 years had the highest asthma hospitalization rate (29.9 per 10,000) from 2000-2005 (Table 8). There has been a general decline in hospitalizations among this age group from 43.4 to 29.6 per 10,000 from 1990 to 2005 (Burden of Asthma 2004). Across the United States, children 0-4 have exhibited the highest rates of asthma hospitalizations (Akinbami, 2006).

Table 8. Annual and Average (2000-2005) Age-Specific Asthma* Hospitalization Rates ** and Overall Age-Adjusted Asthma Hospitalization Rates*, Wisconsin, 2000-2005.**

Age Group (Years)	2000	2001	2002	2003	2004	2005	Average
0-4	31.6	29.2	28.0	32.0	28.9	29.6	29.9
5-14	13.1	9.6	8.8	10.4	8.6	10.2	10.1
15-34	6.2	5.6	4.9	5.7	4.6	4.2	5.2
35-64	8.4	9.1	8.7	9.9	9.1	9.0	9.0
65+	13.0	13.5	13.6	16.3	14.8	16.0	14.5
Overall***	10.7	10.2	9.6	11.1	9.9	10.2	10.3

*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

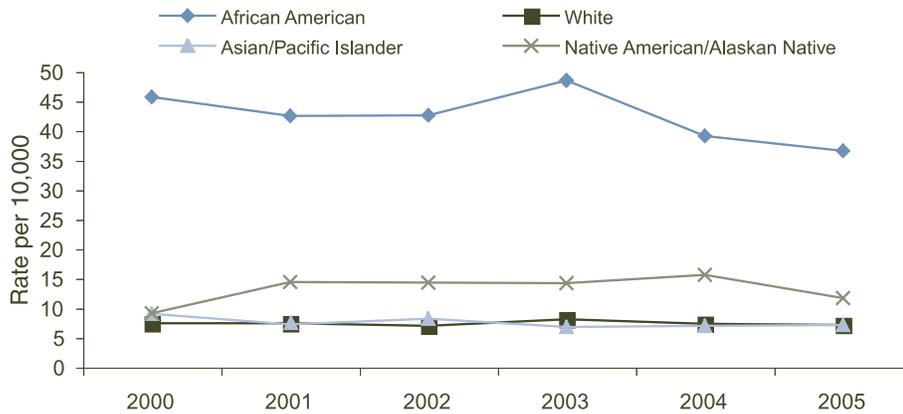
**All rates are per 10,000 population

*** Standard 2000 US population used for direct age-adjustment

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Across racial groups, asthma hospitalization rates in Wisconsin are nearly six times higher in African Americans than whites (Figure 41; Table 9). The higher hospitalization rate in African Americans may be partly due to the higher prevalence rate in this population (almost twice the prevalence than whites, Figure 4). From 1991 to 2005, asthma hospitalization rates among African Americans have dropped from a high of 55.8 per 10,000 in 1993 to a low of 36.6 per 10,000 in 2005 (Burden of Asthma 2004). Asthma hospitalization rates among Native Americans and Alaskan Natives remains slightly higher than rates among whites. Wisconsin females consistently have a slightly higher asthma hospitalization rate than males. Nationally, African Americans have higher asthma hospitalization rates than whites, and women have higher asthma hospitalization rates than males (Mannino et al., 2002).

Figure 41. Age-Adjusted Asthma* Hospitalization Rates ** by Race^a and Year, Wisconsin, 2000-2005.



*Age-adjusted to the year 2000 US standard population.

**Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

^aRace groups include both Hispanic and Non-Hispanic individuals

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Table 9. Annual and Average (2000-2005) Age-Adjusted Asthma* Hospitalization Rates ** by Sex, Race^a, and Ethnicity, Wisconsin, 2000-2005.

Sex	2000	2001	2002	2003	2004	2005	Average
Female	12.2	11.8	11.2	13.0	11.5	11.5	11.9
Male	8.9	8.4	7.9	9.1	8.1	8.7	8.5
Race^a							
White	7.4	7.4	7.0	8.1	7.3	7.1	7.4
African American	45.7	42.5	42.6	48.5	39.1	36.6	42.4
Asian/Pacific Islander	9.0	7.2	8.2	6.8	7.0	7.1	7.5
Native American/Alaskan Native	9.1	14.4	14.3	14.2	15.6	11.7	13.3
Ethnicity							
Hispanic	9.3	9.7	11.5	13.0	11.5	11.6	11.2
Non-Hispanic	10.0	9.6	9.4	10.8	9.6	9.4	9.8
Overall	10.7	10.2	9.6	11.1	9.9	10.2	10.3

*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

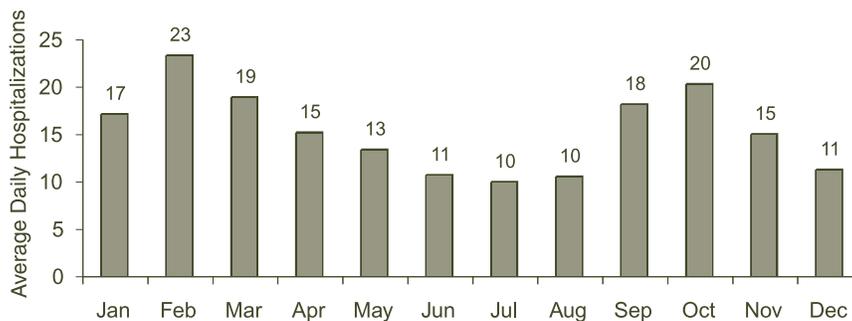
**All rates are per 10,000 population, standard 2000 US population used for direct age-adjustment

^aRace groups include both Hispanic and Non-Hispanic individuals

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

In Wisconsin asthma admissions are usually highest in early spring and early fall (Figure 42). Factors thought to contribute to these seasonal peaks include increased infections and high pollen and/or fungal counts.

Figure 42. Average Daily Asthma Hospitalizations* among Wisconsin Residents by Month of Admission, 2005.



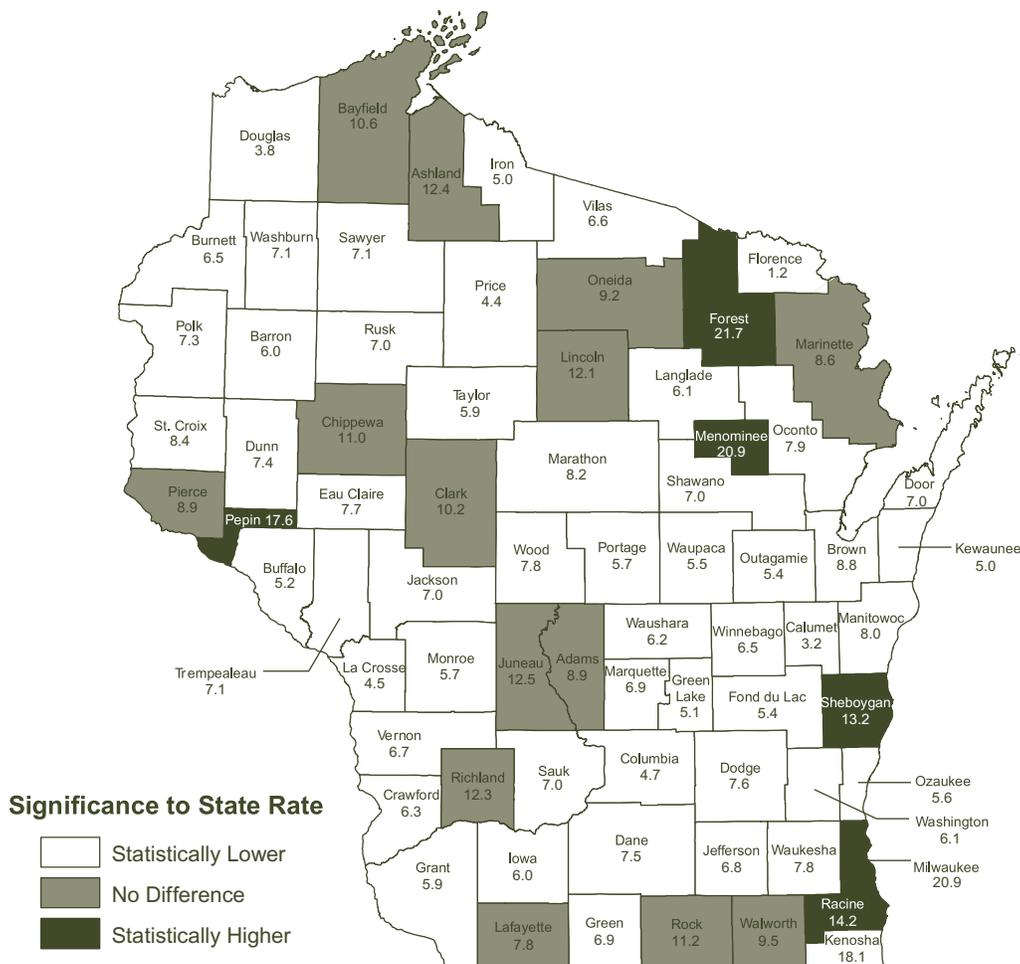
*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: 2005 Inpatient hospitalization discharge file, Wisconsin Hospital Association Information Center, Inc.

Age-adjusted asthma hospitalization rates from 2003-2005 by county are provided in Appendix C. The Wisconsin overall asthma hospitalization rate from 2003-2005 was 10.4 per 10,000 population, similar to the rate from 2000-2002 of 10.1 per 10,000 population (Burden of Asthma 2004). Figure 43 depicts asthma hospitalization rates by county according to their statistical relationship to the overall state rate of 10.4 per 10,000 population. Forest (21.7), Milwaukee (20.9), and Menominee (20.9) Counties experienced the highest county-specific rates of asthma hospitalizations per 10,000 population in Wisconsin from 2003-2005 (Appendix C).

Figure 43. Age-Adjusted* Asthma Hospitalization Rates per 10,000 by County and Comparison to the Overall State Rate, 2003-2005.**

Overall State Rate: 10.4 per 10,000 Population



*Age-adjusted to the year 2000 US standard population.

**Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Emergency Department Visits

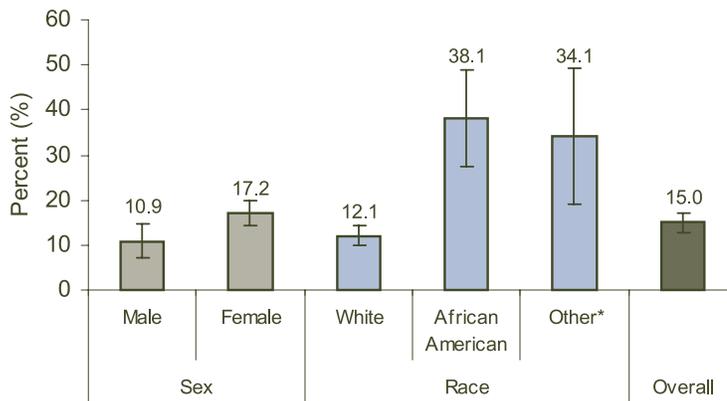
Like hospitalizations, emergency department (ED) visits for asthma provide an important public health surveillance endpoint. ED visits can be used to determine the severity of asthma in specific populations and geographic areas, which can be used to help direct prevention and intervention efforts. ED visits are mostly preventable with routine health care visits to primary care providers or asthma specialists, use of proper medication and trigger recognition and reduction.

Asthma is one of the leading causes for ED visits, accounting for approximately 1.8 million of the nearly 110 million ED visits in the United States in 2004 (DeFrances and Podgornik, 2006). This is a rate of 63 ED visits per 10,000 individuals. This section examines asthma ED visits in Wisconsin from 2002 through 2005.

Behavioral Risk Factor Surveillance Survey Emergency Department Visits

Data from the 2002 through 2005 Behavioral Risk Factor Surveillance System (BRFSS) adult asthma history module indicates that 15 percent of Wisconsin adults with current asthma reported having one or more asthma-related ED visits in the past year (Figure 44). Adult females with current asthma report more asthma-related ED visits than their male counterparts (not significant). In addition, Wisconsin adult African Americans with current asthma report a significantly higher frequency of ED visits than white adults (38.1 percent vs. 12.1 percent).

Figure 44. Asthma-Related Emergency Department Visits in the Past Year among Adults with Current Asthma by Sex, Race* and Overall, Wisconsin, 2002-2005.



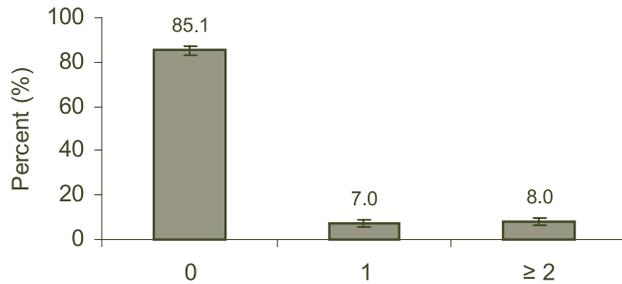
Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

*Race groups include both Hispanic and non-Hispanic individuals.

*The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives, multiracial respondents, and individuals that reported being of other races. These groups were combined due to low number of sampled respondents.

Seven percent of Wisconsin adults with current asthma reported having one ED visit in the last year while 8 percent reported having two or more ED visits for asthma in the past year (Figure 45).

Figure 45. Number of Asthma-Related Emergency Department Visits in the Past Year among Adults with Current Asthma, Wisconsin, 2002-2005.



Data Source: 2002-2005 Wisconsin Behavioral Risk Factor Surveillance System, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Hospital Emergency Department Visits

Chapter 153 of Wisconsin Statutes requires all acute care, non-federal hospitals to report hospital ED visits. Data on ED visits have been collected for billing purposes since 2002, and include demographic, diagnosis, charge and payor information. The data collected do not contain any identifying information; therefore, counts and rates are based on the number of ED visits rather than on the number of individuals seen in the ED for asthma. Asthma cases were defined based on ICD-9CM codes 493.00 – 493.92 for individuals residing in Wisconsin. Visits by individuals who were residents of another state were excluded, as were events in which Wisconsin residents received emergency medical care in out-of-state facilities.

