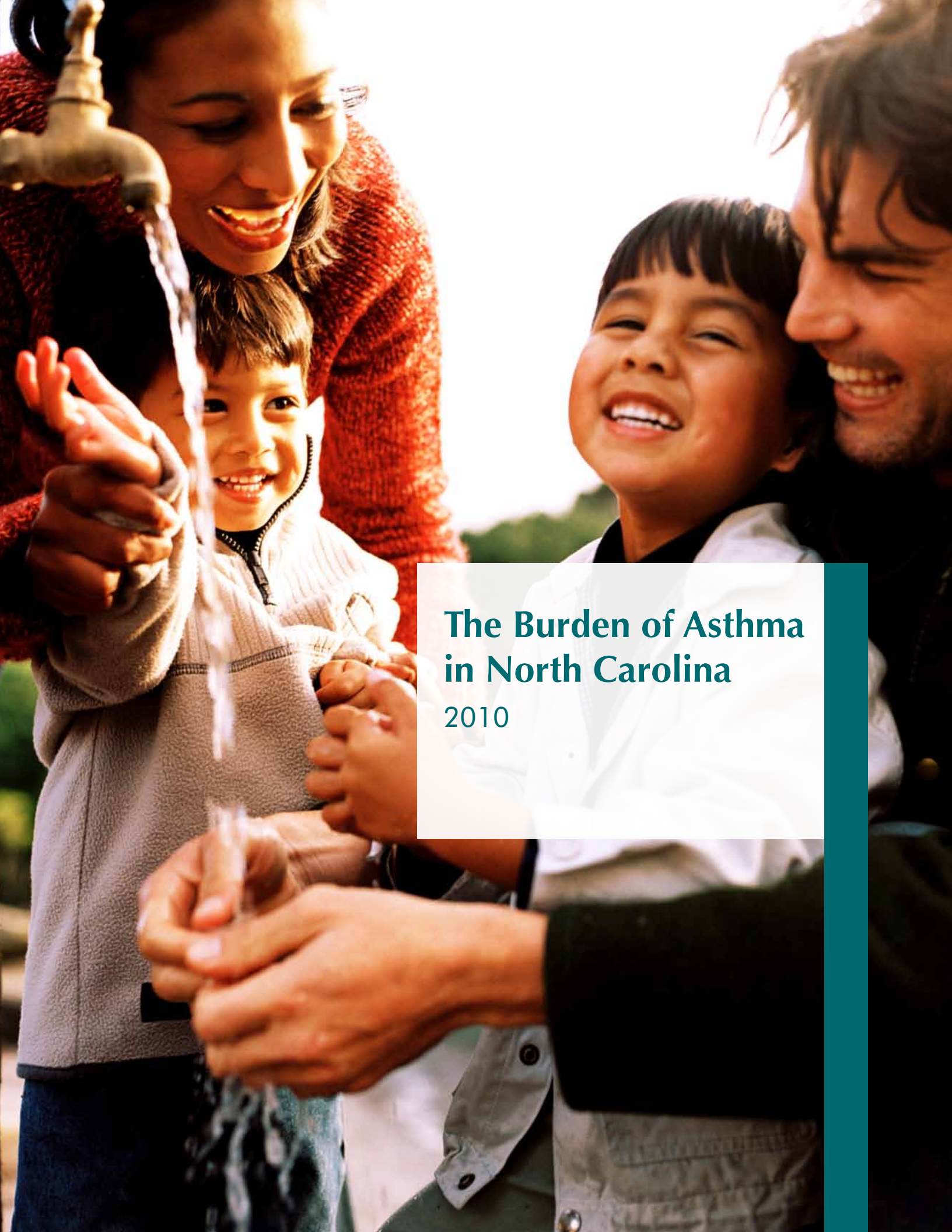

The Burden of Asthma in North Carolina

2010

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North Carolina Asthma Program
Chronic Disease & Injury Section
Division of Public Health
North Carolina Department of Health and Human Services

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Chronic Disease and Injury Section
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Table of Contents

List of Figures

List of Tables

Executive Summary

The status of asthma in North Carolina since the previous edition of this document has undergone some notable changes. Foremost among these is the continued decline in the overall asthma hospitalization and asthma mortality rates (all ages). Current asthma prevalence among children remained higher than the national rate, while current asthma prevalence among adults increased (although still below the national rate).

More recent data showed continued disparities by gender, race, age, education and income. Female adults continued to have higher asthma prevalence and asthma mortality than male adults. African Americans had especially disproportionate rates of asthma-related emergency department visits, hospitalizations, and mortality. Children under the age of five years had higher asthma hospitalization and emergency department visit rates than persons in the 5-64 years and 65 years and older age groups. Adult lifetime and current prevalence rates decreased with increasing educational level. Adults living in households with an annual income of less than $15,000 have higher asthma prevalence than persons in other income groups.

North Carolina data were better than the *Healthy People 2010* targets for the following objectives: Reduce pediatric asthma hospital admissions rate (among persons 0-17 years), reduce asthma deaths (among persons 65 years and older), and reduce hospitalizations for asthma (among persons 5-64 years and 65 years and older). Data from 2009 indicate that the state is also close to the HP2010 target to reduce hospital emergency department visits for asthma (among persons aged 5-64 years).

Key Findings

Asthma Prevalence

- Based on weighted prevalence rates, in 2010, it was estimated that over 383,000 children (16.8%) in North Carolina had been diagnosed with asthma at some point in their lives (lifetime asthma) and over 235,000 children (10.3%) still had asthma (current asthma).
- From 2005-2008, child current asthma prevalence in North Carolina decreased significantly (11.5% to 8.2%), but increased from 2008-2010 (8.2% to 10.3%).
- In 2009, boys had higher lifetime and current asthma prevalence than girls in North Carolina middle schools, while girls had higher current asthma prevalence than boys in North Carolina high schools.
- In 2009, asthma prevalence (lifetime and current asthma) was similar for North Carolina and national high school student rates.
- Based on 2010 weighted prevalence rates, it was estimated that approximately 901,000 adults (12.6%) in North Carolina were diagnosed with asthma at some point in their lives (lifetime asthma) and approximately 534,600 adults (7.5%) still had asthma (current asthma).
- In 2010, North Carolina groups with the highest asthma prevalence included: females (lifetime and current asthma), African Americans (current asthma), persons with less than a high school education (lifetime and current asthma), and persons living in households with an annual income of less than $15,000 (lifetime and current asthma).

Symptoms and Management

- In 2008, approximately 69 percent of adults with current asthma in North Carolina reported having symptoms of asthma at least weekly, and about half of adults reported experiencing asthma symptoms for at least one day during the past 30 days that made it difficult for them to stay asleep.
- In 2008, almost half of adults with current asthma reported having an asthma attack or episode in the past 12 months.
- In 2008, more adults with current asthma than adults without current asthma reported that their general health status was poor or fair.
- In 2010, among children with current asthma, almost half missed at least one day of day care or school in the past year because of their asthma.
- In 2008, over one-fourth of adults with current asthma reported that they were unable to work or carry out usual activities due to their asthma at least one day during the past 12 months.
- In 2010, 57.1 percent of North Carolina children with current asthma had received an asthma management plan from their doctor or health care provider.
- In 2009, 26.9 percent of North Carolina adults with current asthma reported that they received an asthma management plan from their doctor or healthcare provider.

Healthcare Utilization and Cost of Asthma

- In 2008, about 46 percent of North Carolina adults with current asthma reported that they did not see a doctor, nurse or other health professional for a routine checkup for their asthma in the past 12 months.
- In 2008, about 46 percent of adults with current asthma reported that they did not see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms in the past 12 months.
- From 2005-2010, nearly 26 percent of North Carolina children with current asthma visited an emergency department or urgent care center during the past 12 months because of their asthma.
- In 2008, 33 percent of North Carolina adults with current asthma visited an emergency department or urgent care center at least once in the past 12 months because of their asthma.
- From 2003-2009, the hospital discharge rates due to asthma (where asthma was the primary diagnosis) for North Carolina residents of all ages were lower than the national rates. During this time period, the state rate decreased by 23.1 percent (from 14.3 per 10,000 in 2003 to 11.0 per 10,000 in 2010).
- In 2008, among North Carolina adults with current asthma and no health insurance, 50.1 percent reported that they did not see a doctor, nurse or health professional for a routine checkup for their asthma in the past 12 months; 52.7 percent reported that they made no visits to a health professional for urgent treatment of worsening asthma symptoms in the past 12 months; 58.2 percent reported never having taken medication to prevent an asthma attack in the past 30 days; and 51.6 percent reported that they had never used an inhaler in the past 30 days during an asthma attack to stop it.
- In North Carolina, while the overall asthma hospital discharge rate decreased by 23.1 percent from 2003 to 2010, the average charge per case increased from $7,503 to $12,632 during that period.
- Among Medicaid recipients in North Carolina in 2008, children had higher average costs per visit than adults for outpatient services, emergency department visits, all pharmacy prescription drugs, and asthma medications.
- Among Medicaid recipients in North Carolina in 2008, adults had higher average costs per visit than children for inpatient services (<24 hours and 24+ hours).

Mortality

- Asthma mortality rates among all ages in North Carolina (2000-2010) were generally higher than those for the United States (2000-2010).
- In North Carolina (2000-2010), the mortality rate among persons aged 65 years and older (51.9 per million) was nearly four times higher than persons aged 35 to 64 years (13.5 per million).
- Asthma mortality rates among females were higher than males in North Carolina (2000-2010).
- Asthma mortality rates among African Americans were higher than whites in North Carolina (2000-2010).

Healthy People 2010

Reduce pediatric asthma hospitalization rate

- In 2010, the North Carolina pediatric asthma hospitalization rate (14.4 per 10,000) was better than the HP2010 target (17.3 per 10,000).

Reduce asthma deaths

- In 2010, the North Carolina asthma mortality rate among residents aged 35 to 64 years (13.3 per million) did not reach the HP2010 target (9.0 per million).

- In 2010, the North Carolina asthma mortality rate among residents aged 65 years and older (31.6 per million) was better than the HP2010 target (60.0 per million).

Reduce hospitalizations for asthma

- In 2010, the North Carolina asthma hospitalization rate among children under age 5 years (26.5 per 10,000) was worse than the HP2010 target (25.0 per 10,000).

- In 2010, the North Carolina age-adjusted asthma hospitalization rates among residents aged 5 to 64 years (7.0 per 10,000) and 65 years and older (2.2 per 10,000) were better than the HP2010 targets (7.7 per 10,000 and 11.0 per 10,000 respectively).

Reduce hospital emergency department visits for asthma

- In 2009, the North Carolina emergency department visit rates for asthma among children under age 5 years (102.0 per 10,000) and adults aged 65 years and older (23.3 per 10,000) were worse than the HP2010 targets (80.0 per 10,000 and 15.0 per 10,000, respectively).

- In 2009, the North Carolina emergency department visit rate for asthma among persons aged 5-64 years (49.8 per 10,000) was about the same as the HP2010 target (50.0 per 10,000).

Introduction

Asthma is a chronic lower respiratory disease that affects the lungs, causing repeated episodes of wheezing, shortness of breath, chest tightness, and nighttime or early morning coughing. In 2009, almost 40 million people (over 10 million children and over 29 million adults) in the United States had been diagnosed with asthma at some point in their lives. Approximately 7.1 million children and 17.5 million adults currently have this chronic disease.[1] It was estimated that the total economic cost of asthma in our country in 2010 was $20.7 billion. Of that, $15.6 billion was for direct costs, including hospital care ($5.5 billion), physician services ($4.2 billion), and prescription drugs ($5.9 billion).[2] Given its magnitude with respect to its notable prevalence and costs, the U.S. Department of Health and Human Services, through the Healthy People 2010 initiative's 10-year goals and objectives included asthma among the 28 focus areas.[3]

There is no consensus on what causes asthma; however, a number of associated risk factors and triggers have been identified. While a person may experience asthma episodes or attacks only when his or her lungs are irritated, once he or she has been diagnosed with asthma, it is with him or her for the rest of their lives.