Hospitals are not required to provide data on race and ethnicity in ED records; therefore, rates for racial and ethnic groups were not calculated. The cause for an ED visit is coded as either the principal (main condition) or underlying (secondary condition) diagnosis. Most rates given here are based on asthma as the principal diagnosis, and any deviations are appropriately noted.

In 2005, there were 22,115 ED visits among Wisconsin residents for which asthma was the principal diagnosis (Table 10). Wisconsin females had approximately 2,000 more visits than males. The average cost of an asthma ED visit in 2005 was \$773. The cumulative cost for asthma-related ED visits in Wisconsin for 2005 was over \$17 million.

Table 10. Number of Asthma Emergency Department (ED) Visits*, Average Charge per Asthma ED visit, and Total Asthma ED Visit Charges by Sex, Age and Primary Payor Group Wisconsin Residents, 2005.

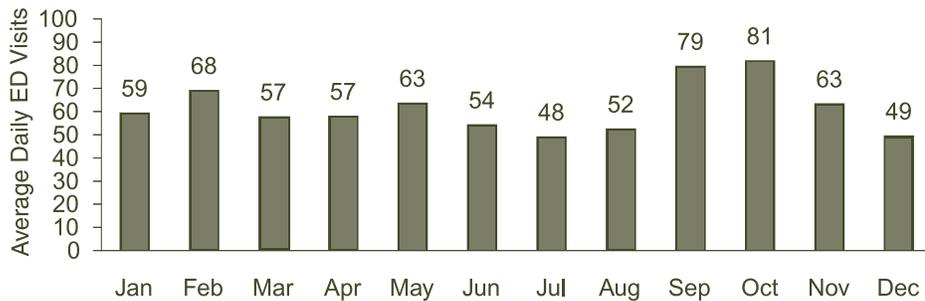
	ED Visits (#)	Average Charge per ED Visit (\$)	Total ED Charges (\$)
Sex			
Male	10,045	725	7,285,502
Female	12,070	813	9,807,510
Age (years)			
0-4	3,184	519	1,653,318
5-14	3,787	555	2,103,420
15-34	7,368	712	5,245,537
35-64	6,623	996	6,598,027
65+	1,153	1,295	1,492,710
Primary Payor Group			
Private/Self Pay	10,494	839	8,803,291
Medicare, Medical Assistance, BadgerCare, other Government Programs	11,486	713	8,187,295
Other/Unknown	135	759	102,426
Overall Wisconsin Population	22,115	773	17,093,012

*Asthma listed as the principal diagnosis (ICD-9-CM 493.00 – 493.92)

Data Source: 2005 Emergency department visit discharge file, Wisconsin Hospital Association Information Center, Inc.

Like inpatient asthma hospitalizations, ED visits for asthma are usually highest in early spring and early fall in Wisconsin (Figure 46).

Figure 46. Average Daily Asthma Emergency Department Visits* among Wisconsin Residents by Month of Visit, 2005.

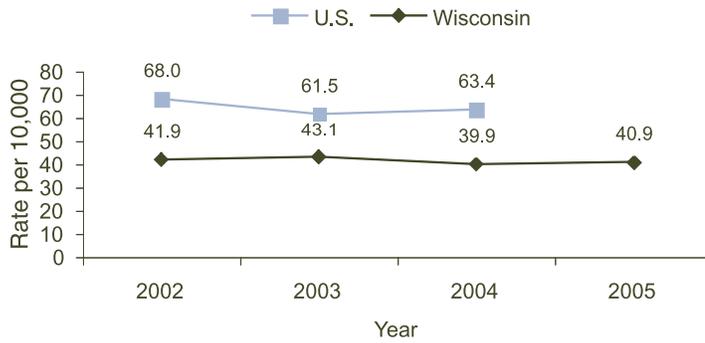


*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: 2005 Emergency department visit discharge file, Wisconsin Hospital Association Information Center, Inc.

Since Wisconsin began surveillance for ED visits in 2002, asthma-related ED rates have remained fairly constant (Figure 47) at approximately 40 visits per 10,000 individuals per year. Wisconsin's ED visit rates have been substantially lower than national ED rates for asthma in every year from 2002 to 2004.

Figure 47. Age-Adjusted* Asthma Emergency Department Visit Rates per 10,000, Wisconsin (2002-2005) and the United States (2002-2004).**



*Age-adjusted to the year 2000 US standard population.

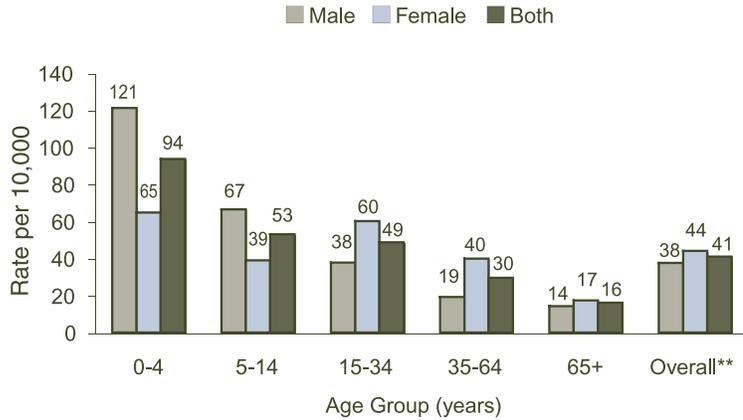
**Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Emergency department visit discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

2002-2004 National Hospital Discharge Survey, Centers for Disease Control and Prevention

Wisconsin children ages 0-4 have the highest asthma ED visit rates at 94 visits per 10,000 (Figure 48). ED rates from asthma are lower for older age groups, with adults 65 years of age and older having the lowest rates (16 per 10,000). Younger males have higher asthma ED rates than younger females. This trend reverses in adulthood with adult females having higher asthma ED rates than adult males.

Figure 48. Asthma* Emergency Department Visit Rates per 10,000 by Age and Sex, Wisconsin, 2005.



*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

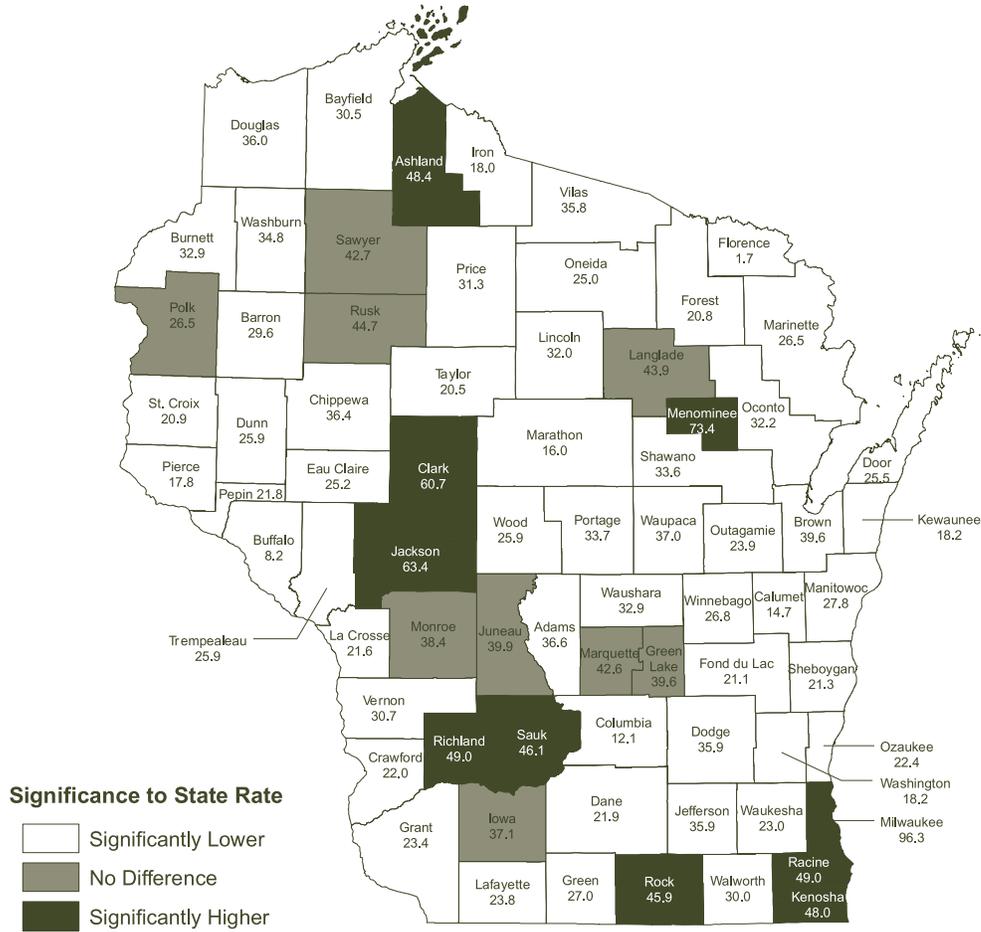
**Age-adjusted to the year 2000 US standard population.

Data Source: 2005 Emergency department visit discharge file, Wisconsin Hospital Association Information Center, Inc.

Age-adjusted asthma ED visit rates from 2003-2005 indicate that Milwaukee County and Menominee County have the highest rates in the state, at 96.3 and 73.4 per 10,000 population, respectively. The overall state rate during the same time period was 41.3 per 10,000 population. Age-adjusted asthma ED rates by county with rankings can be found in Appendix C. Figure 49 displays asthma ED rates by county and depicts their statistical relationship to the overall state rate from 2003-2005.

Figure 49. Age-Adjusted* Asthma Emergency Department Visit Rates per 10,000 by County and Comparison to the Overall State Rate, 2003-2005.**

Overall State Rate: 41.3 per 10,000 Population



*Age-adjusted to the year 2000 US standard population.

**Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Emergency department visit discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

The Medicaid Population

Medicaid is a federal and state-sponsored program designed to provide health care and health-related services for people with disabilities, people 65 years and older, children and their caretakers, and pregnant women below a specified state threshold for income (Wisconsin Medicaid web site, accessed July 2006). The Department of Health and Family Services (DHFS) oversees the Medicaid program in Wisconsin. Because Medicaid pays for health-related office visits, procedures, inpatient hospitalizations, emergency care and prescriptions, detailed information for many of the variables in the Medicaid population is available to DHFS staff.

At the end of 2005, there were approximately 827,000 individuals in Wisconsin covered by Medicaid, or about 15 percent of the state population. Forty-five percent of eligible Medicaid clients were children ages 0-17 in low-income families (Medicaid Overview, 2006). Due to the nature of the income and age requirements for Medicaid eligibility, individuals on Medicaid may represent a population that is particularly susceptible to asthma. As previously seen in Figure 7 current asthma rates are higher among adults with the lowest household incomes. In addition, children have been found to have the highest hospitalization and ED rates for asthma (see Table 8 and Figure 48). This section will utilize Medicaid data to better understand asthma-related health care utilization in Wisconsin from 2003 to 2005. As the Medicaid population represents a small specialized (younger and lower income) fraction of the Wisconsin population defined by eligibility requirements, results are not applicable to the general population of Wisconsin.

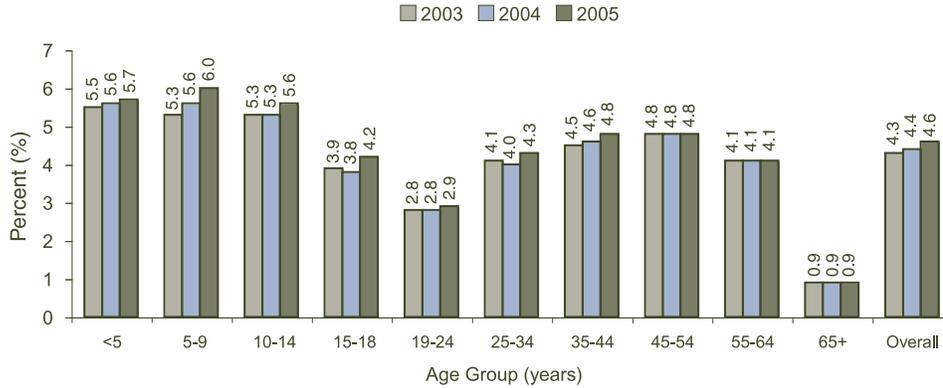
For this analysis, data from both fee-for-service (FFS) claims and managed care encounters were analyzed. It is important to note that data from Medicaid are based on billed claims, and therefore only represent services and prescriptions that were billed to Medicaid. Information on unfilled prescriptions or test results is not available in the claims data.

Ambulatory Care Visits

Ambulatory care consists of health care that is provided on an outpatient basis, including services such as diagnosis, treatment and rehabilitation. For asthma, the National Asthma Education and Prevention Program (NAEPP) recommend routine physician office follow-up care every one to six months, depending on the severity of an individual's asthma (CDC, 2003). These appointments are necessary to monitor medication regimens, assess asthma control and review management plans. For this analysis, an asthma visit was defined by ICD-9 codes 493 as either the primary or secondary diagnosis.

An average of 4.4 percent of Medicaid recipients from 2003 to 2005 had an ambulatory care visit for asthma (Figure 50). A higher percentage of Medicaid children had ambulatory care visits for asthma than adults, especially in comparison to those over 65 years of age. However, older individuals are more likely to have Medicare coverage, and details on their care may not be reported to Medicaid. There has been a steady increase in the number of Medicaid beneficiaries receiving ambulatory care visits for asthma since 2000. From 2000 to 2002, an average of 3.5 percent of Medicaid recipients had ambulatory care visits for asthma (Burden of Asthma 2004). Medicaid recipients with ambulatory care visits for asthma averaged approximately two visits for asthma during each measurement year; this did not differ greatly by age group (data not shown). Males had a slightly higher average asthma ambulatory visit rate than females (Figure 51). This is probably a reflection of the younger age composition of Medicaid beneficiaries. Male children (under 18 years of age) were previously shown to have a higher prevalence of asthma than female children (Figure 12) and should be reflected in the ambulatory care data.

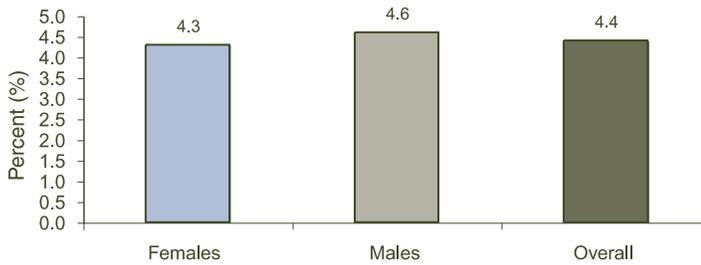
Figure 50. Percent of Medicaid Recipients with Asthma* Ambulatory Visits by Year and Age Group, Wisconsin, 2003-2005.



*Asthma listed as the primary or secondary diagnosis

Data Source: 2003-2005 Division of Health Care Financing, Wisconsin Department of Health and Family Services

Figure 51. Percent of Medicaid Recipients with Asthma* Ambulatory Visits by Sex, Wisconsin, 2003-2005.

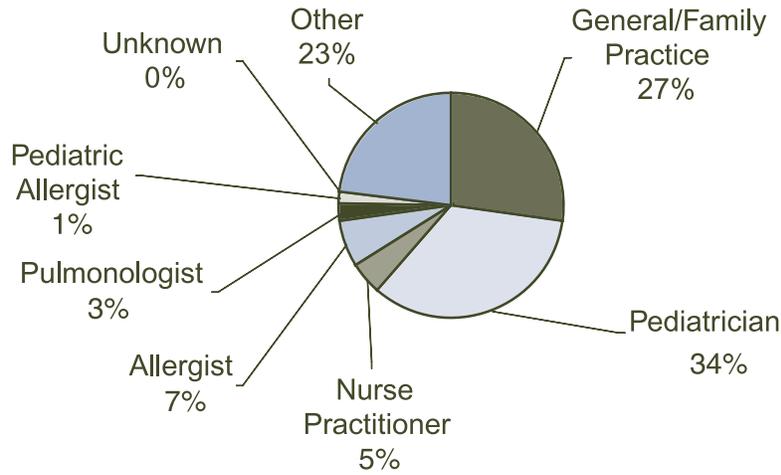


*Asthma listed as the primary or secondary diagnosis

Data Source: 2003-2005 Division of Health Care Financing, Wisconsin Department of Health and Family Services

The majority of ambulatory care visits for asthma were seen by pediatricians or general/family medicine practitioners in 2005 (Figure 52). Few specialists were seen for asthma ambulatory care visits. This is similar to what has been seen since 2000 (Burden of Asthma 2004). The use of pediatricians is likely a reflection of the young age structure of the Medicaid population.

Figure 52. Distribution of Ambulatory Visits for Asthma* by Provider Type among Medicaid Recipients, Wisconsin, 2005.



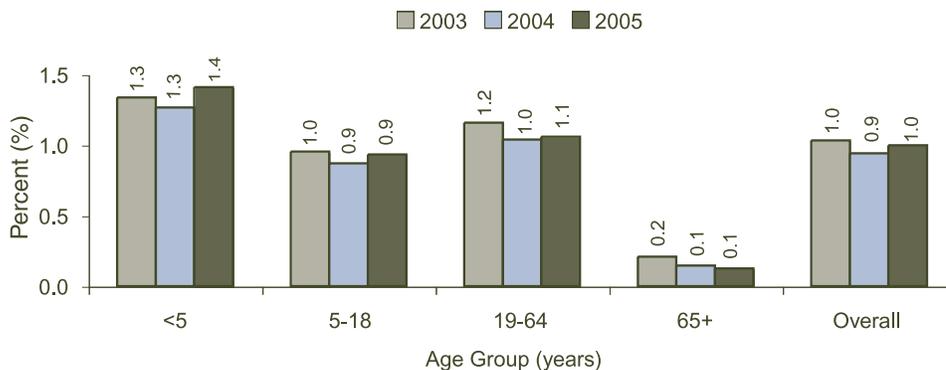
*Asthma listed as the primary or secondary diagnosis

Data Source: 2003-2005 Division of Health Care Financing, Wisconsin Department of Health and Family Services.

Emergency Department Visits

An ED visit for asthma was defined by ICD-9 codes 493 as the primary diagnosis. An average of 1 percent of all Medicaid recipients had an ED visit for asthma from 2003-2005 (Figure 53). A higher percent of Medicaid children 0-4 years of age had ED visits where asthma was the primary diagnosis compared to older age groups. Like ambulatory care visits, adults in the age category of 65 years and older had a low percentage of individuals with ED visit. This is most likely due to the use of other insurance coverage such as Medicare. Individuals with ED visits for asthma had an average of 1.4 visits for which asthma was the primary diagnosis (data not shown). ED visits rates for asthma among Medicaid recipients have been largely unchanged since 2000-2002 (Burden of Asthma 2004). Asthma ED visits were similar among male and female Medicaid recipients (data not shown).

Figure 53. Percent of Medicaid Recipients with Asthma* Emergency Department Visits by Year and Age Group, Wisconsin, 2003-2005.



*Asthma listed as the primary diagnosis

Data Source: 2003-2005 Division of Health Care Financing, Wisconsin Department of Health and Family Services

Appropriate Medication Usage: HEDIS Measure

The National Committee for Quality Assurance (NCQA) has developed a set of standardized performance measures called the Health Plan Employer Data and Information Set (HEDIS) to reliably compare the performance of managed health care plans. HEDIS measures address a broad range of health care issues including asthma. The HEDIS measure specific to asthma pertains to the use of appropriate medications for people with asthma. This measure examines the percentage of health plan members 5-56 years of age with persistent asthma for whom long-term control medications were appropriately prescribed.

HEDIS defines an individual with persistent asthma as someone who meets at least one of the following criteria in the measurement year and the year prior to the measurement year:

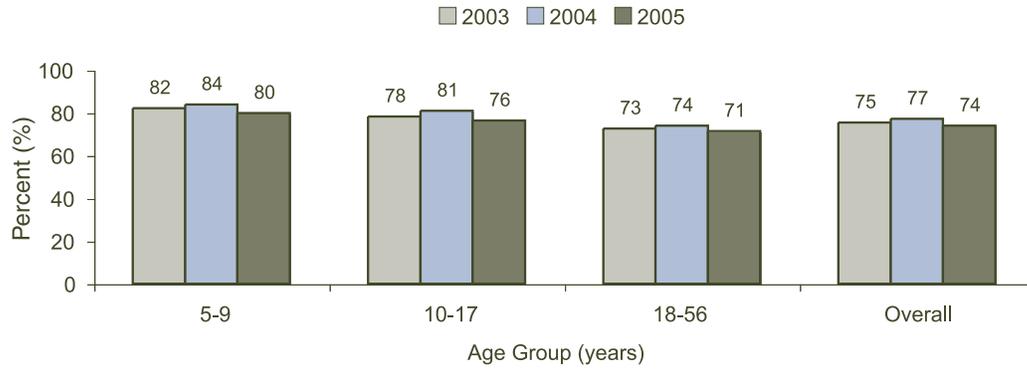
- At least four asthma medication prescriptions
- At least one emergency department visit with a primary diagnosis of asthma
- At least one hospital inpatient visit with a primary diagnosis of asthma
- At least four outpatient visits with asthma listed as one of the diagnoses AND at least two asthma medication prescriptions

Medications classified as acceptable as a primary therapy for long-term control of asthma include cromolyn sodium, leukotriene modifiers, nedocromil, inhaled corticosteroids and methylxanthines.

HEDIS calls for continuous eligibility of recipients to be included in the measurement during the measurement year and the prior year. This condition was slightly modified in this analysis to account for the fluidity of the Medicaid population coming in and out of the program. Instead, this analysis bases continuous eligibility on the same year as the measurement year only. Recipients are allowed a 45 day gap in eligibility, and therefore must be enrolled in Medicaid at least 320 days during the measurement year to be included in the analysis. Recipients can be added or dropped from year-to-year depending upon meeting eligibility and persistent asthma guidelines.

Based on the modified HEDIS measure, approximately 76 percent of Wisconsin Medicaid recipients 5 to 56 years old with persistent asthma received appropriate medication for long-term control of asthma from 2003 to 2005 (Figure 54). Children 5-9 years of age received appropriate medication at a slightly higher rate than older age groups. A decrease in this measure was seen in all age groups from 2004 to 2005. However, there has been a general improvement in use of appropriate medication for persistent asthma among Medicaid recipients since 2000. Only 65 and 69 percent of Wisconsin Medicaid recipients 5 to 56 years of age received appropriate medication for long-term control of asthma in 2000 and 2001, respectively (Burden of Asthma 2004).

Figure 54. Modified HEDIS Measure: Use of Appropriate Medications for People with Persistent Asthma by Age Group, Wisconsin Medicaid Recipients, 2003-2005.



*Asthma listed as the primary diagnosis

Data Source: 2003-2005 Division of Health Care Financing, Wisconsin Department of Health and Family Services



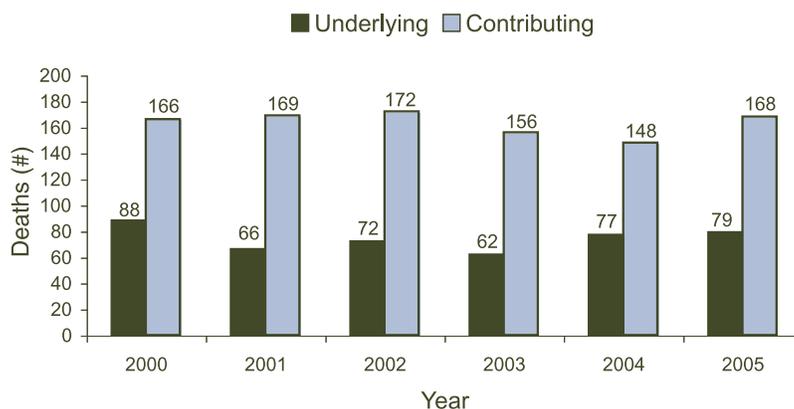
Mortality

Asthma-related deaths represent the most extreme consequence of asthma and most are related to improper prevention and treatment failures. Improved access to health care and proper disease management could prevent many asthma-related deaths. This section describes mortality data and details the demographic characteristics of Wisconsin residents who died of asthma from 1990 to 2005.

Deaths in Wisconsin are reported by the 72 county vital records offices and by two city health offices (West Allis and Milwaukee) to the Vital Records Section of DHFS' Bureau of Health Information and Policy (see Appendix A). Death certificates are completed by physicians, coroners, funeral directors, or county or city health officers. For all death records, one underlying or primary cause of death and up to 20 contributing causes of death are recorded.

During 2004, 3,780 deaths occurred nationally for which asthma was the underlying cause (Miniño et al., 2006); 77 of those deaths occurred in Wisconsin. Between 2000 and 2005 there was an average of 74 deaths per year in Wisconsin for which asthma was the underlying cause. Additionally, an average of 163 death certificates during this six-year period listed asthma as a contributing cause of death and something other than asthma as the underlying cause (Figure 55).

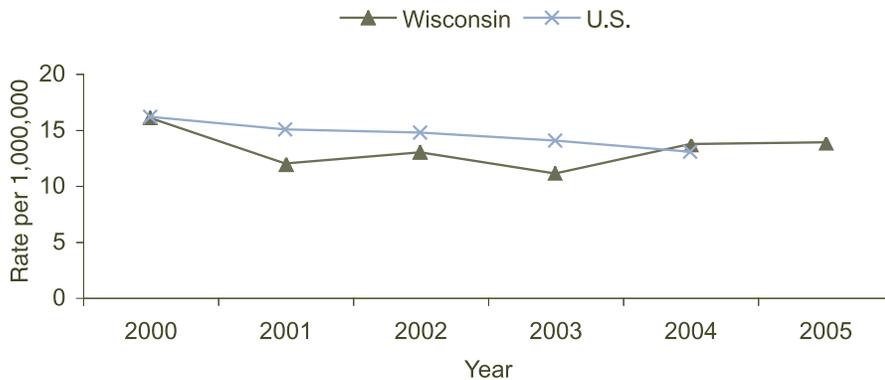
Figure 55. Asthma Mortality by Year, Underlying and Contributing Cause of Death, Wisconsin Residents, 2000-2005.



Data Source: 2000-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

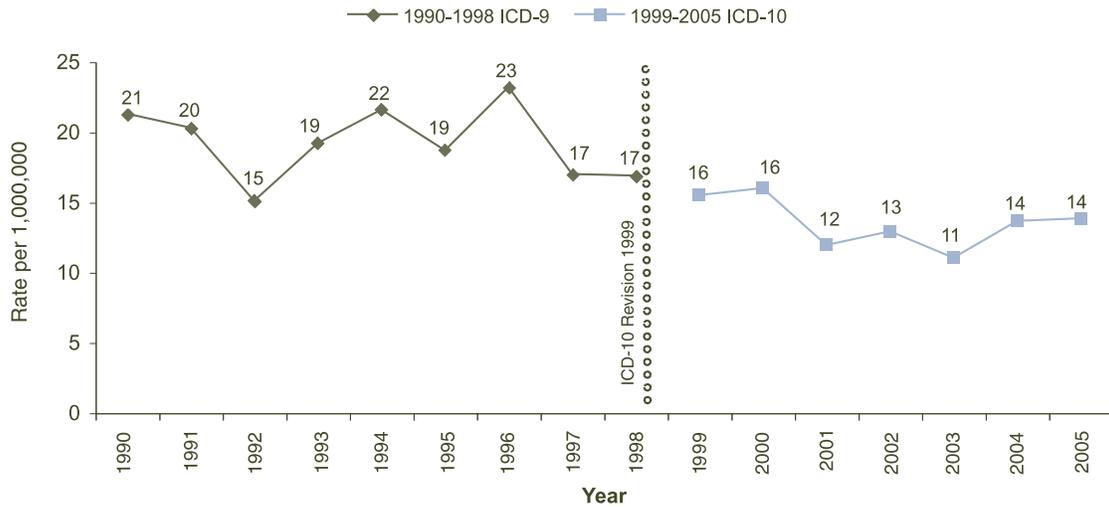
Age-adjusted asthma mortality rates (underlying cause) by year in Wisconsin have remained relatively stable from 2000-2005, with an average rate of 13.2 deaths per million (Figure 56). Mortality rates from 2000-2004 in Wisconsin have been slightly below or similar to national rates (Figure 56). Since Wisconsin began conducting surveillance of asthma mortality in 1990, mortality rates under ICD-9 ranged from a low of 15.1 deaths per million in 1992 to a high of 23.2 deaths per million in 1996 (Figure 57). Since the ICD-10 coding system was implemented in 1999, the rates have ranged from a high of 16.0 deaths per million in 2000 to a low of 11.0 deaths per million in 2003. The decrease over the years may reflect a true decline in asthma-related mortality rates, but may also be due to a change in coding practices from ICD-9 to ICD-10 in 1999. As for other surveillance endpoints for which there are relatively few events, annual rates can be variable and yearly comparisons should be made with caution.