During an asthma episode, the walls of the airways in the lungs become inflamed and swollen. Muscles around the airways tighten, and less air passes in and out of the lungs. Excess mucus forms in the airways, clogging them even more.[4] Asthma episodes can be caused by environmental factors, including allergens; irritants (e.g., cigarette smoke); medicines (e.g., aspirin); upper respiratory viral infections (e.g., colds); sulfites, a group of sulfur-based compounds that may occur naturally (e.g., in wine) or be added to food as an enhancer and preservative; and physical activity, including exercise.[5]

Although there is no cure, asthma can be controlled. Underscoring this observation, the National Asthma Education and Prevention Program (NAEPP) has the goal

"to help people with asthma control their asthma so that they can be active all day and sleep well at night."[6] The most recent update is the *"Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma—Full Report 2007."*[7]

As a public health priority, asthma can be viewed from several perspectives regarding its impact on the individual affected, the community, and society. Individuals with asthma have to cope with the disease's effect on their health, quality of life, and healthcare needs. Asthma control extends beyond the use of an asthma management plan (also called an asthma action plan – an individualized, written worksheet developed between the person with asthma and her/his healthcare provider that gives specific instructions for early treatment of asthma symptoms, steps to take to prevent the asthma condition from getting worse, and guidance on when to seek medical management or emergency/urgent care) and into the community. For example, policies that allow children to carry asthma medications to school and to self-administer them, and provide reimbursement to certified asthma educators are important considerations for the community at-large to support.

In order to support public health efforts to address these and other asthma issues, the Centers for Disease Control and Prevention (CDC) implemented the National Asthma Control Program[6] that coordinates asthma-related activities between and within states. The North Carolina Asthma Program, with funding from the CDC, strives to reduce the burden of asthma by:

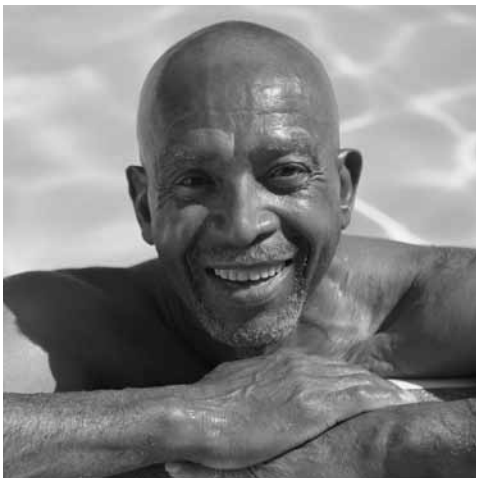
- Developing and maintaining a comprehensive statewide asthma surveillance system;
- Developing and implementing a State Asthma Plan that effectively addresses asthma in all ages, ethnic groups, backgrounds, and in multiple settings;
- Increasing public awareness of the importance of reducing the burden of asthma and the need for supportive policies and environments;
- Providing technical assistance and resources to help support local asthma coalitions;
- Facilitating communication and dissemination of asthma surveillance data to state and national partners; and
- Providing leadership and administration for the statewide asthma coalition, the Asthma Alliance of North Carolina.

The Burden of Asthma in North Carolina 2006 report provided baseline data as part of the Asthma Program's mission. The 2010 document continues the reporting of these surveillance data to guide interventions, support programs, and drive policies. This report uses several state and national surveys and data sources to describe asthma in North Carolina in terms of morbidity, symptoms and management, healthcare utilization, and mortality. New information provided by this report includes: county-level data for emergency department visits due to asthma, asthma in public schools, asthma co-morbidities, and asthma-related healthcare utilization costs by Medicaid recipients.

In this burden report, asthma-related objectives (within the Respiratory Diseases focus area) in Healthy People 2010 are also addressed. We examine North Carolina asthma deaths, hospitalizations, emergency department visits, activity limitations, school/work absenteeism, receipt of asthma education, and receipt of an asthma management plan. Additional 2010 demographic data for North Carolina are presented as Appendix B.

This report complements the Asthma Program's other activities which include the updating of the State Asthma Plan, developing and supporting partnerships and asthma coalitions, implementing and evaluating asthma educational programs, and increasing awareness of this chronic disease. *The Burden of Asthma in North Carolina 2010* report serves as the focal document in tracking and reporting the progress made by the Asthma Program with its partners and stakeholders in reducing the burden of asthma in North Carolina.

Asthma Prevalence



Asthma prevalence (often defined as the percent of the population reporting doctor-diagnosed asthma in a given time period) is commonly examined as an important component of disease burden. For this report, asthma prevalence was assessed using a variety of surveillance data sources. National asthma prevalence data come from the Behavioral Risk Factor Surveillance System (BRFSS)[8] and Youth Risk Behavior Surveillance System (YRBSS),[9] as reported by the Centers for Disease Control and Prevention (CDC), while North Carolina child asthma prevalence data are also available from the North Carolina Child Health Assessment and Monitoring Program (N.C. CHAMP).[10] The BRFSS survey is an annual, random-digit-dial telephone survey of non-institutionalized North Carolina adults aged 18 and older in households with landline telephones.[11] The YRBS is a statewide survey completed every other year (in odd years) designed to assess risk behaviors in school-age adolescents which impact their health.[12] Initiated in 2005, N.C. CHAMP is the first annual survey of its kind in North Carolina to measure the health characteristics of children under the age of 18 and is completed by the adult in the household most knowledgeable of the selected child's health. Additional information about these data sources can be found in Appendix A.

Child lifetime asthma prevalence is based on the number of N.C. CHAMP adult respondents who answered "yes" to the N.C. CHAMP question: "Has a doctor ever told you that (CHILD) has asthma?" Child current asthma prevalence is based on the proportion of respondents who answered "yes" to the child lifetime asthma question and "yes" to the follow-up question: "Does (CHILD) still have asthma?"

For middle and high school students (6th through 8th grades, 9th through 12th grades, respectively), **lifetime** asthma prevalence is based on the number of student-respondents who answer "yes" to the N.C. YRBS question: "Has a doctor or nurse **ever** told you that you have asthma?" For this group, **current** asthma

prevalence is based on respondents who answered "yes" to the lifetime asthma question and "yes" to the question: "Do you **still** have asthma?"

Adult lifetime asthma prevalence is based on the proportion of respondents (persons 18 years and older) who answered "yes" to the BRFSS question: "Have you ever been told by a doctor, nurse or other health professional that you had asthma?" Adult current asthma prevalence is based on the proportion of respondents who answered "yes" to the adult lifetime asthma question and "yes" to the follow-up question: "Do you still have asthma?"

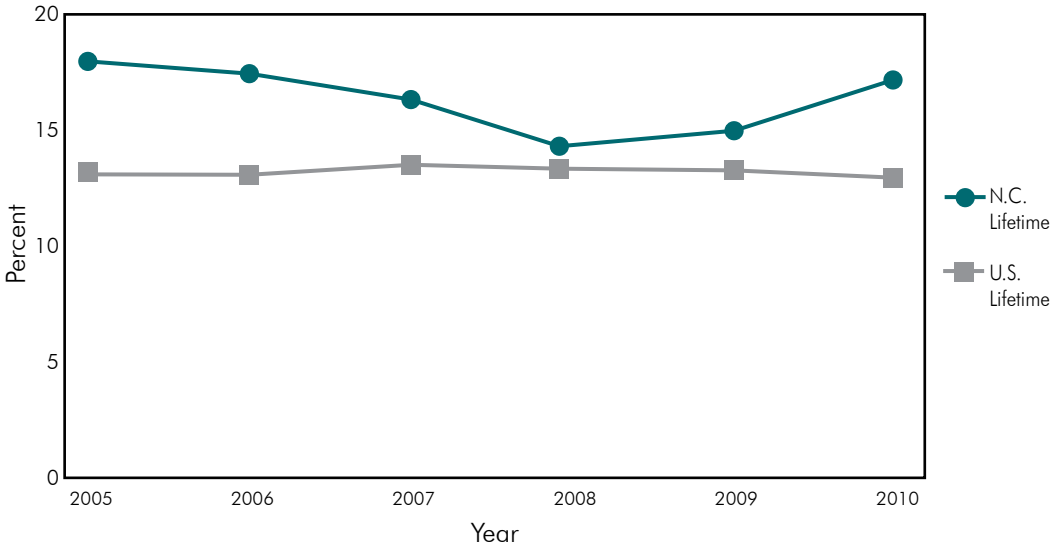
The following report contains sections on lifetime and current asthma prevalence for children, middle and high school students, and adults. Child asthma prevalence is presented by gender, race, age, grade level and type of health insurance coverage. Middle and high school student lifetime and current asthma is presented by gender, grade level, and race/ethnicity; and is compared to the national prevalence for students of the same grade level. Adult asthma prevalence is presented by gender, race/ethnicity, age, education level, annual household income, and age at first diagnosis. North Carolina adult asthma prevalence rates are also compared with national adult asthma rates. Prevalence rates are presented with 95 percent confidence intervals (CIs). Statistical significance (i.e., non-overlapping 95 percent CIs) is indicated wherever applicable and whenever a particular group is statistically different than the reference group (further description can be found in the Technical Notes). Data tables and web sites for the sources cited are placed in Appendix D.

Lifetime Asthma

Children

Based on the weighted prevalence rates, the number of children with lifetime asthma in North Carolina was estimated to be 377,620 in 2005 and 383,315 in 2010. The weighted prevalence percentages are given in the tables in Appendix D.

Figure 1-1. Lifetime Asthma Prevalence among Children, North Carolina and United States, 2005-2010

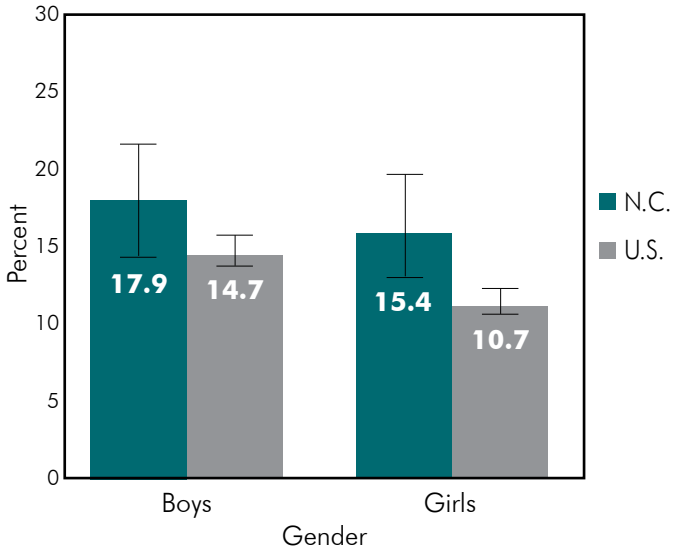


Sources: N.C.: 2005-2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

U.S.: 2005-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC (Data from 38 states plus the District of Columbia)

- From 2005 to 2010, lifetime asthma prevalence for children living in North Carolina was higher than that for children throughout the nation.
- From 2005 to 2008, lifetime asthma prevalence for children living in North Carolina declined from 17.8 percent to 14.2 percent (statistically significant decrease), but increased from 2008 to 2010 (16.8%).
- The lifetime asthma prevalence rates for children throughout the United States were similar to the rates in North Carolina (i.e., overlapping confidence intervals) from 2005-2010.

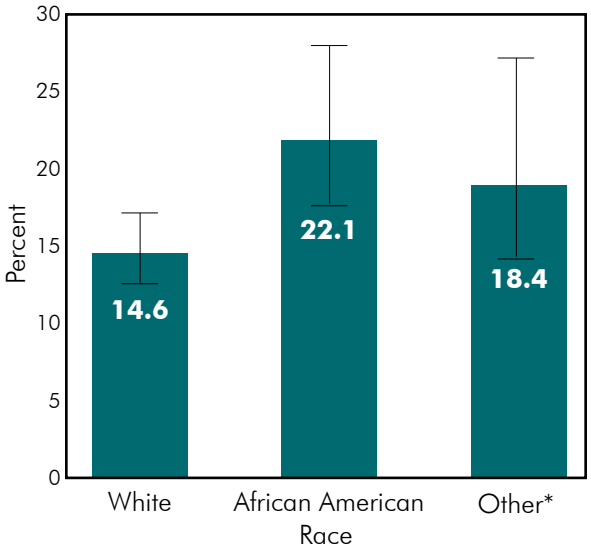
Figure 1-2. Lifetime Asthma Prevalence among Children, by Gender, North Carolina and United States, 2010



Sources: N.C.: 2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics
U.S.: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- Both boys and girls in North Carolina had higher lifetime asthma prevalence than their counterparts in the nation.
- Child lifetime asthma prevalence was higher among boys (17.9%) than girls (15.4%) in North Carolina.
- A similar pattern occurred throughout the nation (boys: 14.7%, girls: 10.7%).