Figure 56. Age-Adjusted* Asthma Mortality Rates by Year, Wisconsin Residents, 2000-2005, and U.S. Age-Adjusted* Asthma** Mortality by Year, 2000-2004.**



*Standard 2000 US population used for direct age-adjustment
 **Asthma listed as the underlying cause of death (ICD-10 codes J45 and J46)
 Data Sources: 2000-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services
 United States Department of Health and Human Services (US DHHS), Centers for Disease Control and Prevention (CDC), National Center for Health Statistics (NCHS), Office of Analysis and Epidemiology(OAE), Compressed Mortality File (CMF) compiled from CMF 1999-2004, Series 20, No. 21 2006 on CDC WONDER On-line Database.

Figure 57. Age-Adjusted* Asthma Mortality Rates by Year, Wisconsin Residents 1990-2005. 1990-1998 Coded with ICD-9, and 1999-2005 Coded with ICD-10.**



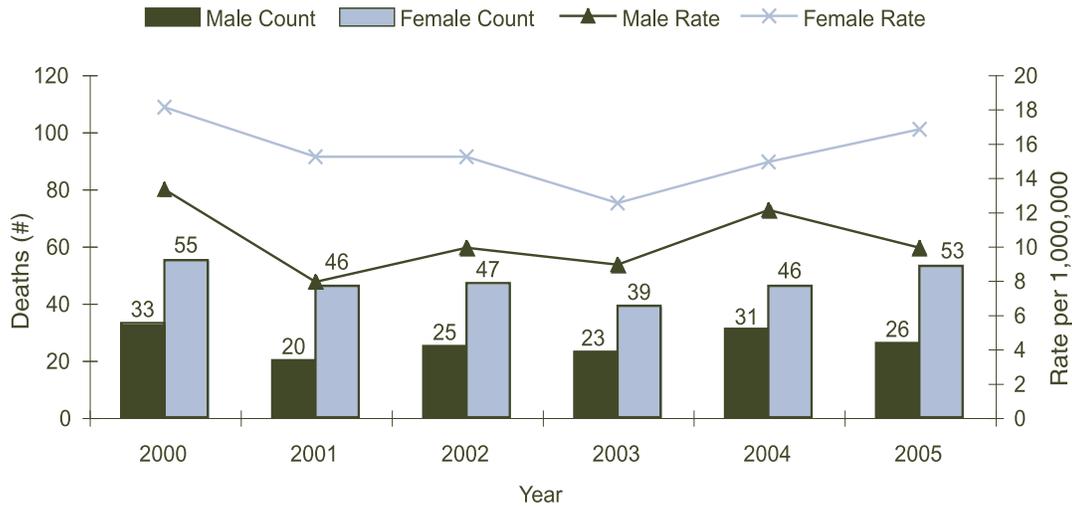
*Standard 2000 US population used for direct age-adjustment

**Asthma listed as the underlying cause of death (ICD-9 codes 493.0 - 493.9 and ICD-10 codes J45 and J46)

Data Sources: 1990-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

The crude number of deaths and age-adjusted asthma mortality rates are higher in females than males in Wisconsin (Figure 58). Among females, higher age-adjusted asthma mortality rates have been seen every year since 1990, with the exception of 1991 and 1996 (Burden of Asthma 2004). The higher mortality rates seen in females are consistent with national statistics, as are the higher prevalence, hospitalization and emergency department visit rates for Wisconsin females.

Figure 58. Asthma Death Counts and Age-Adjusted* Asthma Mortality Rates by Year and Sex, Wisconsin Residents, 2000-2005.**



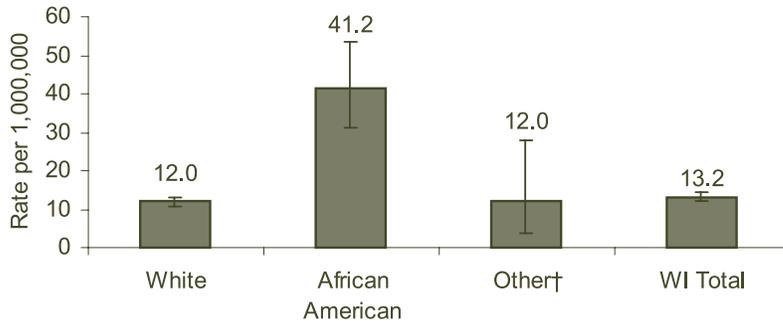
*Standard 2000 US population used for direct age-adjustment

**Asthma listed as the underlying cause of death (ICD-10 codes J45 and J46)

Data Sources: 2000-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Racial differences in asthma mortality rates can also be seen in Wisconsin. The six year age-adjusted mortality rates from 2000-2005 show that African Americans were more than three times likely to die of asthma than members of any other racial group (Figure 59). The higher rate among African Americans was statistically significant, and is consistent with the elevated asthma mortality rates observed for African Americans at the national level (Mannino et al., 2002). This racial trend was also consistent with higher prevalence, hospitalization and emergency department visit rates seen in the African American population.

Figure 59. Six Year Age-Adjusted* Asthma Mortality Rates by Race[†], Wisconsin Residents, 2000-2005.**



*Standard 2000 US population used for direct age-adjustment

**Asthma listed as the underlying cause of death (ICD-10 codes J45 and J46)

[†]Race groups include both Hispanic and non-Hispanic individuals.

†The 'Other' category is comprised of Asians, Native Hawaiians, Pacific Islanders, Native Americans, Alaskan Natives and those of unknown race.

Data Source: 2000-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

In Wisconsin and nationally, individuals 65 and over are the age group with the highest mortality rates from asthma. Between 2000 and 2005 there was an average of 63.4 deaths per million in the 65 and over Wisconsin population (Table 11). Due to small numbers of deaths in children 0-4 and 5-14, rates are unstable and are not displayed in Table 11. Whereas children with asthma appear to have higher rates of hospitalizations and emergency department visits than older adults, rates of asthma mortality are much greater in older adults than children.

Table 11. Annual and Average (2000-2005) Age-Specific Asthma* Mortality Rates and Total Age-Adjusted Asthma Mortality Rates***, Wisconsin Residents, 2000-2005.**

Age Group	2000	2001	2002	2003	2004	2005	Average
0-4	DSU						
5-14	DSU						
15-34	6.1	3.4	3.4	DSU	6.0	4.6	4.4
35-64	11.1	9.4	8.8	8.3	8.6	10.3	9.4
65+	76.8	53.9	65.1	54.9	64.3	65.1	63.4
WI***	16.0	11.9	12.9	11.0	13.7	13.9	13.2

*Asthma listed as the underlying cause of death (ICD-10 codes J45 and J46)

**All rates are per 1,000,000

***Standard 2000 US population used for direct age-adjustment

DSU: Data statistically unreliable, the number of deaths is less than 5

Data Source: 2000-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services

Because mortality rates at the county level are based on a small number of events, they are statistically unstable and are not provided in this update. Six-year age-adjusted asthma mortality rates from 2000 to 2005 based on the National Center for Health Statistics (NCHS) urban/rural classification are provided in Table 12 (see Appendix D for definition). Milwaukee County, the only large central metro county in Wisconsin, had the highest asthma mortality rate at 17.3 deaths per million. However, based on overlapping 95% confidence intervals, only the large fringe metro counties had a significantly lower age-adjusted asthma mortality rate than Milwaukee County.

Table 12. Six Year Age-Adjusted Asthma* Mortality Rates by National Center for Health Statistics (NCHS) Urban/Rural Classification, Wisconsin Residents, 2000-2005.**

2006 NCHS Urban/Rural Classification	Age-Adjusted Mortality Rate (95% Confidence Interval)
Large Central Metro (Milwaukee County) - Central counties in metro areas of 1 million or more population	17.3 (14.0 – 21.1)
Large Fringe Metro -Outlying (suburban) counties in metro areas of 1 million or more population	10.3 (7.7 – 13.6)
Medium Metro -Counties in metro areas of 250,000-999,999 population	10.9 (8.1 – 14.3)
Small Metro -Counties in metro area of 50,000-249,999 population	13.7 (11.1 – 16.2)
Micropolitan -Counties in an area with an urban cluster of 10,000-49,999 population	11.7 (8.9 – 15.2)
Noncore -Nonmicropolitan	13.9 (11.0 – 17.3)
Wisconsin —Total Population	13.2 (12.0 – 14.5)

*Asthma listed as the underlying cause of death (ICD-10 codes J45 and J46)

**Standard 2000 US population used for direct age-adjustment, rates are per 1,000,000

Data Source: 2000-2005 Vital Records Office, Bureau of Health Information and Policy, Division of Public Health, Wisconsin Department of Health and Family Services



Progress Towards Healthy People

Healthy People 2010 is a health plan for the United States that contains a set of disease prevention and health promotion objectives to achieve during the first decade of the current century (available at: <http://www.healthypeople.gov/>). They were created by the federal

Department of Health and Human Services (DHHS), and are intended to serve as benchmarks for increasing the quality of life and the number of years of healthy living and for eliminating health disparities. Asthma is included as one of the focus areas in Healthy People 2010.

Eight goals related to asthma have been identified:

- Reduce asthma deaths
- Reduce hospitalizations for asthma
- Reduce hospital emergency department visits for asthma
- Reduce activity limitations among persons with asthma
- Reduce the number of school or work days missed by persons with asthma due to asthma
- Increase the proportion of persons with asthma who receive formal patient education, including information about community and self-help resources, as an essential part of the management of their condition
- Increase the proportion of persons with asthma who receive appropriate asthma care according to the National Asthma Education and Prevention Program (NAEPP) guidelines
- Establish in at least 25 states a surveillance system for tracking asthma death, illness, disability, impact of occupational and environmental factors on asthma, access to medical care, and asthma management

This section measures Wisconsin's progress toward meeting some of the goals set forth in Healthy People 2010. Wisconsin rates are also compared to national rates. At this time Wisconsin has data to measure asthma deaths, hospitalizations and emergency department visits.

Healthy People 2010 Goal: Reduce Hospitalizations for Asthma

Wisconsin asthma hospitalization rates were higher than applicable Healthy People 2010 goals for all age groups for both 2000-2002 and 2003-2005 (Table 13). National hospitalization rates for asthma in 1998 (baseline) and in 2002 were higher than target rates and Wisconsin rates. Wisconsin asthma hospitalization rates for children four and under and for adults 65 and over increased slightly from 2000-2002 to 2003-2005. National asthma hospitalization rates for these same two age groups also increased from 1998 to 2002.P

Table 13. Wisconsin, US and Healthy People 2010 Target Asthma Hospitalization Rates, 1998-2005.

Age Group (years)	Wisconsin 2000 - 2002 (per 10,000)	Wisconsin 2003 - 2005 (per 10,000)	US Baseline 1998** (per 10,000)	US 2002** (per 10,000)	Healthy People 2010 Target** (per 10,000)
≤ 4	29.6	30.2	45.6	59.0	25.0
5-64*	8.0	7.9	12.5	12.4	7.7
≥ 65*	13.3	15.6	17.7	22.4	11.0

*Age-adjusted to the 2000 US standard population

**US Department of Health and Family Services, Centers for Disease Control and Prevention, National Center for Health Statistics Healthy People 2010 midcourse review data. Available at: <http://wonder.cdc.gov/data2010/>
Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Healthy People 2010 Goal: Reduce Hospital Emergency Department Visits for Asthma

Asthma emergency department (ED) rates in Wisconsin children and individuals five years of age and older have met Healthy People 2010 goals since ED data collection began in 2002 (Table 14). ED rates in children four years of age and younger remain higher than the target goal. Wisconsin ED rates remain well below national ED rates.

Table 14. Wisconsin, US and Healthy People 2010 Target Asthma Emergency Department Rates, 1995-2005.

Age Group (years)	Wisconsin 2002 (per 10,000)	Wisconsin 2003 - 2005 (per 10,000)	US Baseline 1995-1997* (per 10,000)	US 2001-2003* (per 10,000)	Healthy People 2010 Target* (per 10,000)
≤ 4	91.3	92.1	150.0	153.7	80.0
5-64	41.7	40.7	71.1	59.6	50.0
≥ 65	14.3	14.7	29.5	30.9	15.0

*US Department of Health and Family Services, Centers for Disease Control and Prevention, National Center for Health Statistics Healthy People 2010 midcourse review data. Available at: <http://wonder.cdc.gov/data2010/>
Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Healthy People 2010 Goal: Reduce Asthma Deaths

Neither the US, nor Wisconsin meet the target Healthy People 2010 goal for asthma mortality rates in any age group (Table 15). While asthma mortality rates in the US and Wisconsin have decreased slightly from earlier years, mortality rates remain higher than target rates.

Table 15. Wisconsin, US and Healthy People 2010 Target Asthma Mortality Rates, 1999-2005.

Age Group (years)	Wisconsin 1999-2001 (per million)	Wisconsin 2002-2005 (per million)	US Baseline 1999* (per million)	US 2004* (per million)	Healthy People 2010 Target* (per million)
≤ 4	DSU	DSU	1.7	1.8	0.9
5-14	3.0	2.4	3.1	2.6	0.9
15-34	4.3	4.2	5.6	4.4	1.9
35-64	10.9	9.0	15.5	12.7	8.0
≥ 65	67.3	62.4	69.5	51.3	47.0

*US Department of Health and Family Services, Centers for Disease Control and Prevention, National Center for Health Statistics Healthy People 2010 midcourse review data. Available at: <http://wonder.cdc.gov/data2010/>
 DSU: Data Statistically Unreliable, based on less than 5 deaths
 Data Source: 1999-2005 Vital Records Office, Bureau of Health Information, Division of Health Care Financing, Wisconsin Department of Health and Family Services



Work-Related Asthma

Approximately 15 to 23 percent of newly-diagnosed asthma cases in adults are thought to be work-related (American Thoracic Society, 2004). Work-related asthma (WRA) is defined as asthma that is caused or exacerbated by occupational exposures. WRA is thought to be one of the most common occupational respiratory illnesses; however, many cases are not recognized as work-related, or are not reported as such. For a case of WRA to be recognized, a health care provider must make a diagnosis of asthma and an association must be made between symptoms of asthma and occupational exposures. Surveillance of WRA is difficult due to the complexity in diagnosing and relating symptoms to exposures in the workplace. As such, Wisconsin has taken several approaches to quantifying the prevalence of WRA.

Behavioral Risk Factor Surveillance Survey (BRFSS)

In 2003 four state-added questions were included on the BRFSS to assess the prevalence of WRA (see Appendix F for questions). Adults who were identified as having current asthma were asked four state-added follow-up questions to determine if their asthma was work-related. The first question asked was, “Were you ever told by a doctor or other medical person that your asthma was related to any job you ever had?” The second question asked was “Did you ever tell a doctor or other medical person that your asthma was related to any job you ever had?” The last two questions ascertained the respondent’s occupation and industry sector.

Current asthma was defined as those who reported ever being told by a doctor, nurse or other health professional that they had asthma and reporting that they still had asthma. WRA was defined as those with current asthma who reported that a medical professional had ever told them that their asthma was related to their job.

In 2003, the prevalence rate of current asthma among Wisconsin adults was 7.5 percent (95% CI (1.0). Among adults with current asthma, 4.9 percent (95% CI (2.3) met the case definition for WRA. Because this value only takes into account individuals who have been told by a medical professional that their asthma was related to a job, this estimate should be considered conservative. Since there were fewer than 50 respondents with WRA, estimates of demographic characteristics of these individuals cannot be appropriately made. Starting in 2006, WRA questions will again be asked on the BRFSS. Results of several years of data will be presented in future publications.

Wisconsin Union Survey

To further explore the prevalence of WRA among Wisconsin’s workforce, the Wisconsin Asthma Coalition’s WRA Workgroup developed an asthma questionnaire for labor union members. Participation in the survey was strictly voluntary. This could lead to potential bias in results, as those with asthma may have been more or less likely to respond. In October of 2003, a total of 7,108 surveys were distributed to union members. A total of 1,837 (25.8 percent) participants completed responses by March of 2004.

The following case definitions were used to identify reported asthma and WRA by participants who completed the questionnaire.

The case definition for current asthma was determined by the participant's responses to the following questions:

1. "During the past 12 months, how often have you had respiratory problems such as coughing, wheezing, shortness of breath or chest tightness?"
 - a. Never
 - b. Less than once a month
 - c. 1-2 times a month
 - d. More than 2 times a month, but not every week
 - e. Every week, but not every day
 - f. Every day or almost every day
2. "Did the doctor or other medical professional ever tell you that you have asthma?"
 - a. Yes, still have asthma
 - b. Yes, but I haven't had asthma for 2 or more years
 - c. No
 - d. Don't know/Not sure
 - e. Choose not to answer

If the participant answered question (1) with any of the following responses: b, c, d, e, or f AND question (2) with response a, they were determined to have current asthma.

Participants were found to meet the case definition for WRA if they had current asthma AND answered yes to the following question:

1. "Did a doctor or other medical professional ever tell you that your asthma was related to any job you ever had?"
 - a. Yes
 - b. No
 - c. Don't know/Not sure
 - d. Choose not to answer

The median age of the participants was 47 years. Forty-two percent of the participants were female and 58 percent were male. Ninety-one percent of the participants were white and four percent were African American. A total of 191 (10.8 percent) individuals were found to have asthma, of which 26 (13.6 percent) met the definition for WRA. More than 50 percent of respondents cited dust, smoke and fumes as causing breathing problems while at work. Of those with asthma, 58 percent worked in service industries and 39 percent worked in manufacturing. Of those determined to have WRA, 40 percent worked in service industries and 56 percent worked in manufacturing. More information on the Wisconsin WRA survey can be found at: dhfs.wisconsin.gov/eh/Asthma/pdf/WAQR12_5_04.pdf

Worker’s Compensation and Asthma Hospitalizations

Worker’s compensation is a form of insurance that covers employees who are injured or become ill because of their work. The insurance covers costs of healthcare as well as lost wages due to illness or injury. If at the time of hospitalization it is known that the costs will be paid through worker’s compensation it can be listed as the payer. Thus another approach used to quantify severe work-related asthma was to examine data on asthma hospitalizations for which the primary payor was worker’s compensation. Table 16 shows the number of asthma hospitalizations where worker’s compensation was the primary payor between 2000 and 2005.

Table 16. Asthma* Hospitalizations with Worker’s Compensation as the Primary Payor by Year, Wisconsin, 2000-2005.

Year	Asthma Principal Diagnosis (#)
2000	19
2001	3
2002	9
2003	10
2004	2
2005	6
Total Asthma Worker’s Compensation payor status	49
Total Asthma Hospitalizations	33,189

*Asthma listed as the principal diagnosis (ICD-9-CM 493.00 – 493.92)
 Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Very few asthma hospitalizations can be clearly identified as work related and thus appropriately billed to worker’s compensation at the time of the hospitalization. From 2000 to 2005, worker’s compensation was the primary payor in 49 cases out of 33,189 hospitalizations where asthma was the principal diagnosis.



References

Akerman M, Calacanis C, Madsen M. Relationship between asthma severity and obesity. *J Asthma* 2005; 41: 521-526.

Akinbami L. The state of childhood asthma, United States, 1980-2005. Advanced data from vital and health statistics. National Center for Health Statistics. 2006; 381: 1-24.

American Lung Association. Asthma and children fact sheet. 2006. Available at: <http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=44352&printmode=1>

American Lung Association. Trends in Asthma Morbidity and Mortality, 2005. Epidemiology and Statistics Unit, Research and Program Services. Available at: <http://www.kintera.org/atf/cf/%7B7A8D42C2-FCCA-4604-8ADE-7F5D5E762256%7D/ASTHMA1.PDF>

American Thoracic Society. Guidelines for assessing and managing asthma risk at work, school, and recreation. *Am J Respir Crit Care Med* 2004; 169:873-881.

Arif A, Delclos G, Lee E, Tortolero S, Whitehead L. Prevalence and risk factors of asthma and wheezing among US adults: an analysis of the NHANES III data. *Eur Respir J* 2003; 21: 827-833.

Boss L, Kreutzer R, Luttinger D, Leighton J, Wilcox K, Redd, S. Public health surveillance of asthma. *J Asthma* 2001; 38: 83-89.

Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System Online Prevalence Data, 1999-2005. Available at: <http://www.cdc.gov/brfss/>

Centers for Disease Control and Prevention. Division of Adolescent and School Health. Addressing asthma within schools, July 2004. Available at: <http://www.cdc.gov/HealthyYouth/asthma/>

Centers for Disease Control and Prevention. Key clinical activities for quality asthma care: recommendations of the National Asthma Education and Prevention Program. *MMWR* 2003;52 (No. RR-6).

Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2006;55 (No. RR-10).

Cesaroni G, Farchi S, Davoli M, Forastiere F, Perucci C. Individual and area-based indicators of socioeconomic status and childhood asthma. *Eur Respir J* 2003; 22: 619-624.

DeFrances C, Podgornik M. 2004 National Hospital Discharge Survey. Advance data from vital and health statistics. National Center for Health Statistics. 2006; 371: 1-20.

Another venue where interventions can help improve asthma management is in schools. While most public secondary schools allow students to carry and administer their own asthma medications, survey data suggest that training for staff in Wisconsin schools could be improved. There is evidence that students with asthma who are routinely absent from school could benefit from intensive case management.

While the health impacts of poorly-managed asthma are the primary motivation for public health action, poorly-managed asthma takes a financial toll as well. In 2005, total cost for asthma-related hospitalizations and emergency department visits exceeded \$62.8 million. Better asthma management can help reduce these costs.

This document will serve as a foundation for prioritizing and tailoring future prevention and intervention efforts to reduce the burden of asthma in Wisconsin. In cooperation with the Centers for Disease Control and Prevention (CDC), DHFS will continue to work with the Wisconsin Asthma Coalition (WAC) and stakeholders from around the state to create and implement strategies for reducing the burden of asthma in Wisconsin.



References

Akerman M, Calacanis C, Madsen M. Relationship between asthma severity and obesity. *J Asthma* 2005; 41: 521-526.

Akinbami L. The state of childhood asthma, United States, 1980-2005. Advanced data from vital and health statistics. National Center for Health Statistics. 2006; 381: 1-24.

American Lung Association. Asthma and children fact sheet. 2006. Available at: <http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=44352&printmode=I>

American Lung Association. Trends in Asthma Morbidity and Mortality, 2005. Epidemiology and Statistics Unit, Research and Program Services. Available at: <http://www.kintera.org/atf/cf/%7B7A8D42C2-FCCA-4604-8ADE-7F5D5E762256%7D/ASTHMA1.PDF>

American Thoracic Society. Guidelines for assessing and managing asthma risk at work, school, and recreation. *Am J Respir Crit Care Med* 2004; 169:873-881.

Arif A, Delclos G, Lee E, Tortolero S, Whitehead L. Prevalence and risk factors of asthma and wheezing among US adults: an analysis of the NHANES III data. *Eur Respir J* 2003; 21: 827-833.

Boss L, Kreutzer R, Luttinger D, Leighton J, Wilcox K, Redd, S. Public health surveillance of asthma. *J Asthma* 2001; 38: 83-89.

Centers for Disease Control and Prevention, Behavioral Risk Factor Surveillance System Online Prevalence Data, 1999-2005. Available at: <http://www.cdc.gov/brfss/>

Centers for Disease Control and Prevention. Division of Adolescent and School Health. Addressing asthma within schools, July 2004. Available at: <http://www.cdc.gov/HealthyYouth/asthma/>

Centers for Disease Control and Prevention. Key clinical activities for quality asthma care: recommendations of the National Asthma Education and Prevention Program. *MMWR* 2003;52 (No. RR-6).

Centers for Disease Control and Prevention. Prevention and control of influenza: recommendations of the Advisory Committee on Immunization Practices (ACIP). *MMWR* 2006;55 (No. RR-10).

Cesaroni G, Farchi S, Davoli M, Forastiere F, Perucci C. Individual and area-based indicators of socioeconomic status and childhood asthma. *Eur Respir J* 2003; 22: 619-624.

DeFrances C, Podgornik M. 2004 National Hospital Discharge Survey. Advance data from vital and health statistics. National Center for Health Statistics. 2006; 371: 1-20.

- Ford E, Mannino D, Homa D, Gwynn C, Redd S, Moriarty D, Mokdad A. Self-reported asthma and health-related quality of life: Findings from the behavioral risk factor surveillance system. *Chest* 2003; 123 (1): 119-127.
- Hamilton B, Sutton P, Ventura S. Revised birth and fertility rates for the 1990s and new rates for Hispanic populations, 2000 and 2001: United States. National vital statistics reports; vol 51 no 12. Hyattsville, MD: National Center for Health Statistics. 2003.
- Hoppin P, Jacobs M, Stillman L. Investing in Best Practices for Asthma: A Business Case for Education and Environmental Interventions. Asthma Regional Council of New England. Boston, MA. 2007.
- Mannino DM, Homa DM, Akinbami LJ, Moorman, JE, Gwynn C, Redd SC. Surveillance for asthma-United States, 1980–1999. In: CDC Surveillance Summaries, March 29, 2002. *MMWR* 2002;51(No. SS-1): 1-13.
- Miniño A, Heron M, Smith B. Deaths: Preliminary data for 2004. National vital statistics reports. National Center for Health Statistics. 2006; 54(19): 1-55.
- National Heart, Lung, and Blood Institute. Data fact sheet on asthma statistics, January 1999. Available at: <http://www.nhlbi.nih.gov/health/prof/lung/asthma/asthstat.pdf>
- National Heart, Lung, and Blood Institute. 1997. Expert Panel Report 2: Guidelines for the diagnosis and management of asthma. National Institutes of Health, Bethesda, MD.
- National Heart, Lung, and Blood Institute. Guidelines for the diagnosis and management of asthma, update on selected topics, 2002. Available at: www.nhlbi.nih.gov/guidelines/asthma/index.htm.
- National Heart, Lung, and Blood Institute. Morbidity and Mortality: 2004 Chart Book on Cardiovascular, Lung, and Blood Diseases. National Institutes of Health, Bethesda, MD.
- Pearce N, Beasley R, Burgess C and Crane J. Asthma epidemiology and methods. New York, NY: Oxford University Press; 1998.
- Rhodes L, Moorman J, Redd S, Mannino D. Self-reported asthma prevalence and control among adults – US, 2001. *MMWR* 2003;52 (17); 381-384.
- Schenker N and Gentleman J. On judging the significance of differences by examining the overlap between confidence intervals. *The American Statistician* 2001;55;3:182-186.
- U.S. Department of Health and Human Services. Healthy People 2010. 2nd ed. With Understanding and Improving Health and Objectives for Improving Health. 2 vols. Washington, DC: U.S. Government Printing Office, November 2000.
- Weisel, C. Assessing Exposure to Air Toxics Relative to Asthma. *Environ Health Persp* 2002; 110: 527-537.

Williams D. Considerations in the long-term management of asthma in ambulatory patients. *Am J Health Sys Pharm* 2006; 63: S14-S21.

Wisconsin Asthma Coalition. *Wisconsin Asthma Plan: Recommendations from the Wisconsin Asthma Coalition*. 2003.

Wisconsin Department of Health and Family Services. *Burden of Asthma in Wisconsin 2004*.