Figure 1-3. Lifetime Asthma Prevalence among Children, by Race, North Carolina, 2010



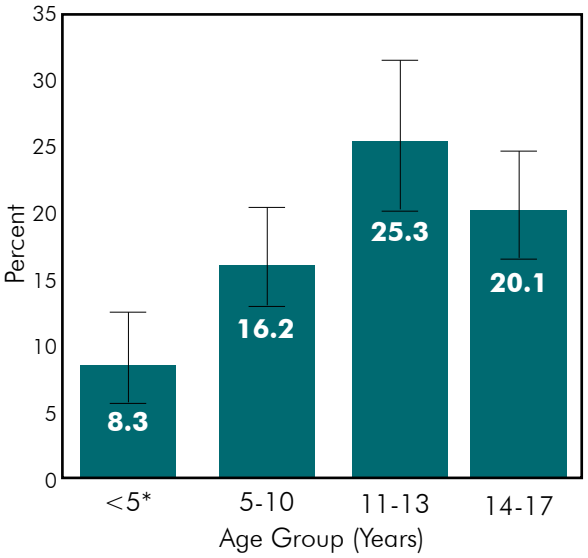
* "Other" race includes Asian, Native Hawaiian or other Pacific Islanders, American Indian or Alaskan Native or other.

Note: Prevalence data for the "Other" group are based on a numerator of less than 50; interpret with caution.

Source: N.C.: 2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Lifetime asthma prevalence was higher among African American children (22.1%) than white children (14.6%) (statistically significant).

Figure 1-4. Lifetime Asthma Prevalence among Children, by Age Group, North Carolina, 2010



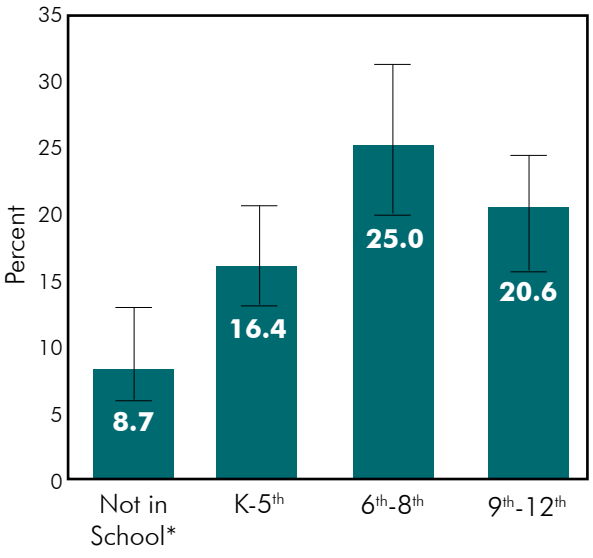
* Prevalence question asked only for children 1 year and older

Note: Prevalence data for the <5 year age group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

☐ The highest lifetime asthma prevalence was among children ages 11-13.

Figure 1-5. Lifetime Asthma Prevalence among Children, by Grade Level, North Carolina, 2010



* Children "Not in School" are those who are not yet in kindergarten.

Note: Prevalence data for the Not in School group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

☐ The highest asthma prevalence was among children in grades 6th-8th.

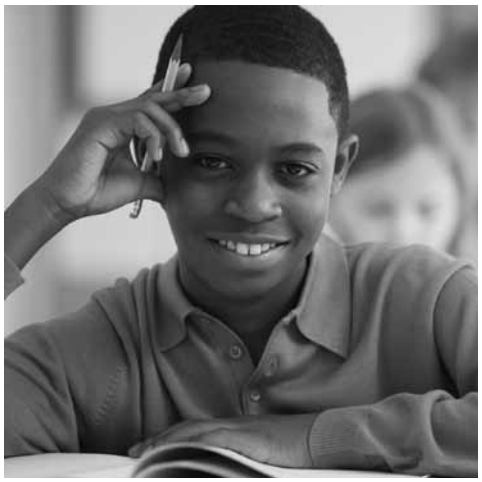
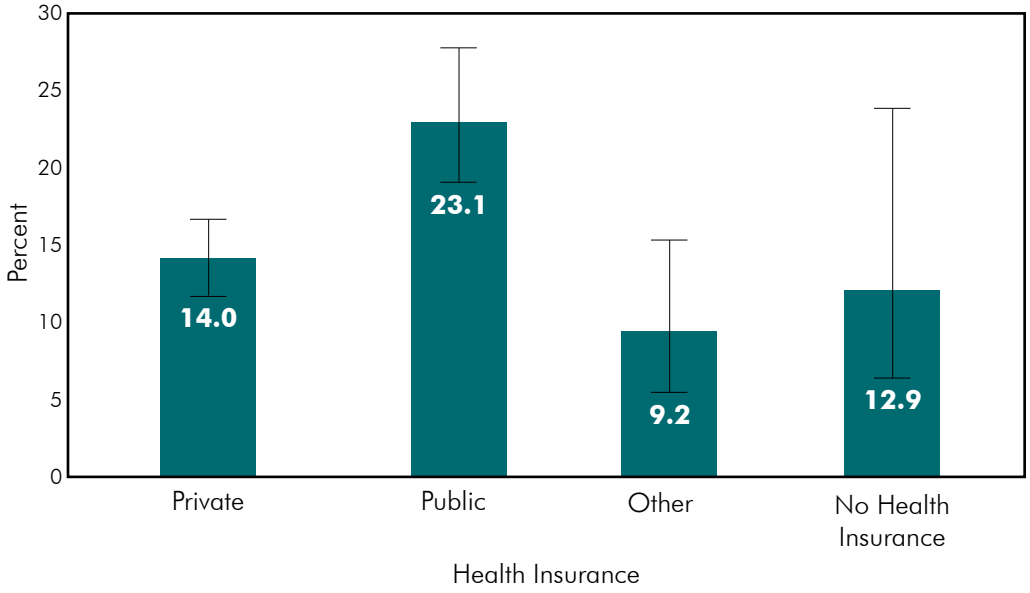


Figure 1-6. Lifetime Asthma Prevalence among Children, by Insurance Coverage, North Carolina, 2010



Note: Health insurance categories: **Private** = State Employee Health Plan, Blue Cross/Blue Shield of North Carolina, or other private health insurance plan purchased from an employer or directly from insurance company. **Public** = Medicaid, Carolina ACCESS, Health Check, or NC Health Choice (a free or reduced price comprehensive healthcare program for children in North Carolina). **Other** = CHAMPUS, TRI CARE, Indian Health Services or other type not otherwise listed. Prevalence data for the Other and No Health Insurance groups are based on a numerator of less than 50; interpret with caution.

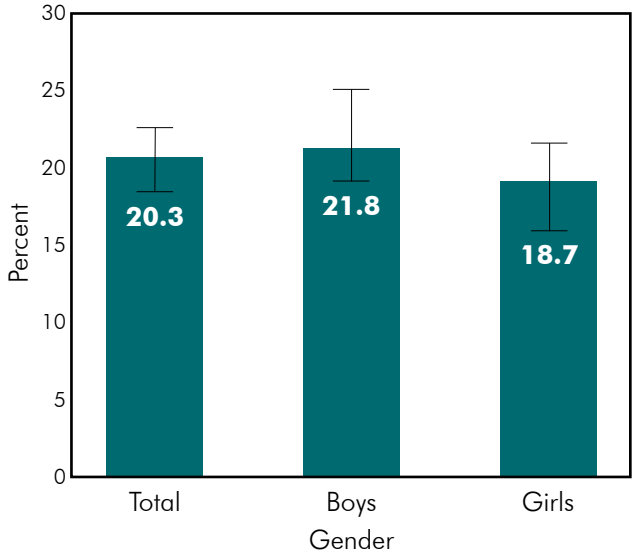
Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

☐ Compared to children with public health insurance (23.1%), children with private insurance coverage (14.0%) had lower lifetime asthma prevalence (statistically significant).

Middle School Students

Weighted data for the following section are from the 2007 N.C. Youth Risk Behavior Survey, with a sample size of 3,115.

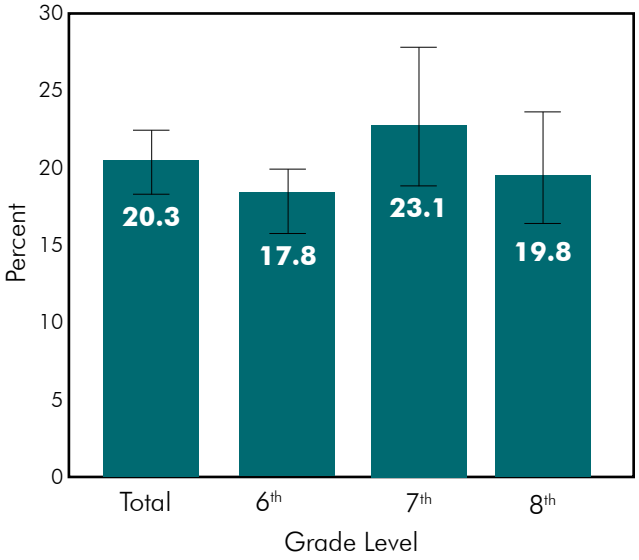
Figure 1-7. Lifetime Asthma Prevalence among Middle School Students, by Gender, North Carolina, 2007



Source: Middle School Reports, 2007 N.C. Youth Risk Behavior Survey

- Lifetime asthma prevalence was similar among middle school boys (21.8%) and girls (18.7%).

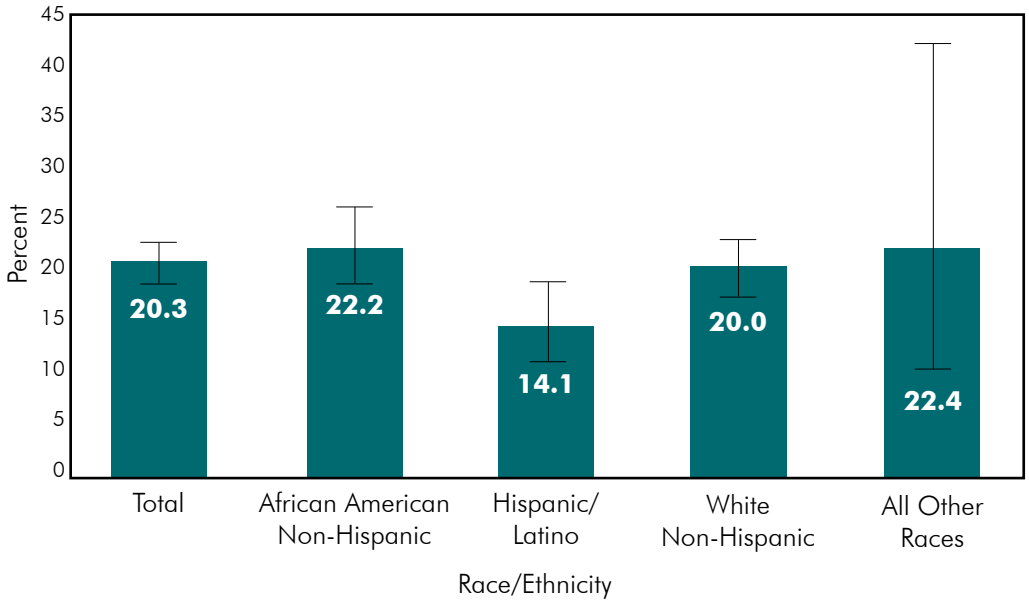
Figure 1-8. Lifetime Asthma Prevalence among Middle School Students, by Grade Level, North Carolina, 2007



Source: Middle School Reports, 2007 N.C. Youth Risk Behavior Survey

- Lifetime asthma prevalence was similar across the three grade levels.