Wisconsin Department of Health and Family Services. *Implementation Plan of the State Health Plan: Healthiest Wisconsin 2010*. Available at: <http://dhfs.wisconsin.gov/statehealthplan/>

Wisconsin Medicaid Program. *Eligibility requirements*. Available at: <http://dhfs.wisconsin.gov/medicaid/>

Wisconsin Medicaid Program Overview, July 2006. Available at: <http://dhfs.wisconsin.gov/medicaid/resources.htm>

Report Terminology

Confidence Interval: The confidence interval is a measure of the precision of an estimate. The wider the interval, the less precise the estimate. The interpretation of the 95% confidence interval is that there is a 95% chance that the true value of the estimate lies within the range of the interval.

Current Asthma Prevalence: The proportion of the population that reports currently having asthma. This is a subset of the population that has ever been diagnosed with asthma. People can be diagnosed with asthma but may no longer have an active form of the disease.

Former Asthma Prevalence: The proportion of the population that has ever been diagnosed with asthma but does not currently have asthma.

Lifetime Asthma Prevalence: The proportion of the population that has ever been diagnosed with asthma.

Prevalence: The proportion of the population at a specific time affected by a disease.

Rate Calculations

- Rates are used throughout this report to measure the burden of asthma. A rate is the number of health events (in this case, asthma-related events) in a given population divided by the number of people in that population who can experience the health event within a specified time (for example, the years 1990-2005)
- In this report, only events occurring among Wisconsin residents were used to calculate rates. Deaths of Wisconsin residents that occur in other states are reported to the Wisconsin Vital Records office and thus, are included in these rate calculations. Hospitalizations and emergency department visits of Wisconsin residents occurring in other states, however, are not reported and therefore, not included in rate calculations. One exception is Medicaid-specific data which does include services provided by out-of-state providers. All events that occurred in Wisconsin to non-Wisconsin residents were excluded in rate calculations.
- Bridged-race census estimates available from the National Center for Health Statistics (<http://www.cdc.gov/nchs/about/major/dvs/popbridge/popbridge.htm>) were used to estimate the annual Wisconsin population for the years 1990 to 2005. These census estimates are from July 1st of each calendar year. These population estimates were used as the denominator when calculating asthma hospitalization, emergency department visit and mortality rates.

- A crude rate is the number of events that occur in a group divided by the population of that particular group. Unless otherwise noted, in this report, rates presented for specific age groups are crude rates. When rates for all ages combined are presented, rates are age-adjusted to account for any differences in the age distribution between populations. Directly age-adjusted rates were calculated by applying the age-specific rates in the population of interest in Wisconsin to the US 2000 April 1st census standard population. Age-adjusted rates should be viewed as relative indexes rather than exact rates. Additional information on age-adjustment is available at: <http://www.cdc.gov/nchs/datawh/nchsdefs/ageadjustment.htm#HP#20>.
- In this report, the age categories used to present most age-specific rates (0-4, 5-14, 15-34, 35-64 and 65 and older) were chosen to allow for comparisons with national asthma surveillance data reported by Mannino et al, 2002. Overall rates were directly age-adjusted using these age groupings.
- Rates based on small numbers can be variable. For example, if 5 deaths occur in a population of one million in a year and 10 deaths occur the next year, the rate changes by 100% from one year to the next. If, instead, 500 deaths occurred in a population of one million in a year and 505 deaths occur the next year, the rate changes by only 1% even though the difference in the number of deaths (5) is the same. As illustrated, changes in rates based upon a small number of events should be interpreted with caution. In this report, where necessary, years of data have been combined to decrease rate variability due to small numbers of asthma events in a given location or time.

Determination of Statistical Significance

- Determination of statistical significance for data in this report is based on non-overlapping 95% confidence intervals. Although this is not strictly speaking a statistical test, it is a commonly accepted way to compare estimates. It has been noted to be more conservative than formal statistical testing (Schenker and Gentleman, 2001).

Confidence Intervals Calculations:

The method used to calculate 95% confidence intervals for rates was based on those used by the National Center for Health Statistics in their vital statistics reports (Hamilton et al., 2003).

- 95% Confidence Intervals for age-specific and age-adjusted rates were calculated in the following way:
 - When the rate is based on 100 or more events, the following formula is used:
 Lower limit = $R - (1.96 * \sqrt{B})$
 Upper limit = $R + (1.96 * \sqrt{B})$

Where
 R = the rate
 B = the number of hospitalizations, emergency department visits, or deaths

- When the rate is based on less than 100 events, the Poisson distribution is used:
Lower limit = $R \cdot L$
Upper limit = $R \cdot U$

Where

R = the rate

L and U = the values in a table derived from the Poisson distribution for the 95% level.

- 95% Confidence Intervals for survey data (Behavioral Risk Factor Surveillance Survey, Youth Tobacco Survey, and Youth Risk Behavioral Survey) were calculated using the SURVEYMEANS procedure in SAS 9.1.3 (SAS Institute Inc., Cary, NC).

Acronyms

BHIP	Bureau of Health Information and Policy, DHFS
BMI	Body Mass Index
BRFSS	Behavioral Risk Factor Surveillance System
CDC	United States Centers for Disease Control and Prevention
CI	Confidence Interval
DHCF	Division of Health Care Financing, DHFS
DHFS	Wisconsin Department of Health and Family Services
DPH	Division of Public Health
ED	Emergency Department
HEDIS	Health Plan Employer Data and Information Set
ICD	International Classification of Disease
NAEPP	National Asthma Education and Prevention Program
NCHS	National Center for Health Statistics
NSCH	National Survey of Children's Health
NHLBI	National Heart, Lung, and Blood Institute
SHEP	School Health Education Profile
WRA	Work-Related Asthma
YRBS	Youth Risk Behavior Survey
YTS	Youth Tobacco Survey

Appendix A. Data Sources

Behavioral Risk Factor Surveillance System (BRFSS)

The Wisconsin Behavioral Risk Factor Surveillance System (BRFSS) is an annual, statewide telephone survey of a random sample of Wisconsin household residents aged 18 and older which produces estimates representative of the Wisconsin population living in households. The Wisconsin BRFSS is part of the national BRFSS, which is coordinated by the U.S. Centers for Disease Control and Prevention (CDC). Every state health department, the District of Columbia and three U.S. territories conduct a survey as part of the system to measure adult health risk behaviors and attitudes and the use of preventive health services.

Asthma questions have been included on the Wisconsin BRFSS since 1999. In 2002 Wisconsin began including two optional asthma modules on the Wisconsin BRFSS, the adult asthma module and the child asthma module. From 2002 to 2004 the adult asthma module contained nine questions asked of adults with current asthma including information on quality of life and health care utilization. In 2005 the pharmaceutical question was replaced with two new questions. Traditionally, the BRFSS only asked questions pertaining to adults aged 18 years and older. In 2002, a child asthma module was included which included questions about asthma in children living in the household with the adult survey respondent. Special household weights had to be calculated to calculate asthma prevalence in children based on these questions. In 2005, the child module was changed to ask about the asthma status in one particular randomly selected child. Wisconsin also added optional questions to the BRFSS in 2003 and 2005. In 2003 adults with current asthma were asked questions about work-related asthma and in 2005 they were asked about the use of asthma management plans (see Appendix F for BRFSS module questions).

In 2005, the Wisconsin BRFSS had 4,900 phone interviews, including partial interviews. Any responses where the respondent answered “Don’t Know/Not Sure” and “Refused” were not included in estimating response rates.

Death Records

Death certificates for deaths occurring in Wisconsin are collected by the Vital Records Office, Bureau of Health Information and Policy (Division of Public Health (DPH), DHFS). The death certificates are submitted by the 72 County Register of Deeds offices and by two city health offices (West Allis and Milwaukee). Deaths of Wisconsin residents that occur in other states and countries are recorded by those governments and submitted to the Wisconsin Vital Records Office.

In 1999, the coding system used to classify causes of death changed to a newer version (from the International Classification of Diseases-9 (ICD-9) to ICD-10). Due to this change in coding, rates in 1998 and before are not directly comparable to those in 1999 and after.

Hospital Emergency Department Visits

In 2002, the Bureau of Health Information and Policy (DPH, DHFS) began collecting data on emergency department (ED) visits from Wisconsin hospitals. In October of 2003, the Wisconsin Hospital Association assumed the collection of ED data. Information on race and ethnicity is not available in ED data. The ZIP code collected is used to determine county of residence. If a ZIP code straddled county boundaries, the patients from that ZIP code area were randomly allocated to a county based on a probability equal to the proportion of the ZIP code area's population in each county.

Of asthma hospital ED visits from 2002 to 2005, 3255 (3.5 percent) were for patients who reported ZIP codes that were out of state. These ED visits, as well as those with a missing or invalid ZIP code (n=37), were not included in rates for this report. All asthma hospital ED visit rates presented in this report are for Wisconsin residents only. Out-of-state hospital ED visits of Wisconsin residents are not captured in these data. It is important to note that these rates are based on the number of asthma hospital ED visits (principal diagnosis (ICD-9-CM codes 493.00 – 493.92) and not the number of people with asthma hospital ED visits.

Inpatient Hospitalizations

Inpatient hospitalization data have been available in Wisconsin since 1989 from the DHFS Bureau of Health Information and Policy. In October of 2003, the collection of inpatient hospitalization data was transferred to the Wisconsin Hospital Association. Data are reported by all of Wisconsin's acute care, non-federal hospitals. Data presented here are from the years 1990 to 2005, the most recent year of complete data available.

ZIP code information collected was used to determine county of residence. If a ZIP code straddled county boundaries, the patients from that ZIP code area were randomly allocated to a county based on a probability equal to the proportion of the ZIP code area's population in each county.

It is important to note that rates are based on the number of hospitalizations and not the number of individuals admitted to hospitals with asthma as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92). A total of 2,384 hospitalizations (2.4 percent) of all asthma hospitalizations were for non-Wisconsin residents (as determined by patient ZIP code data), or were missing zip code from 1990-2005. All asthma hospitalization rates presented in this report are for Wisconsin residents only. Out-of-state hospitalizations of Wisconsin residents are not captured in these data.

Medicaid

The Wisconsin Medicaid program is a state/federal assistance program, administered by the Wisconsin Department of Health and Family Services, which provides medical insurance to individuals who meet specific eligibility criteria. These eligibility criteria are a combination of income level and other factors such as falling into a specific age category, having a disability or being pregnant. As of December 2005, there were approximately 827,000 individuals covered by the Wisconsin Medicaid program (Wisconsin Medicaid web site, accessed August, 2007).

As the Medicaid program pays for health care of recipients, detailed information on procedures, ambulatory visits, hospitalizations and prescription medication usage is maintained by the program for the purpose of reimbursement. Data pertaining to asthma health care usage among Medicaid recipients was utilized in this report for the years 2003 through 2005.

National Survey of Children's Health, 2003

The National Survey of Children's Health (NSCH) is a random telephone survey of households with children under 18 years of age done by the Maternal and Child Health Bureau of the U.S. Department of Health and Human Services. The National Center for Health Statistics at the CDC conducted the state-based survey to estimate national and state level prevalence for a variety of physical, emotional and behavioral health indicators. Questions on asthma prevalence and health-related quality of life were included on the survey. The respondent was the parent or guardian of the child living in the surveyed household. A total of 102,353 surveys were completed nationally, 1,970 of those were done in Wisconsin. Survey results were weighted to represent the population of non-institutionalized children ages 0-17 nationally, and in each state.

School Health Education Profile

The School Health Education Profile (SHEP) in Wisconsin is conducted by the Wisconsin Department of Public Instruction and is used to monitor characteristics and assess trends in health education and policies in public middle/junior high and high schools. The survey is developed and supported by the CDC Division of School and Adolescent Health (DASH) Program.

The first Wisconsin SHEP survey was conducted in 1994 and administration was repeated in 1998, 2002 and 2004. All regular public secondary schools serving at least one of grades 6 through 12 are included in the school sampling frame. The survey has two sets of questionnaires - one for the school principal and the other for the lead health teacher from each school included in the sample. Asthma policy questions were included on the 2002 and 2004 school principal survey. In 2002, 361 out of the 459 (79 percent) and in 2004, 313 out of 425 (74 percent) principal questionnaires were returned. Results reported here are from both the 2002 and 2004 SHEP school principal surveys.

Wisconsin Work-Related Asthma Survey

The work-related asthma (WRA) Workgroup of the Wisconsin Asthma Coalition developed a survey to assess the prevalence of WRA in members of Wisconsin Unions. Questions on asthma prevalence and symptoms, as well as symptoms due to work exposures were asked. In addition, information on demographics and occupation were collected. Due to limited funding, Wisconsin unions were selected as a means to collect information from a population of workers. Various unions were contacted to request their participation. The questionnaires were distributed to union members from those unions that agreed to participate. Participation by union members was strictly voluntary. Survey distribution began in October of 2003 and ended in March of 2004. A total of 7,108 questionnaires were distributed to union members. A total of 1,837 (25.8 percent) participants completed responses.

Youth Risk Behavior Survey

The Youth Risk Behavior Survey (YRBS) is part of a national surveillance system led by the Centers for Disease Control and Prevention. The survey is conducted in several states and large cities across the U.S. to monitor health-risk behaviors of public high school students in grades nine through twelve. In Wisconsin, the survey has been administered every two years since 1993 by the Wisconsin Department of Public Instruction.

Questions on asthma prevalence and asthma attacks have been included on the Wisconsin YRBS since 2003. Data from the 2005 YRBS was included in this report. In 2005, public schools in Wisconsin containing grades 9, 10, 11, and 12 were included in the sampling frame. The survey was completed by 2,389 students in 52 public high schools. The school response rate was 80 percent and the student response rate was 83 percent leading to an overall response rate of 67 percent.

Youth Tobacco Survey

The Wisconsin Youth Tobacco Survey (YTS) is a comprehensive measure of youth awareness, attitudes and related behaviors about tobacco use in Wisconsin. The purpose of this survey is to monitor trends of these attitudes and behaviors to assist in improving youth programs and initiatives. It is a nationwide survey coordinated by the CDC that was first administered in Wisconsin in the academic year 1999-2000. In Wisconsin, the survey is coordinated by the Bureau of Community Health Promotion in the Wisconsin Department of Health and Family Services. In Wisconsin, the survey has been continued on an annual basis in public middle school youth and biennially in public high school youth. The 2003 YTS, for the first time, included two asthma-related questions. Data in this report is from the 2004 and 2006 YTS, which included both public middle and high schools.