Figure 1-9. Lifetime Asthma Prevalence among Middle School Students, by Race/Ethnicity, North Carolina, 2007



Note: Use caution in interpreting confidence intervals wider than 20 percentage points (All Other Races)

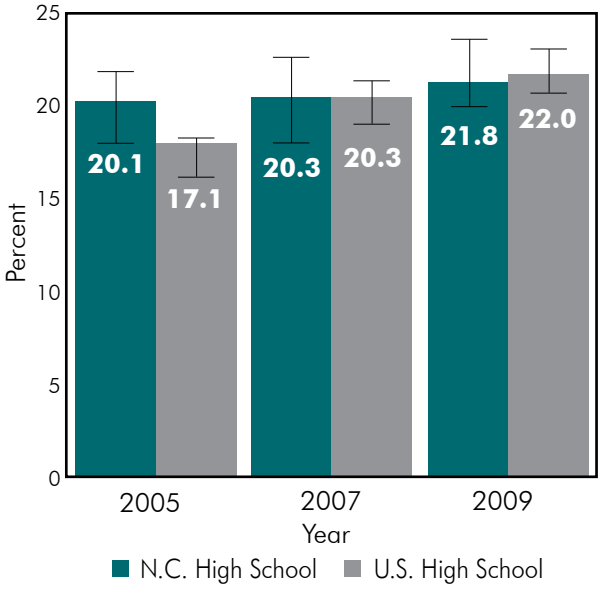
Source: Middle School Reports, 2007 N.C. Youth Risk Behavior Survey

☐ Lifetime asthma prevalence was similar across all race/ethnicity groups.

High School Students

Weighted data for the following section are from the Youth Online: High School Youth Risk Behavior Survey. The sample sizes ranged from 13,634 (U.S.) and 3,798 (N.C.) in 2005 to 16,089 (U.S.) and 5,564 (N.C.) in 2009.

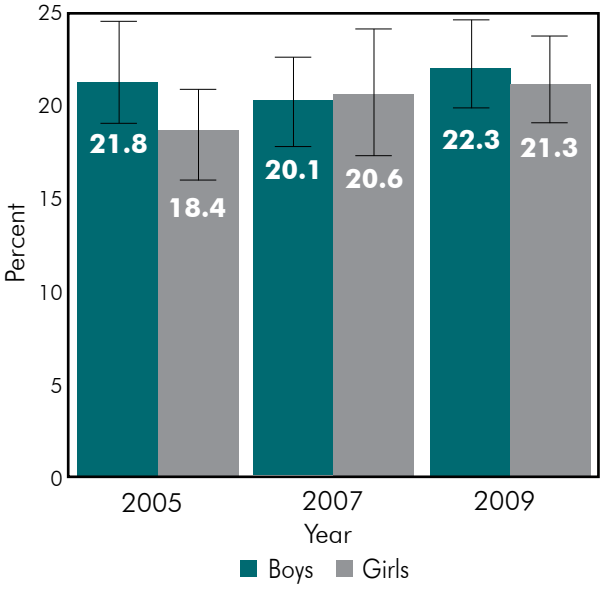
Figure 1-10. Lifetime Asthma Prevalence among High School Students, North Carolina and United States, 2005-2009



Sources: Youth Online: 2005-2009 High School Youth Risk Behavior Survey

- Lifetime asthma prevalence rates among high school students in North Carolina were similar from 2005 to 2009 and similar to the rates for national students.
- However, lifetime asthma prevalence for high school students throughout the nation increased from 2005 (17.1%) to 2009 (22.0%) (statistically significant).

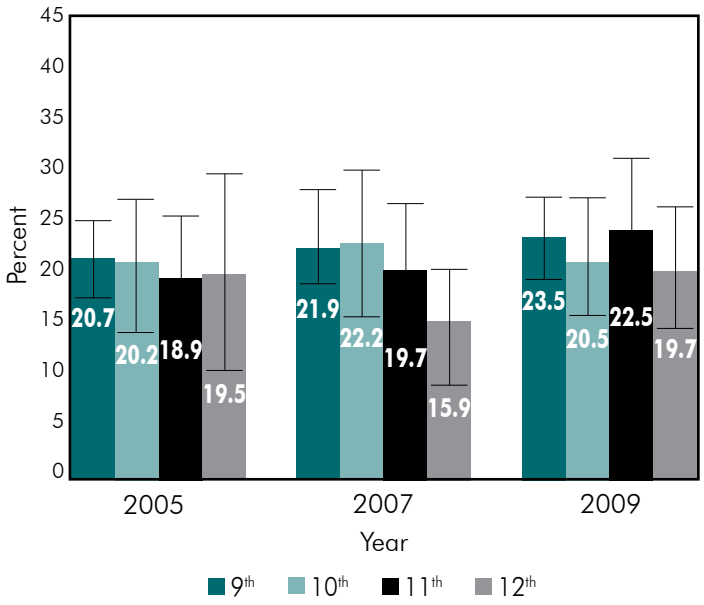
Figure 1-11. Lifetime Asthma Prevalence among High School Students, by Gender, North Carolina, 2005-2009



Sources: Youth Online: 2005-2009 High School Youth Risk Behavior Survey

- From 2005-2009, lifetime asthma prevalence among high school boys and girls was similar, although a slight increase was observed for girls over that period (18.4% to 21.3%).

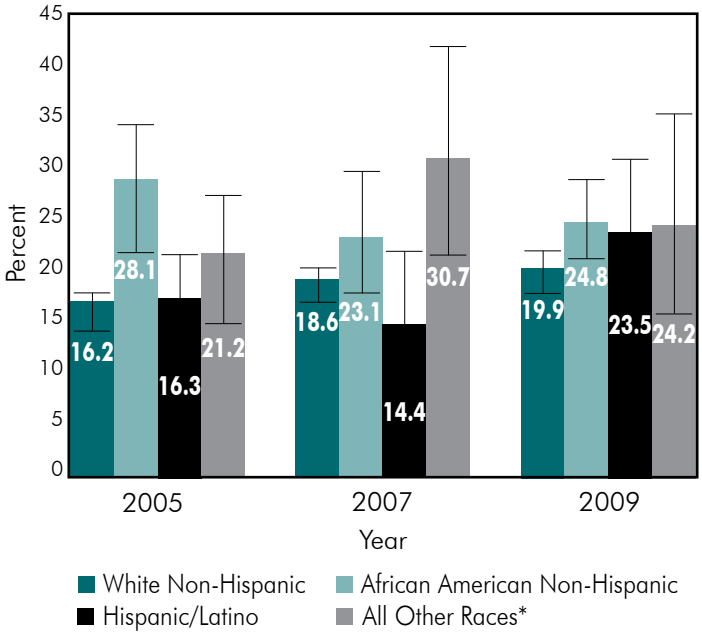
Figure 1-12. Lifetime Asthma Prevalence among High School Students, by Grade Level, North Carolina, 2005-2009



Source: High School Reports, 2005-2009 N.C. Youth Risk Behavior Survey

- Lifetime asthma prevalence was similar across all grade levels.
- Lifetime asthma prevalence for students in the 9th and 11th grades increased from 2005 to 2009 (2.8% and 3.6%, respectively).
- Except in 2005, students in the 12th grade had the lowest lifetime asthma prevalence when compared to the other grades.

Figure 1-13. Lifetime Asthma Prevalence among High School Students, by Race/ Ethnicity, North Carolina, 2005-2009



* "All Other Races" include: American Indian or Alaska Native, Asian, Native Hawaiian or other Pacific islander

Note: Use caution in interpreting confidence intervals wider than 20 percentage points (2007 All Other Races)

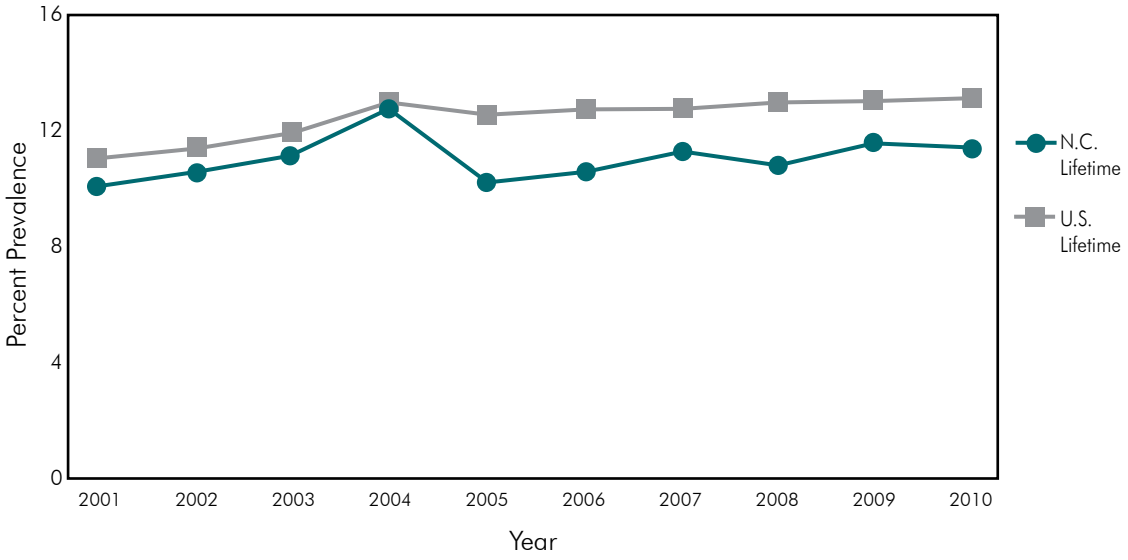
Source: High School Reports, 2005-2009 N.C. Youth Risk Behavior Survey

- In 2005, African American, Non-Hispanic high school students (28.1%) had a higher lifetime asthma prevalence rate than their White, Non-Hispanic (16.2%) and Hispanic/ Latino (16.3%) counterparts (statistically significant).
- Lifetime asthma prevalence was similar among all racial/ethnic groups in 2009.

Adults

BRFSS data are used to present adult asthma in North Carolina. Based on the weighted prevalence rates, the number of adults with lifetime asthma in North Carolina was estimated to be 624,605 in 2005 and 900,957 in 2010. The weighted prevalence percentages are given in the tables in Appendix D.

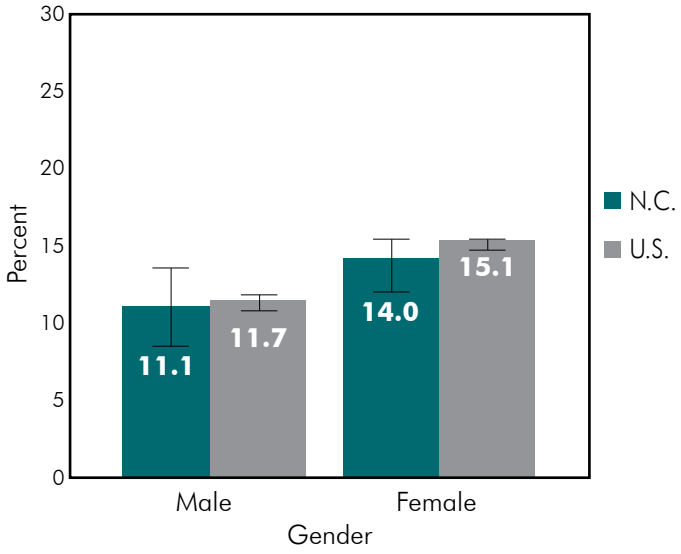
Figure 1-14. Lifetime Asthma Prevalence among Adults, North Carolina and United States, 2001-2010



Source: 2001-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- From 2001-2010, the lifetime asthma prevalence rates for North Carolina adults have consistently been lower than the national rates.
- Following the national trend, an increase can be seen from 2001 (10.1%) to 2010 (12.6%) in the North Carolina lifetime asthma prevalence rates (statistically significant); this is a 24.8 percent increase since 2001.
- Lifetime asthma prevalence throughout the nation also increased from 2001 (11.0%) to 2010 (13.5%) (statistically significant).
- The percentage increase (2.5%) for North Carolina was similar to the increase for the nation (2.5%).

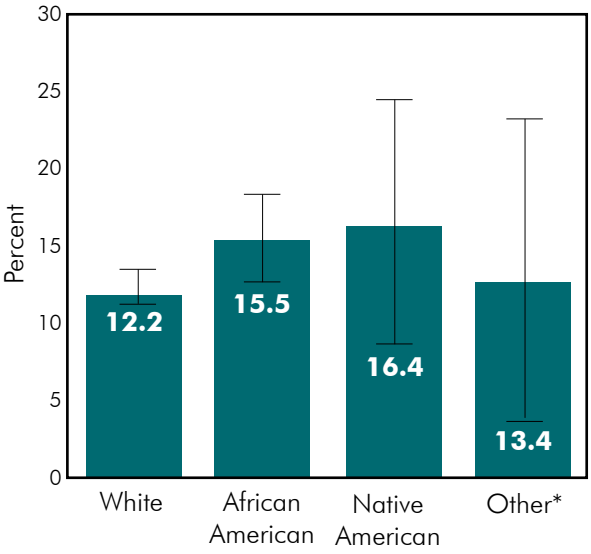
Figure 1-15. Lifetime Asthma Prevalence among Adults, by Gender, North Carolina and United States, 2010



Sources: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- Lifetime asthma prevalence was higher among females (14.0%) than males (11.1%) in North Carolina.
- These rates were lower than their national counterparts.
- U.S. females (15.1%) had a higher lifetime asthma prevalence rate than U.S. males (11.7%) (statistically significant).

Figure 1-16. Lifetime Asthma Prevalence among Adults, by Race, North Carolina, 2010



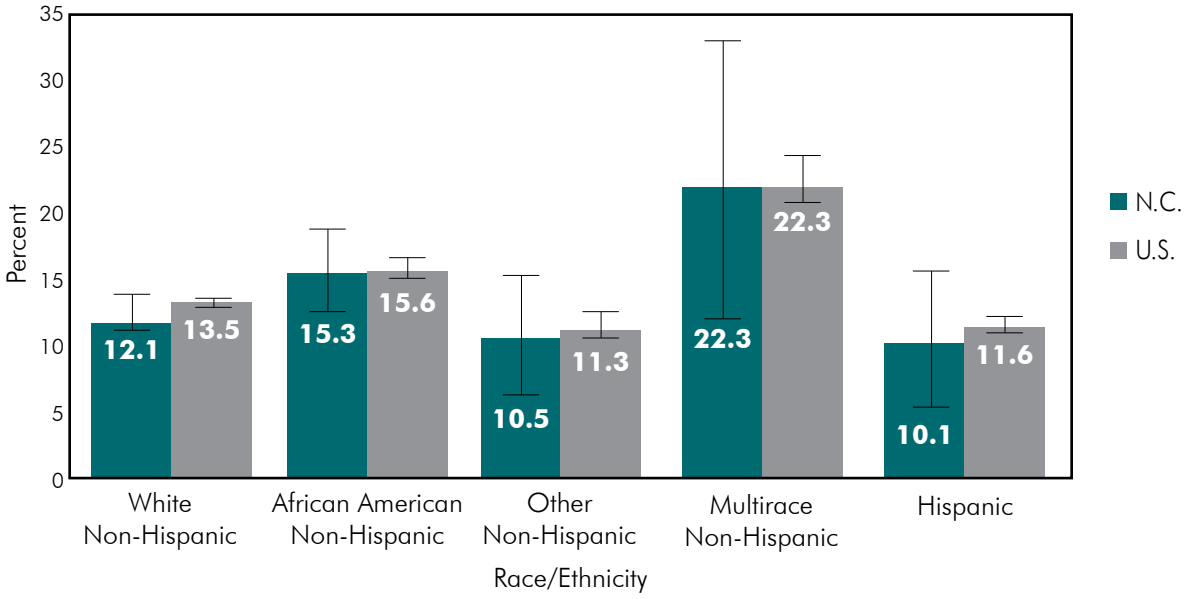
* "Other" race includes Native Hawaiian or other Pacific Islanders, not specified, or no preferred race.

Note: Prevalence data for the Native American and "Other" groups are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Native American adults (16.4%), had higher lifetime asthma prevalence than African American (15.5%), and white (12.2%) adults.

Figure 1-17. Lifetime Asthma Prevalence among Adults, by Race/Ethnicity, North Carolina and Unites States, 2010

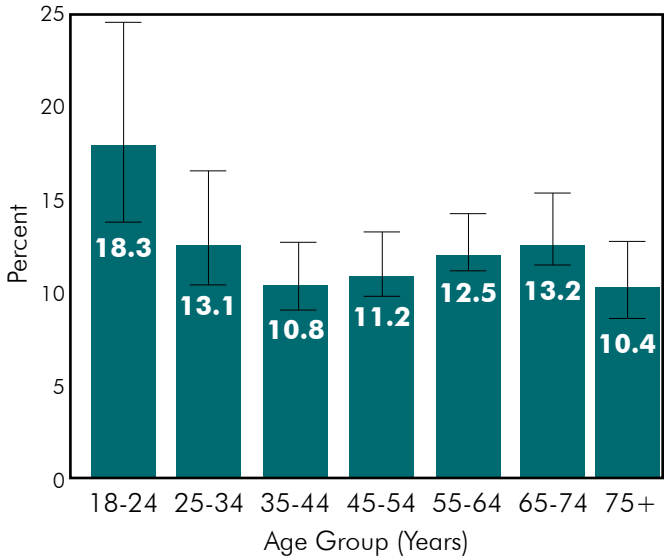


Note: Use caution in interpreting confidence intervals wider than 20 percentage points (North Carolina Multirace Non-Hispanic)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- Lifetime prevalence rates among all racial/ethnic groups in North Carolina were similar to the rates for these groups throughout the nation.
- North Carolina Hispanic adults had lower lifetime asthma prevalence (10.1%) than their non-Hispanic counterparts.
- Lifetime asthma prevalence among Hispanic adults (10.1%) in North Carolina was also lower than Hispanic adults (11.6%) throughout the nation.

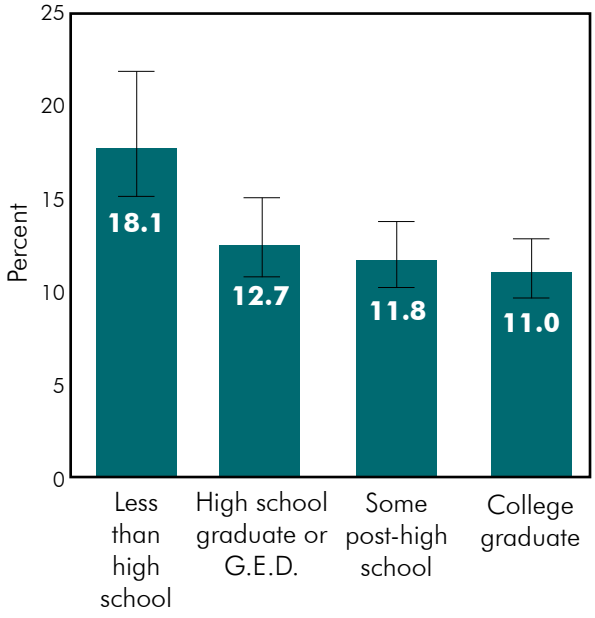
Figure 1-18. Lifetime Asthma Prevalence among Adults, by Age Group, North Carolina, 2010



Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- The lifetime asthma prevalence rate among adults in the 18-24 age group (18.3%) was higher than the rates among the 35-44 (10.8%), 45-54 (11.2%), and 75+ age (10.4%) groups (statistically significant).

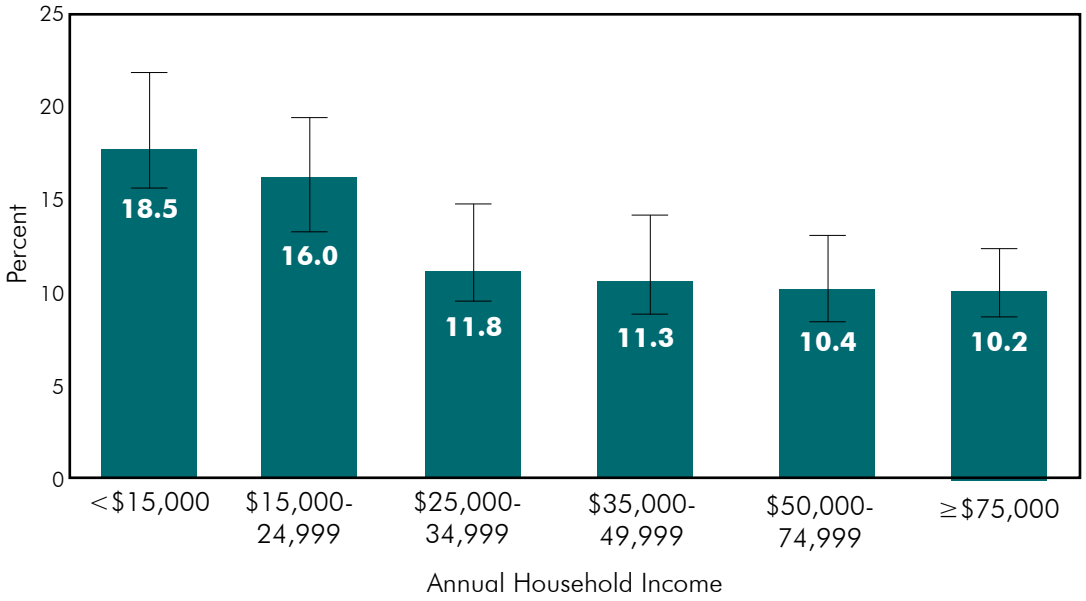
Figure 1-19. Lifetime Asthma Prevalence among Adults, by Educational Level, North Carolina, 2010



Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Lifetime asthma prevalence among adults decreased with increasing education level (less than high school – 18.1%; college graduate – 11.0%; statistically significant).

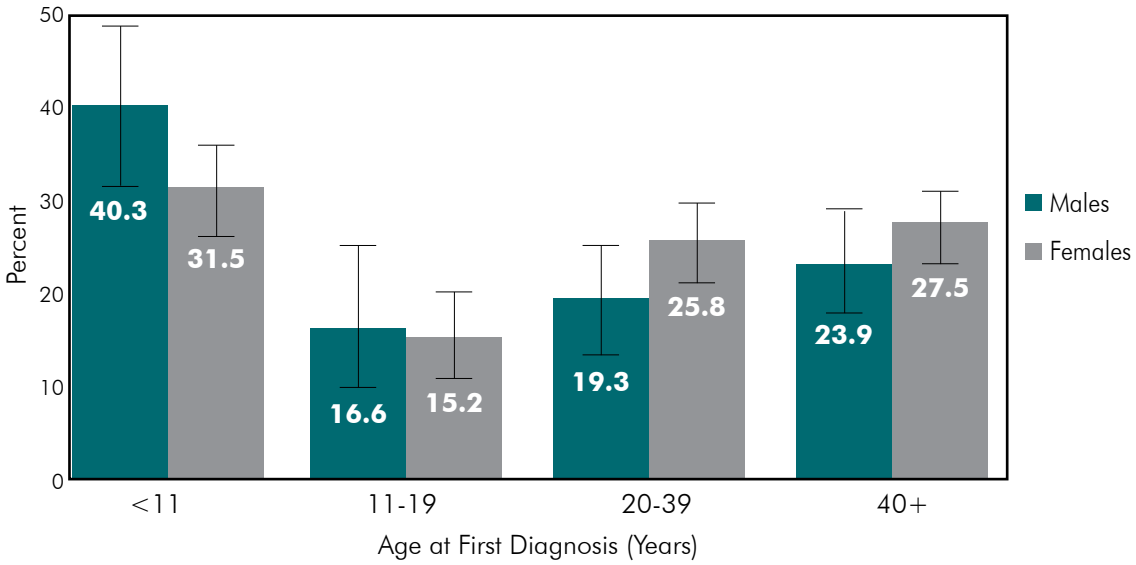
Figure 1-20. Lifetime Asthma Prevalence among Adults, by Annual Household Income, North Carolina, 2010



Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Lifetime asthma prevalence among adults decreased with increasing household income level (less than $15,000 – 18.5%; $75,000 or greater – 10.2%; statistically significant).
- Adults in households with incomes less than $15,000 had statistically, significantly higher lifetime asthma prevalence than those with higher incomes, except those in the $15,000-24,999 income group.