The YTS randomly samples from all eligible public schools in the state. All students in the selected classes were eligible to participate in the survey. The survey is administered during the spring semester of each academic year. In 2004, 43 of 50 (86 percent) randomly selected middle schools and 42 of 50 (84 percent) randomly selected high schools agreed to participate. In the participating schools, 1,682 of the 1,892 (89 percent) sampled middle school students and 1,443 of the 1,648 (88 percent) sampled high school students completed usable questionnaires. This resulted in an overall response rate of 77 percent for public middle schools and 74 percent for public high schools in 2004. In 2006, 43 of 50 (86 percent) public middle schools and 39 of 49 (79 percent) public high schools agreed to participate in the YTS. There were a total of 1,892 of 2,139 (88 percent) public middle school students and 1,739 of 2,400 (87 percent) public high school students that completed the survey. The overall response rate for 2006 was 76 percent in public middle schools and 69 percent in public high schools.

Appendix B. Detailed Data Tables

Table 17. Annual Number of Asthma Hospitalizations* among Wisconsin Residents, 1990-2005.

Age Group	Year																
	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
≤ 4	1,537	1,379	1,547	1,457	1,142	1,205	1,295	1,308	1,143	1,109	1,079	980	949	1,084	979	1,007	19,200
5-14	1,195	1,336	1,244	1,369	1,018	1,039	1,095	1,368	968	955	1,019	734	665	771	629	725	16,130
15-34	1,123	1,112	1,206	1,440	1,283	1,397	1,263	1,185	1,041	1,006	913	837	736	854	687	642	16,725
35-64	1,493	1,591	1,459	1,684	1,588	1,668	1,809	1,622	1,674	1,938	1,744	1,921	1,872	2,148	2,006	2,013	28,230
≥ 65	1,260	1,201	988	1,165	995	914	874	795	861	906	913	951	959	1,160	1,058	1,154	16,154
Sex																	
Male	3,015	2,992	2,966	3,200	2,577	2,644	2,697	2,716	2,231	2,427	2,322	2,173	2,061	2,375	2,109	2,267	40,772
Female	3,593	3,627	3,478	3,915	3,449	3,579	3,639	3,562	3,456	3,487	3,346	3,250	3,120	3,642	3,250	3,274	55,667
Race																	
White	-	4,418	4,310	2,924	4,011	4,168	4,133	4,089	3,632	3,804	3,594	3,596	3,434	4,020	3,607	3,555	57,295
African American	-	1,425	1,634	1,659	1,567	1,589	1,763	1,703	1,554	1,530	1,491	1,321	1,352	1,564	1,290	1,244	22,686
Native American	-	40	58	54	65	60	56	51	44	48	50	68	68	69	74	61	866
Asian	-	40	51	50	52	64	54	58	42	52	59	44	53	42	45	43	749
Ethnicity																	
Hispanic	-	-	194	234	210	232	226	211	201	232	122	138	163	189	193	204	2,749
Non-Hispanic	-	-	5,922	6,703	5,606	5,840	5,941	5,793	5,289	5,192	5,097	4,912	4,828	5,576	4,981	4,902	76,582
Total	6,608	6,619	6,444	7,115	6,026	6,223	6,336	6,278	5,687	5,914	5,668	5,423	5,181	6,017	5,359	5,541	96,439

*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Inpatient hospitalization discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Table 18. Annual Number of Asthma Emergency Department Visits* among Wisconsin Residents, 2002-2005.

Age Group	Year				
	2002	2003	2004	2005	Total
≤ 4	3,092	3,092	3,088	3,184	12,456
5-14	4,142	4,223	3,823	3,787	15,975
15-34	7,672	8,267	7,171	7,368	30,478
35-64	6,502	6,611	6,438	6,623	26,174
≥ 65	1,010	988	1,012	1,153	4,163
Sex					
Male	10,218	10,459	9,829	10,045	40,551
Female	12,200	12,722	11,703	12,070	22,115
Total	22,418	23,181	21,532	22,115	89,246

*Asthma listed as the principal diagnosis (ICD-9-CM codes 493.00 – 493.92)

Data Source: Emergency department visit discharge file, Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Appendix C. Table of County-Specific Data

Hospitalization and ED visit rates by county are summarized in Table 19. Ranks for each county by rate are presented with a lower rank signifying a higher rate in that county. For example, Milwaukee had the highest ED visit rate by county from 2003-2005 and thus was assigned an ED visit county rank of one.

Table 19. Hospitalization and Emergency Department Visit Rates and County Ranks, Wisconsin Counties, 2003-2005.

County	Hospitalization Rate per 10,000 (95% CI) 2003-2005	Hospitalization County Rank	ED Visit Rate per 10,000 (95% CI) 2003-2005	ED Visit County Rank
ADAMS	8.93 (6.73 – 11.63)	18	36.55 (32.18 – 40.91)	21
ASHLAND	12.37 (9.48 – 15.85)	9	48.37 (42.96 – 53.77)	7
BARRON	5.98 (4.77 – 7.40)	53	29.64 (26.92 – 32.36)	38
BAYFIELD	10.58 (7.88 – 13.91)	14	30.47 (25.82 – 35.12)	36
BROWN	8.78 (8.08 – 9.47)	20	39.62 (38.35 – 40.88)	16
BUFFALO	5.22 (3.41 – 7.64)	63	8.24 (6.01 – 11.03)	71
BURNETT	6.54 (4.55 – 9.09)	47	32.92 (28.27 – 37.56)	31
CALUMET	3.15 (2.25 – 4.28)	71	14.68 (13.02 – 16.34)	69
CHIPPEWA	11.01 (9.43 – 12.59)	13	36.43 (33.93 – 38.93)	22
CLARK	10.16 (8.24 – 12.07)	15	60.73 (56.52 – 64.93)	4
COLUMBIA	4.68 (3.69 – 5.86)	67	12.05 (10.55 – 13.55)	70
CRAWFORD	6.26 (4.31 – 8.79)	49	22.02 (18.43 – 25.60)	55
DANE	7.46 (6.98 – 7.93)	31	21.86 (21.19 – 22.54)	56
DODGE	7.59 (6.53 – 8.65)	30	35.87 (33.85 – 37.89)	25
DOOR	6.95 (5.31 – 8.95)	41	25.47 (22.26 – 28.68)	47
DOUGLAS	3.81 (2.85 – 4.98)	70	35.99 (32.98 – 39.00)	23
DUNN	7.38 (5.89 – 9.12)	32	25.89 (23.42 – 28.35)	44
EAU CLAIRE	7.66 (6.61 – 8.72)	29	25.17 (23.62 – 26.72)	48
FLORENCE	1.22* (0.03 – 6.80)	72	1.66* (0.45 – 4.25)	72
FOND DU LAC	5.40 (4.57 – 6.23)	61	21.13 (19.72 – 22.53)	60
FOREST	21.70 (16.48 – 28.05)	1	20.84 (16.33 – 26.20)	62
GRANT	5.88 (4.71 – 7.26)	55	23.35 (21.23 – 25.48)	52
GREEN	6.89 (5.41 – 8.65)	43	26.99 (24.28 – 29.70)	40
GREEN LAKE	5.06 (3.41 – 7.22)	64	39.60 (34.94 – 44.25)	17
IOWA	5.95 (4.31 – 8.02)	54	37.11 (33.01 – 41.22)	19
IRON	4.96* (2.48 – 8.87)	66	18.03 (12.33 – 25.46)	66
JACKSON	7.04 (5.05 – 9.56)	37	63.35 (57.34 – 69.36)	3
JEFFERSON	6.75 (5.69 – 7.81)	44	35.94 (33.80 – 38.08)	24
JUNEAU	12.54 (10.09 – 15.00)	8	39.87 (35.85 – 43.88)	15
KENOSHA	18.10 (16.89 – 19.31)	4	48.03 (46.33 – 49.74)	8
KEWAUNEE	5.00 (3.38 – 7.14)	65	18.23 (15.25 – 21.21)	64
LA CROSSE	4.49 (3.75 – 5.24)	68	21.61 (20.23 – 22.98)	58
LAFAYETTE	7.80 (5.49 – 10.75)	26	23.78 (20.04 – 27.51)	51
LANGLADE	6.07 (4.27 – 8.36)	52	43.91 (39.09 – 48.74)	12
LINCOLN	12.11 (9.87 – 14.36)	11	32.00 (28.89 – 35.11)	33

Appendices

MANITOWOC	8.02 (6.89 – 9.15)	24	27.80 (25.97 – 29.63)	39
MARATHON	8.22 (7.31 – 9.13)	23	16.02 (14.91 – 17.13)	68
MARINETTE	8.61 (6.97 – 10.24)	21	26.46 (23.95 – 28.97)	43
MARQUETTE	6.91 (4.89 – 9.49)	42	42.62 (37.30 – 47.93)	14
MENOMINEE	20.91 (13.89 – 30.22)	3	73.43 (61.68 – 85.19)	2
MILWAUKEE	20.93 (20.39 – 21.46)	2	96.34 (95.35 – 97.33)	1
MONROE	5.69 (4.46 – 7.14)	57	38.39 (35.40 – 41.39)	18
OCONTO	7.93 (6.35 – 9.78)	25	32.20 (29.25 – 35.15)	32
ONEIDA	9.21 (7.45 – 11.26)	17	25.02 (22.21 – 27.83)	49
OUTAGAMIE	5.36 (4.72 – 6.01)	62	23.89 (22.72 – 25.06)	50
OZAUKEE	5.62 (4.68 – 6.56)	59	22.36 (20.67 – 24.04)	54
PEPIN	17.59 (12.88 – 23.46)	5	21.81 (16.43 – 28.38)	57
PIERCE	8.86 (7.14 – 10.88)	19	17.76 (15.49 – 20.03)	67
POLK	7.28 (5.91 – 8.88)	33	26.46 (23.96 – 89.96)	42
PORTAGE	5.67 (4.56 – 6.77)	58	33.74 (31.58 – 35.91)	28
PRICE	4.40* (2.61 – 6.95)	69	31.27 (26.47 – 36.07)	34
RACINE	14.20 (13.24 – 15.17)	6	49.04 (47.50 – 50.58)	5
RICHLAND	12.31 (9.56 – 15.60)	10	49.01 (43.78 – 54.24)	6
ROCK	11.20 (10.24 – 12.15)	12	45.88 (44.18 – 47.59)	10
RUSK	6.99 (4.78 – 9.86)	40	44.68 (39.19 – 50.18)	11
SAUK	6.99 (5.74 – 8.24)	39	46.10 (43.25 – 48.96)	9
SAWYER	7.09 (4.97 – 9.82)	35	42.65 (37.40 – 47.89)	13
SHAWANO	7.00 (5.63 – 8.60)	38	33.60 (30.73 – 36.47)	29
SHEBOYGAN	13.22 (11.97 – 14.48)	7	21.34 (19.98 – 22.70)	59
ST. CROIX	8.38 (7.11 – 9.65)	22	20.86 (19.17 – 22.55)	61
TAYLOR	5.86 (4.08 – 8.14)	56	20.51 (17.38 – 23.64)	63
TREMPEALEAU	7.05 (5.35 – 9.11)	36	25.86 (22.69 – 29.03)	45
VERNON	6.65 (5.07 – 8.56)	45	30.70 (27.42 – 33.98)	35
VILAS	6.58 (4.78 – 8.83)	46	35.82 (31.47 – 40.16)	26
WALWORTH	9.54 (8.41 – 10.68)	16	29.98 (28.22 – 31.74)	37
WASHBURN	7.12 (4.90 – 10.0)	34	34.81 (29.87 – 39.75)	27
WASHINGTON	6.12 (5.32 – 6.93)	51	18.21 (17.00 – 19.43)	65
WAUKESHA	7.78 (7.26 – 8.30)	27	22.99 (22.20 – 23.78)	53
WAUPACA	5.50 (4.43 – 6.75)	60	37.03 (34.35 – 39.71)	20
WAUSHARA	6.19 (4.58 – 8.18)	50	32.94 (29.34 – 36.54)	30
WINNEBAGO	6.45 (5.71 – 7.19)	48	26.83 (25.57 – 28.10)	41
WOOD	7.78 (6.64 – 8.91)	28	25.86 (23.96 – 27.75)	46
Wisconsin Overall	10.38 (10.22 – 10.54)		41.32 (41.05 – 41.59)	

* Rates are based on less than 20 visits and should be interpreted with caution.

Data Source: Bureau of Health Information and Policy; prepared from data collected by the Bureau of Health Information and Policy through September 30, 2003 and thereafter by the Wisconsin Hospital Association Information Center, Inc.