Figure 1-21. Age at First Diagnosis of Asthma among Adults, by Gender, North Carolina, 2008



Sources: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

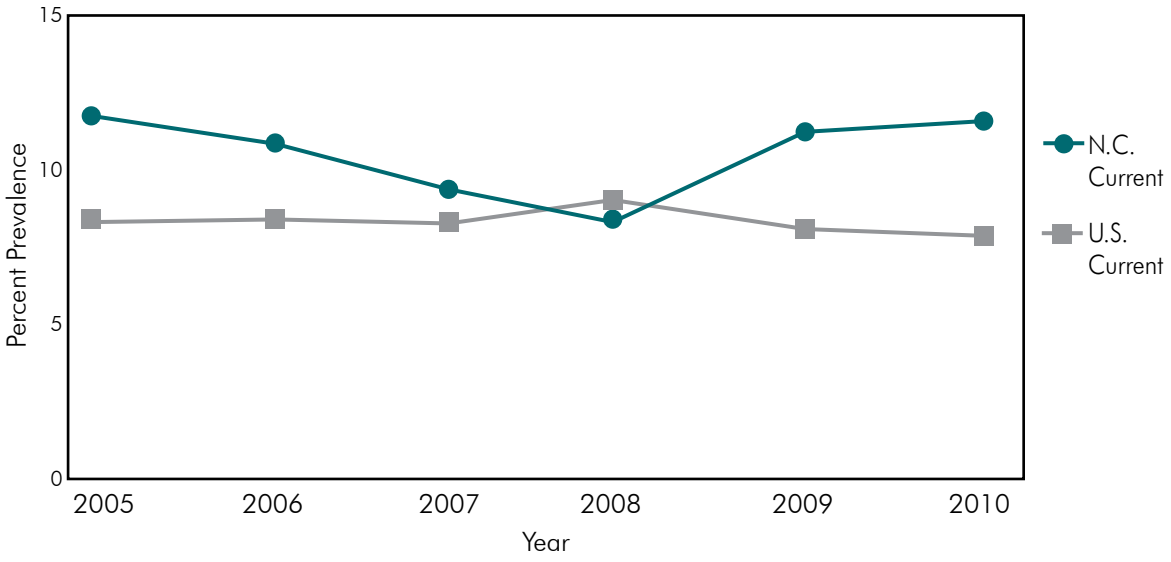
- Among adults with lifetime asthma, the highest proportion of males (40.3%) and females (31.5%) were first diagnosed at less than 11 years of age.
- More females than males were diagnosed at ages 20 and higher.

Current Asthma

Children

Based on the weighted prevalence rates, the weighted number of children with current asthma in North Carolina was estimated to be 243,968 in 2005 and 235,008 in 2010. The weighted prevalence percentages are given in the tables in Appendix D.

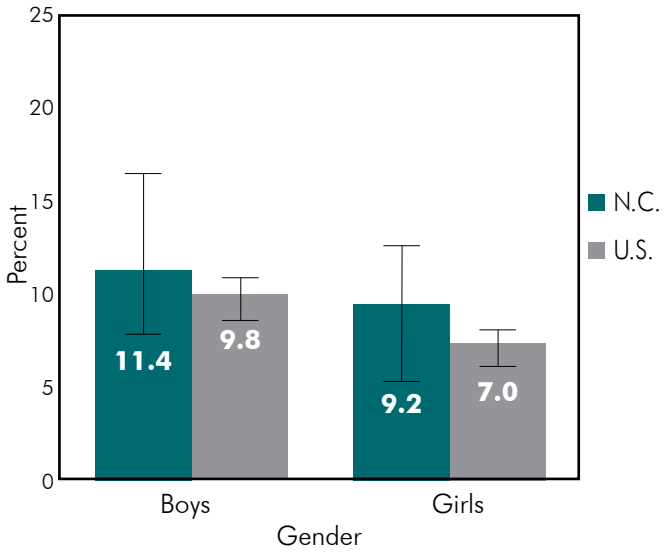
Figure 1-22. Current Asthma Prevalence among Children, North Carolina and United States, 2005-2010



Sources: N.C.: 2005-2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics
U.S.: 2005-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- With the exception of 2008, child current asthma prevalence in North Carolina was higher than the nation from 2005-2010.
- Child current asthma prevalence in North Carolina decreased (statistically significant) from 2005 (11.5%) to 2008 (8.2%), but then increased from 2008 to 2010 (10.3%).
- The current asthma prevalence rates for children throughout the nation were similar from 2005-2010.

Figure 1-23. Current Asthma Prevalence among Children, by Gender, North Carolina and United States, 2010

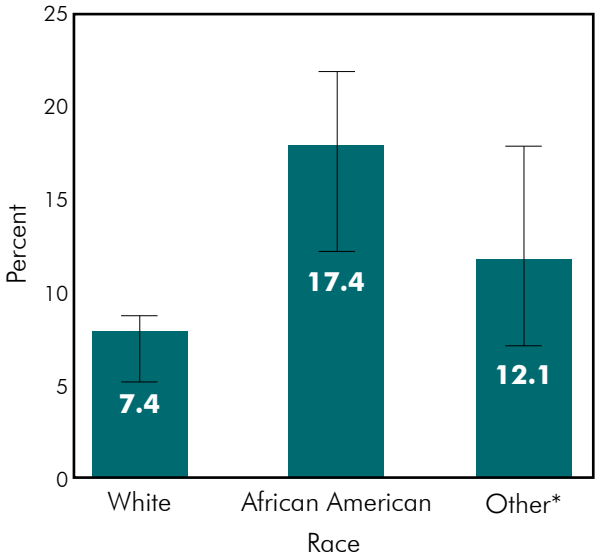


Sources: N.C.: 2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

U.S.: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- Child current asthma prevalence was higher among boys (11.4%) than girls (9.2%) in North Carolina.
- A similar pattern occurred throughout the nation – boys (9.8%) had higher child current asthma prevalence rates than girls (7.0%) (statistically significant).

Figure 1-24. Current Asthma Prevalence among Children, by Race, North Carolina, 2010



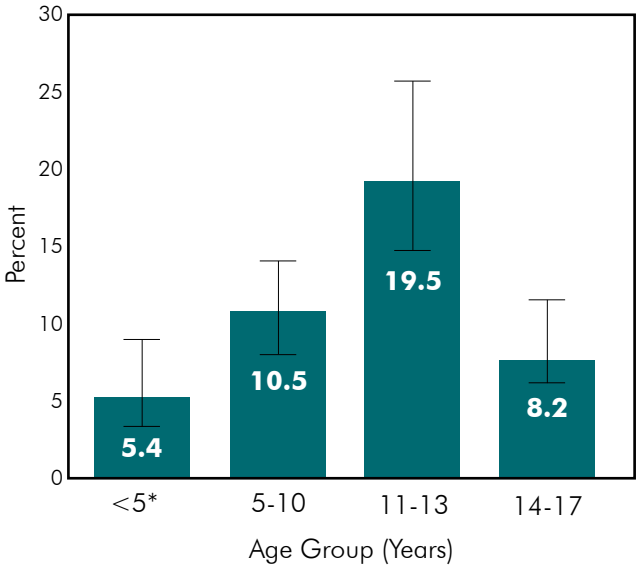
* "Other" race includes Asian, Native Hawaiian or other Pacific Islander, American Indians or Alaskan Native or other.

Note: Prevalence data for the "Other" group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Current asthma prevalence was higher among African American children (17.4%) than white children (7.4%; statistically significant).

Figure 1-25. Current Asthma Prevalence among Children, by Age Group, North Carolina, 2010



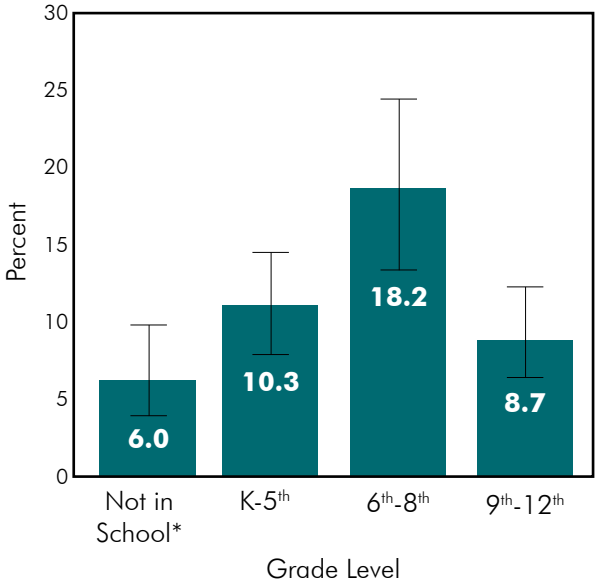
* Prevalence question asked only for children 1 year and older

Note: Prevalence data for the <5 year age group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Children aged 11-13 had a current asthma prevalence rate (19.5%) that was higher than the rates for the 5-10 and 14-17 year age groups (statistically significant).

Figure 1-26. Current Asthma Prevalence among Children, by Grade Level, North Carolina, 2010



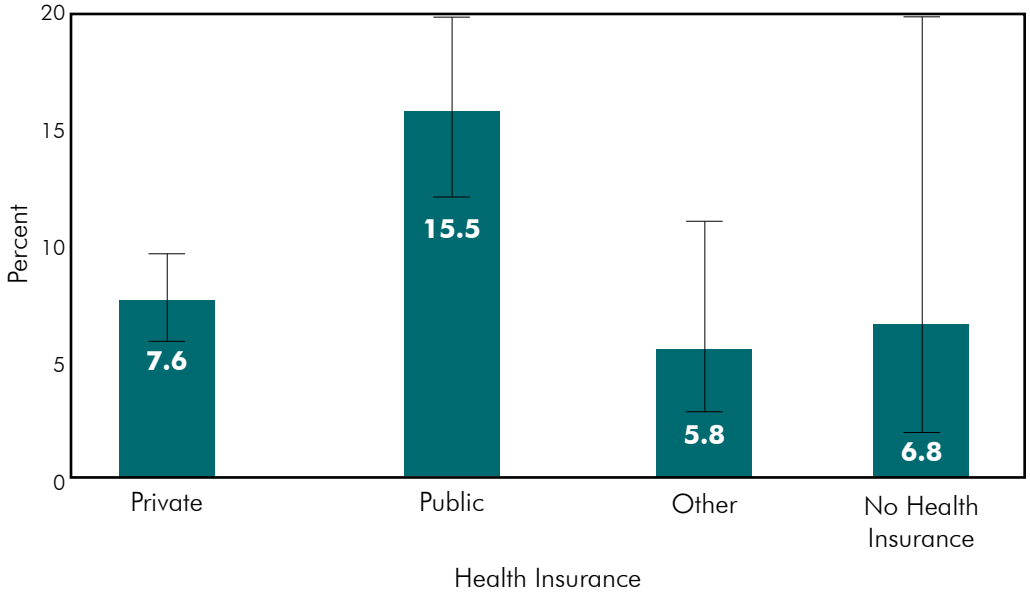
* Children Not in School are those not yet in kindergarten.

Note: Prevalence data for "Not in School" group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Children in 6th – 8th grades had a child current asthma prevalence rate (18.2%) that was higher than the rates for those in 9th-12th grades (8.7%) (statistically significant).

Figure 1-27. Current Asthma Prevalence among Children, by Insurance Coverage, North Carolina, 2010



Note: Health insurance categories: **Private** = State Employee Health Plan, Blue Cross/Blue Shield of North Carolina, or other private health insurance plan purchased from an employer or directly from insurance company. **Public** = Medicaid, Carolina ACCESS, Health Check, or NC Health Choice (a free or reduced price comprehensive healthcare program for children in North Carolina). **Other** = CHAMPUS, TRI CARE, Indian Health Services or other type not otherwise listed. Prevalence data for the Other and No Health Insurance groups are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Compared to children with public health insurance (15.5%), children with private insurance coverage (7.6%) had lower current prevalence (statistically significant).

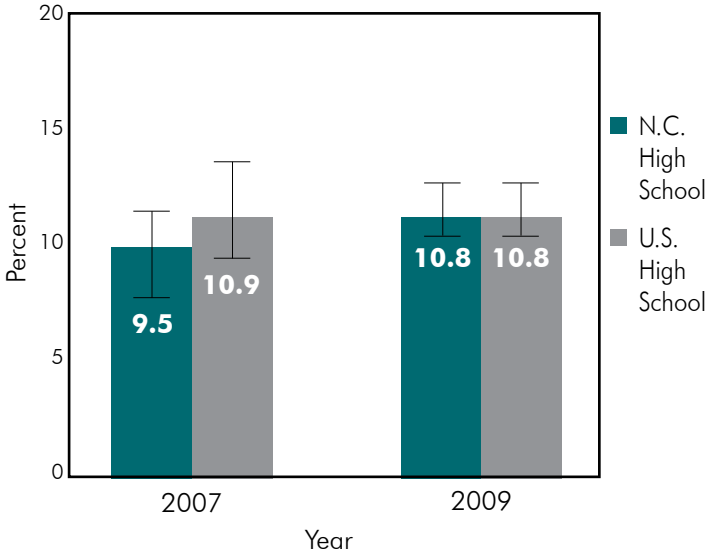
Middle School Students

- Current asthma prevalence was available only for N.C. middle school students (2009: 11.2%, unweighted sample size 3,353). (These percentages were provided by the Middle School Report, N.C. Youth Risk Behavior Survey, 2009.)
- Current asthma prevalence by gender for middle school students showed boys had a higher rate (11.5%) than girls (10.8%).
- Current asthma prevalence rates by grade level for middle school students were: 6th grade – 11.3 percent, 7th grade – 10.3 percent, 8th grade – 11.7 percent.
- Current asthma prevalence by race/ethnicity for middle school students showed non-Hispanic Black students had the highest rate (15.5%) compared to non-Hispanic White students (10.7%), Hispanic/Latino students (7.8%), and students from all other races (7.8%).

High School Students

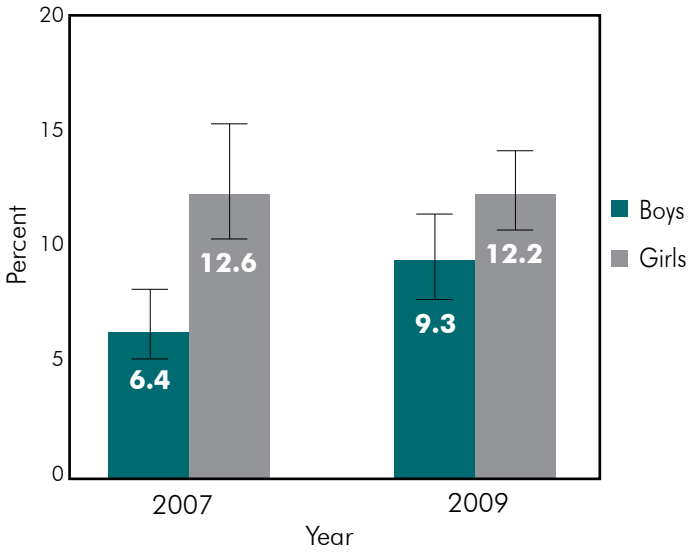
The following section focuses on current asthma among high school students, using weighted data from the Youth Risk Behavior Survey. It begins with a comparison of current asthma prevalence among high school students in North Carolina and throughout the nation.

Figure 1-28. Lifetime Asthma Prevalence among High School Students, North Carolina and United States, 2005-2009



Sources: Youth Online: 2007-2009 High School Youth Risk Behavior Survey

Figure 1-29. Current Asthma Prevalence among High School Students, by Gender, North Carolina, 2007-2009

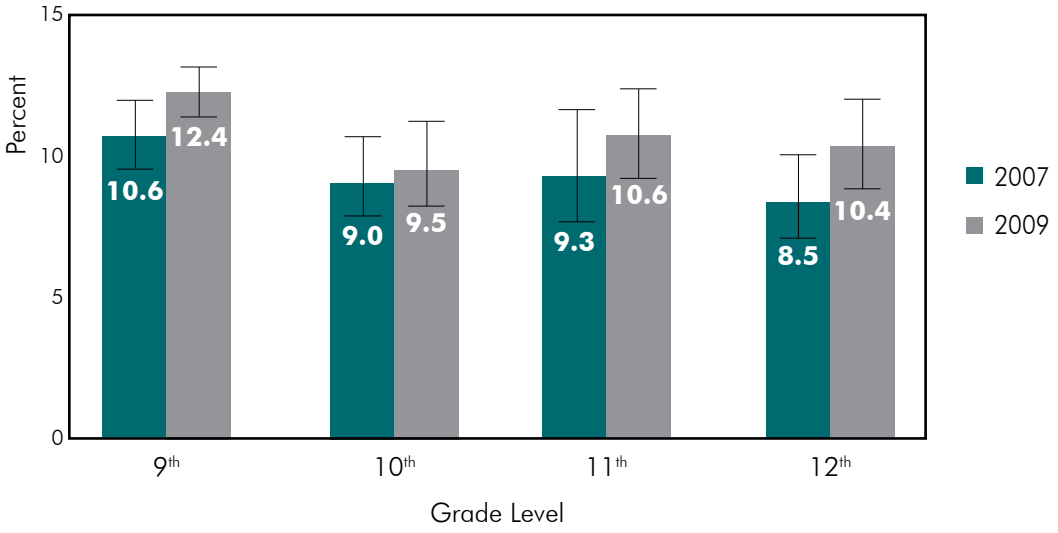


Source: Youth Online: 2007-2009 High School Youth Risk Behavior Survey

- Current asthma prevalence among North Carolina high school students in 2007 (9.5%) was slightly lower than the U.S (10.9%).
- Both the state and the national prevalence rates were 10.8 percent in 2009.

- In 2007, current asthma prevalence among high school girls (12.6%) was higher than boys (6.4%) (statistically significant).
- Girls' current asthma prevalence rates were similar from 2007 to 2009, while boys' current asthma prevalence rates increased slightly from 2007 to 2009.

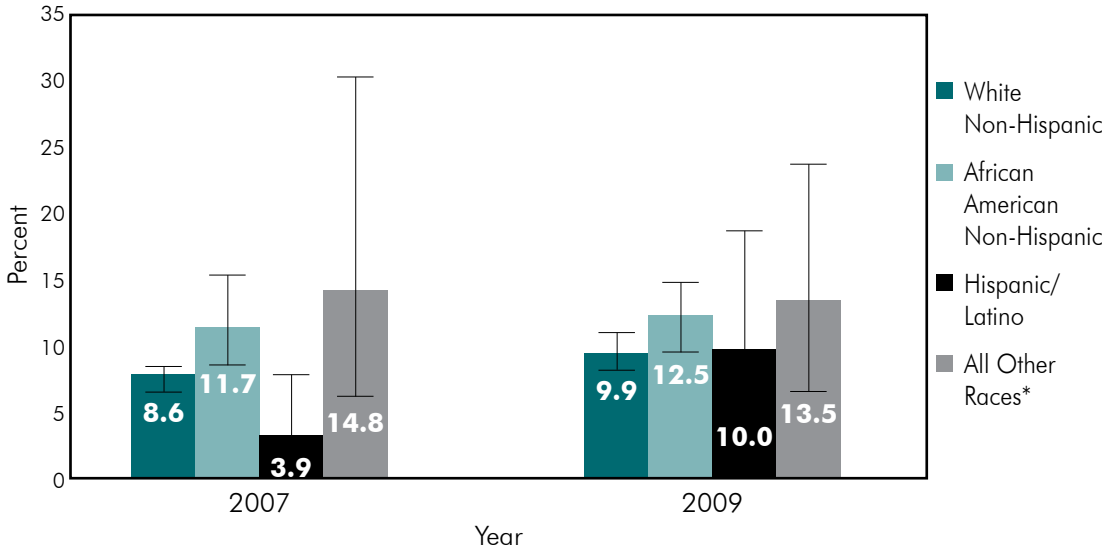
Figure 1-30. Current Asthma Prevalence among High School Students, by Grade Level, North Carolina, 2007-2009



Source: Youth Online: 2007-2009 High School Youth Risk Behavior Survey

- Current asthma prevalence increased for all grade levels from 2007 to 2009.
- During this period, the largest percentage increase was among 12th grade students (1.9%), followed closely by 9th graders (1.8%).
- Students in the 9th grade had the highest current asthma prevalence in 2007 (10.6%) and 2009 (12.4%).

Figure 1-31. Current Asthma Prevalence among High School Students, by Race/Ethnicity, North Carolina, 2007-2009



Note: "All Other Races" include Asian, American Indian or Alaskan Native, Native Hawaiian or Other Pacific Islander

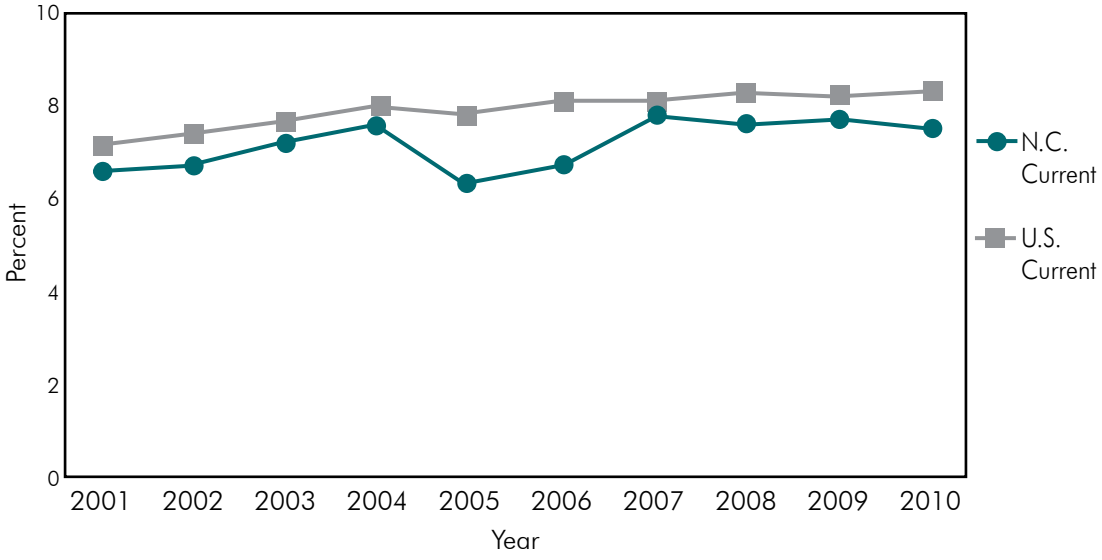
Sources: Youth Online: 2007-2009 High School Youth Risk Behavior Survey

- Hispanic/Latino students had the lowest prevalence (3.9%) in 2007, which was lower than those for African American, Non-Hispanic students (11.7%; statistically significant).
- Only students from "All Other Races" exhibited a decrease in current asthma prevalence from 2007 (14.8%) to 2009 (13.5), while the other three racial/ethnic groups had increases.
- Current asthma prevalence increased from 2007 to 2009 for white Non-Hispanic, African American Non-Hispanic, and Hispanic/Latino students.

Adults

Based on the weighted prevalence rates, the weighted number of adults with current asthma in North Carolina was estimated to be 397,774 in 2001 and 534,605 in 2010. The weighted prevalence percentages are given in the tables in Appendix D. The following section begins with a comparison of current asthma prevalence among adults in North Carolina and throughout the nation.

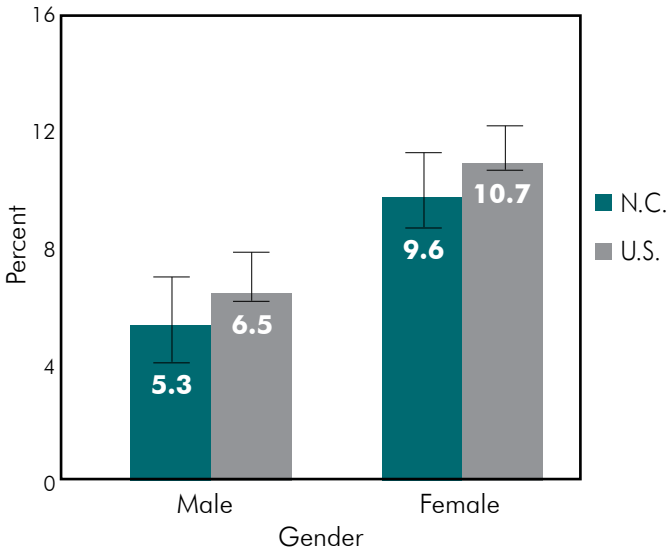
Figure 1-32. Current Asthma Prevalence among Adults, North Carolina and United States, 2001-2010



Source: 2001-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- During this span of 10 years, the current asthma prevalence rates for North Carolina adults have consistently been lower than the national rates; only for 2005 and 2006 were the state rates statistically significantly lower than the national rates.
- However, following the national trend, an increase can be seen from 2001 (6.4%) to 2010 (7.5%) in current state asthma prevalence rates, although the percentage increase (1.1%) for North Carolina was lower than the nation (1.4%).
- Adult current asthma prevalence increased from 2001 (7.2%) to 2010 (8.6%) throughout the nation (statistically significant).