Appendix D. 2006 National Center for Health Statistics (NCHS) Urban-Rural Classification

The NCHS has developed a six level urban/rural classification scheme as a method for studying the effect of urban versus rural environments on the health of individuals. Using this method, every county in the nation is given a classification based on three factors including:

- 1) The 2003 Office of Management and Budget (OMB) definitions of metropolitan and nonmetropolitan counties (with revisions through 2005)
- 2) The Rural-Urban Continuum Codes and the Urban Influence Codes classifications developed by the Economic Research Service of the U.S. Department of Agriculture
- 3) county-level data on several variables from Census 2000 and 2004 postcensal population estimates

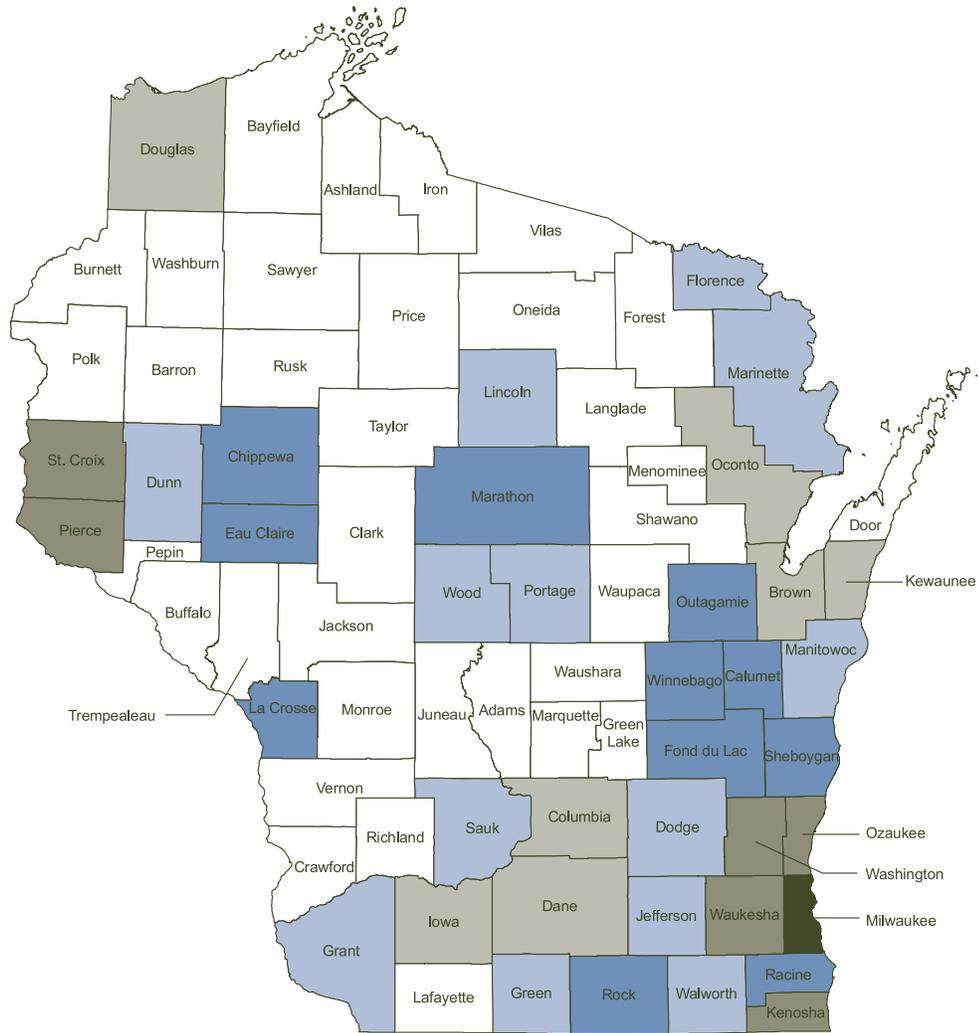
The classification system divides counties into one of six categories, four metropolitan and two nonmetropolitan (Table 20). The most urban category consists of large metropolitan central counties and the most rural category consists of nonmetropolitan noncore counties. Figure 60 shows the classification of Wisconsin's 72 counties according to the NCHS urban/rural classification system. Asthma prevalence, hospitalization, emergency department and mortality rates were calculated for Wisconsin according to this six category system to examine differences in asthma outcomes based on geography.

Table 20. Classification rules used to assign counties to the six urbanization levels of the 2006 NCHS Urban-Rural Classification.

Urban-rural category	Classification rules
Metropolitan	
Large central metro ¹	Counties in a metropolitan statistical area of 1 million or more population: 1) that contain the entire population of the largest principal city of the metropolitan statistical area, or 2) whose entire population resides in the largest principal city of the metropolitan statistical area, or 3) that contain at least 250,000 of the population of any principal city in the metropolitan statistical area
Large fringe metro	Counties in a metropolitan statistical area of 1 million or more population that do not qualify as large central
Medium metro	Counties in a metropolitan statistical area of 250,000 to 999,999 population
Small metro	Counties in a metropolitan statistical area of 50,000 to 249,999 population
Nonmetropolitan	
Micropolitan	Counties in a micropolitan statistical area
Noncore	Counties that are neither metropolitan nor micropolitan

¹There must be at least one large central county in each large metro area
 Data Source: 2006 NCHS Urban-Rural Classification Scheme for Counties
 Online: http://www.cdc.gov/nchs/r&d/rdc_urbanrural.htm

Figure 60. Classification of Wisconsin Counties using the 2006 NCHS Urban-Rural Classification.



Urban/Rural Classification

- Large Central Metro
- Large Fringe Metro
- Medium Metro
- Small Metro
- Micropolitan
- Noncore

Appendix E. Population Distribution of Wisconsin

According to the 2000 US Census, the Wisconsin population as of April 1st of 2000 was 5,363,675 persons. Although white persons continue to make up the majority of Wisconsin's population, there has been a large increase in the proportion of the population represented by other racial and ethnic groups. Wisconsin's total population of non-whites increased from 7.8 percent to 11.1 percent from 1990 to 2000. The fastest growing ethnic group in Wisconsin was the Hispanic or Latino population, which increased by 107 percent in this period (University of Wisconsin Extension and Applied Population Laboratory, 2001). African Americans continue to be the second largest racial group in Wisconsin representing 5.7 percent of the population. The population distribution of the United States is included in Table 21 for comparison to the Wisconsin population distribution.

Table 21. Wisconsin and US Census Data by Sex, Age Group, Race and Ethnicity, 2000.

	Population	Wisconsin Population Distribution (%)	US Population Distribution (%)
Male	2,649,041	49.4	49.1
Female	2,714,634	50.6	50.9
Under 5 years of age	342,340	6.4	6.8
5 to 9 years	379,484	7.1	7.3
10 to 14 years	403,074	7.5	7.3
15 to 19 years	407,195	7.6	7.2
20 to 24 years	357,292	6.7	6.7
25 to 34 years	706,168	13.2	14.2
35 to 44 years	875,522	16.3	16.0
45 to 54 years	732,306	13.7	13.4
55 to 59 years	252,742	4.7	4.8
60 to 64 years	204,999	3.8	3.8
65 to 74 years	355,307	6.6	6.5
75 to 84 years	251,621	4.7	4.4
85 years and over	95,625	1.8	1.5
One race	5,296,780	98.8	97.6
White	4,769,857	88.9	75.1
Black or African American	304,460	5.7	12.3
American Indian and Alaska Native	47,228	0.9	0.9
Asian	88,763	1.7	3.6
Native Hawaiian and Other Pacific Islander	1,630	-.*	0.1
Some other race	84,842	1.6	5.5
Two or more races	66,895	1.2	2.4
Hispanic or Latino (of any race)	192,921	3.6	12.5
Total Wisconsin population	5,363,675	100.0	

*-Represents zero or rounds to zero.

Data Source: U.S. Census Bureau, Census 2000

Appendix F. Behavioral Risk Factor Surveillance Survey Optional Modules**Adult Asthma Module: Questions asked of Adults with Current Asthma**

During the past 12 months, have you had an episode of asthma or an asthma attack?

- a. Yes
- b. No
- c. Don't know/Not sure
- d. Refused

During the past 12 months, how many times did you visit an emergency room or urgent care center because of your asthma?

- a. Number of visits ___
- b. None
- c. Don't know/Not sure
- d. Refused

During the past 12 months, how many times did you see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms?

- a. Number of visits ___
- b. None
- c. Don't know/Not sure
- d. Refused

During the past 12 months, how many times did you see a doctor, nurse or other health professional for a routine checkup for your asthma?

- a. Number of visits ___
- b. None
- c. Don't know/Not sure
- d. Refused

During the past 12 months, how many days were you unable to work or carry out your usual activities because of your asthma?

- a. Number of days
- b. None
- c. Don't know/Not sure
- d. Refused

Symptoms of asthma include cough, wheezing, shortness of breath, chest tightness and phlegm production when you don't have a cold or respiratory infection. During the past 30 days, how often did you have any symptoms of asthma?

- a. Not at any time
- b. Less than once a week
- c. Once or twice a week
- d. More than 2 times a week, but not every day
- e. Every day, but not all the time
- f. Every day, all the time
- g. Don't know/Not sure
- h. Refused

During the past 30 days, how many days did symptoms of asthma make it difficult for you to stay asleep?

- a. None
- b. One or two
- c. Three to four
- d. Five
- e. Six to ten
- f. More than ten
- g. Don't know/Not sure
- h. Refused

2002 through 2004 Pharmaceutical Question

During the past 30 days how often did you take asthma medication that was prescribed or given to you by doctor? This includes using an inhaler.

- a. Didn't take any
- b. Less than once a week
- c. Once or twice a week
- d. More than 2 times a week, but not every day
- e. Once every day
- f. 2 or more times every day
- g. Don't know/Not sure
- h. Refused

2005 Pharmaceutical Questions

During the past 30 days, how many days did you take a prescription asthma medication to PREVENT an asthma attack from occurring?

- a. Never
- b. 1 to 14 days
- c. 15 to 24 days
- d. 25 to 30 days
- e. Don't know/Not sure
- f. Refused

During the past 30 days, how often did you use a prescription asthma inhaler DURING AN ASTHMA ATTACK to stop it?

- a. Never (include no attack in past 30 days)
- b. One to four times (in the past 30 days)
- c. Five to fourteen times (in the past 30 days)
- d. Fifteen to twenty-nine times (in the past 30 days)
- e. Thirty to fifty-nine times (in the past 30 days)
- f. Sixty to ninety-nine times (in the past 30 days)
- g. More than 100 times (in the past 30 days)
- h. Don't know/Not sure
- i. Refused

Child Asthma Prevalence Module**2002 through 2004 Module**

Earlier you said there were [fill in number] children age 17 or younger living in your household. How many of these children have ever been diagnosed with asthma?

- a. Number of children ___
- b. None
- c. Don't know/Not sure
- d. Refused

[Fill in (Does this child/How many of these children) from Q1] still have asthma?

- a. Number of children ___
- b. None
- c. Don't know/Not sure
- d. Refused

2005 Module

The next two questions are about the "Xth" child.

Has a doctor, nurse or other health professional ever said that the child has asthma?

- a. Yes
- b. No
- c. Don't know/Not sure
- d. Refused

Does the child still have asthma?

- a. Yes
- b. No
- c. Don't know/Not sure
- d. Refused

2003 Work-Related Asthma Module: Questions asked of Adults with Current Asthma

Were you ever told by doctor or other medical professional that asthma was related to your job?

- a. Yes
- b. No
- c. Never worked outside the home
- d. Don't know/Not sure
- e. Refused

Did you ever tell doctor or other medical professional that asthma was related to job?

- a. Yes
- b. No
- c. Don't know/Not sure
- d. Refused

Occupation when first developed asthma symptoms

- a. Occupation__
- b. Not in labor force
- c. Don't know/Not sure
- d. Refused

Industry when first developed asthma symptoms

- a. Industry__
- b. Not in labor force
- c. Don't know/Not sure
- d. Refused

2005 Asthma Management Question: Question asked of Adults with Current Asthma

An asthma management plan is a printed form that tells when to change the amount or type of medicine, when to call the doctor for advice and when to go to the emergency room. Has a doctor or other health professional ever given you an asthma management plan?

- a. Yes
- b. No
- c. Don't know/Not sure
- d. Refused

Appendix G. Useful Asthma Links and Resources

Asthma Management

<http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.htm>

<http://www.cdc.gov/mmwr/preview/mmwrhtml/rr5206a1.htm>

Data and Surveillance

<http://www.cdc.gov/asthma/asthmadata.htm>

<http://diversitydata.sph.harvard.edu/index.jsp>

<http://childstats.gov/index.asp>

Asthma Initiatives

<http://www.chawisconsin.org/>

<http://www.lungusa.org/wisconsin/>

<http://www.chw.org/display/PPF/DocID/25086/router.asp>

<http://www.cdc.gov/asthma/interventions/default.htm>

Children, Adolescent & School Health

http://www.mchlibrary.info/KnowledgePaths/kp_asthma.html



Wisconsin Department of Health and Family Services

Author:

Rebecca Danhof, MPH, Epidemiologist, Bureau of Environmental and Occupational Health, Division of Public Health

CDC Asthma Capacity Building Grant:

Henry Anderson, MD, Co-Principal Investigator and Chief Medical Officer Bureau of Environmental and Occupational Health, Division of Public Health

Cristine Rameker, MPH, Asthma Program Manager, Bureau of Environmental and Occupational Health, Division of Public Health

Mark Werner, PhD, Co-Principal Investigator and Environmental Public Health Tracking Program, Bureau of Environmental and Occupational Health, Division of Public Health

Additional DHFS Reviewers:

Marni Bekkedal, PhD, Research Scientist, Environmental Public Health Tracking Program, Bureau of Environmental and Occupational Health, Division of Public Health

Kristen Malecki, PhD, Epidemiologist, Environmental Public Health Tracking Program, Bureau of Environmental and Occupational Health, Division of Public Health

William Otto, Section Chief, Bureau of Environmental and Occupational Health, Division of Public Health

Chuck Warzecha, MS, CIH, Director, Bureau of Environmental and Occupational Health, Division of Public Health

Arthur Wendel, MD, MPH, Former Centers for Disease Control and Prevention Epidemic Intelligence Office, Bureau of Environmental and Occupational Health, Division of Public Health

Centers for Disease Control and Prevention:

Joyalyn Hill, BSN, Public Health Advisor, National Asthma Control Program

Jeanne Moorman, MS, Statistician, National Asthma Control Program

Additional Contributors:

Jennifer Cohen, MLS, Fight Asthma Milwaukee Allies, Children's Research Institute, and Medical College of Wisconsin

Kristine Dawson, MS, APS Healthcare

Meredith Lins, RN, BSN, Bureau of Environmental and Occupational Health, Division of Public Health

John Meurer, MD, MBA, Fight Asthma Milwaukee Allies, Children's Research Institute, and Medical College of Wisconsin

Karl Pearson, MS, Research Analyst, Bureau of Health Information and Policy, Division of Public Health

Brian Weaver, Wisconsin Department of Public Instruction

Aaron Weier, GIS Analyst, Bureau of Information and Technology Services, Division of Enterprise Services

Anne Ziege, PhD, Behavioral Risk Factor Surveillance Survey Coordinator, Bureau of Health Information and Policy, Division of Public Health

Wisconsin Department of Health and Family Services

**Division of Public Health
Bureau of Environmental and Occupational Health**

**P.O. Box 2659
Madison, WI 53701-2659**

<http://dhfs.wisconsin.gov>

PPH 45055 (Rev. 10/07)