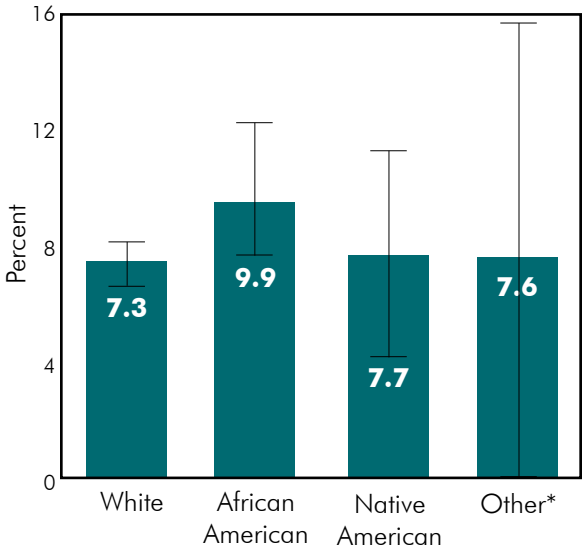
Figure 1-33. Current Asthma Prevalence among Adults, by Gender, North Carolina and United States, 2010



Sources: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

- Adult current asthma prevalence for females (9.6%) was greater than for males (5.3%) in North Carolina; these rates were lower than their national counterparts.
- Adult current asthma prevalence for females (10.7%) was higher than for males (6.5%) throughout the nation (statistically significant).

Figure 1-34. Current Asthma Prevalence among Adults, by Race, North Carolina, 2010



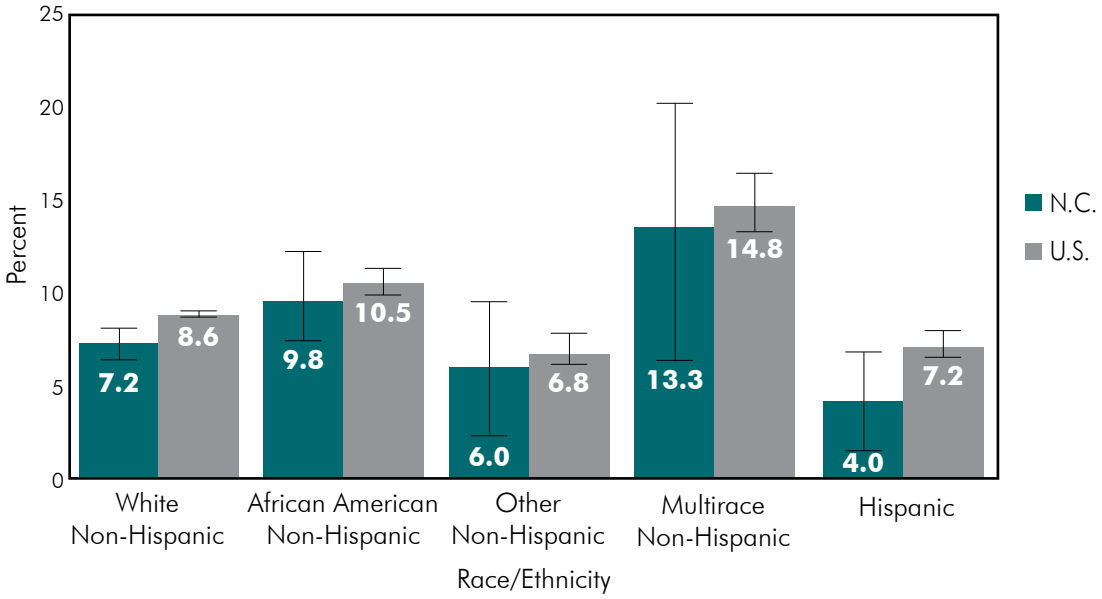
* "Other" race includes Native Hawaiian or other Pacific Islanders, not specified, or no preferred race.

Note: Prevalence data for the Native American and Other groups are based on numerators of less than 50; interpret with caution.

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- African American, Non-Hispanic adults (9.9%), had a higher adult current asthma prevalence than white, Non-Hispanic adults (7.3%).

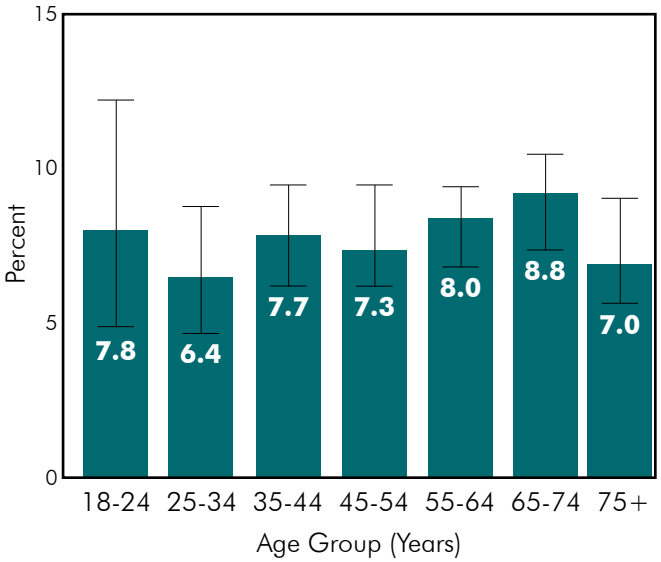
Figure 1-35. Current Asthma Prevalence among Adults, by Race/Ethnicity, North Carolina and United States, 2010



Sources: 2010 N.C. Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

☐ Hispanic adults had lower adult current asthma prevalence than their non-Hispanic counterparts in North Carolina and throughout the United States.

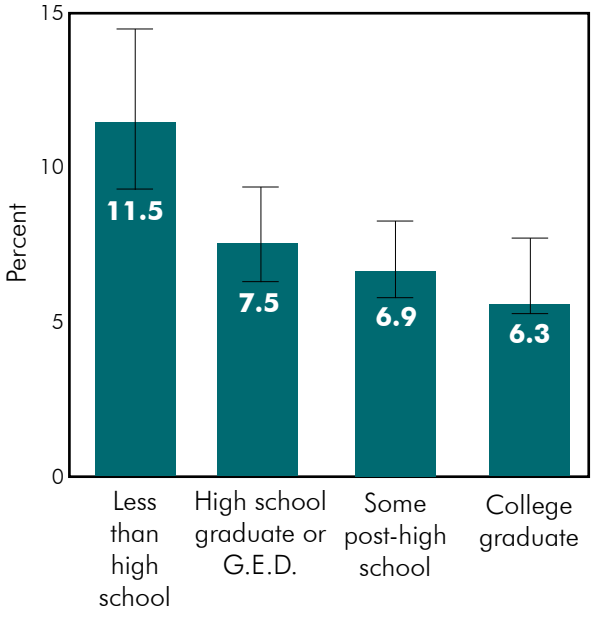
Figure 1-36. Current Asthma Prevalence among Adults, by Age Group, North Carolina, 2010



Note: Prevalence data for the 18-24 year age group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Figure 1-37. Current Asthma Prevalence among Adults, by Educational Level, North Carolina, 2010

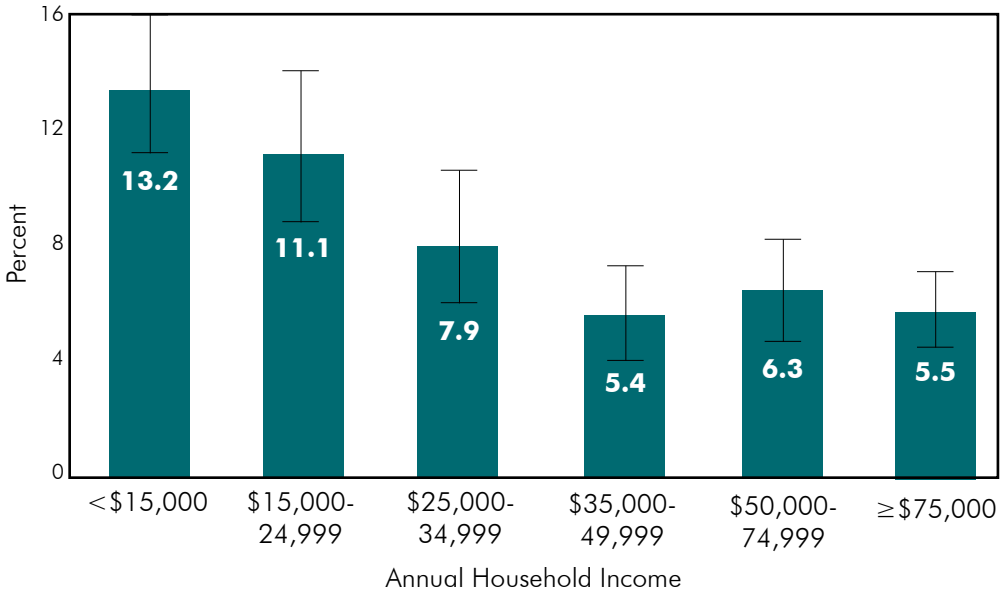


Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Adult current asthma prevalence was highest in the 65-74 age group (8.8%) and lowest in the 25-34 age group (6.4%).

- Adult current asthma prevalence decreased with increasing education level (less than high school – 11.5%; college graduate – 6.3%; statistically significant).

Figure 1-38. Current Asthma Prevalence among Adults, by Annual Household Income, North Carolina, 2010



Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Adult current asthma prevalence decreased with increasing annual household income level (less than $15,000 – 13.2%; $75,000 or greater – 5.5%; statistically significant).

Key Findings

Children

- Based on weighted prevalence rates, in 2010, it was estimated that over 383,000 children (16.8%) in North Carolina had been diagnosed with asthma at some point in their lives (lifetime asthma) and over 235,000 children (10.3%) still had asthma (current asthma).
- From 2005-2008, child current asthma prevalence in North Carolina decreased significantly (11.5% to 8.2%), but then increased from 2008-2010 (8.2% to 10.3%).

Middle and High School Students

- Boys had higher asthma prevalence (lifetime and current) than girls in North Carolina middle schools, while girls had higher asthma prevalence (lifetime and current) than boys in North Carolina high schools.
- In 2009, asthma prevalence (lifetime and current) was similar for North Carolina and national high school students.

Adults

- Based on weighted prevalence rates, it was estimated that approximately 901,000 adults (12.6%) in North Carolina had been diagnosed with asthma at some point in their lives (lifetime asthma) and approximately 534,600 adults (7.5%) still had asthma (current asthma).
- In 2010, North Carolina groups with the highest asthma prevalence (lifetime and current) included: females, African Americans (current asthma prevalence), persons with less than high school education, and persons living in households with an annual income of less than $15,000.

Symptoms and Management

Asthma severity can vary greatly among individuals.[7] It affects how a person with asthma manages his or her disease and how healthcare providers treat that person's chronic condition. Recognizing the critical relationship between symptoms and management, the National Heart, Lung, and Blood Institute (NHLBI) released the *Expert Panel Report 3 (EPR-3) Summary Report: Guidelines for the Diagnosis and Management of Asthma* in October 2007.[7] These guidelines were developed within a framework to organize topics for managing asthma long term and for managing exacerbations. Appendix C contains six tables from the EPR-3 report that further describe assessments and stepwise approaches for asthma management in children and adults.[6]

This chapter on symptoms and asthma management among children and adults in North Carolina examines the following topics: symptoms and severity of asthma (adults); asthma attack prevalence (adults); health-related quality of life (children and adults); missed activities (children and adults); asthma action plan (children and adults); asthma management in schools (children/students); asthma co-morbidities (adults); and tobacco smoke as a key environmental trigger (adults). Understanding the magnitude and impact of these issues is important to programs that address asthma at the individual, healthcare and community levels.

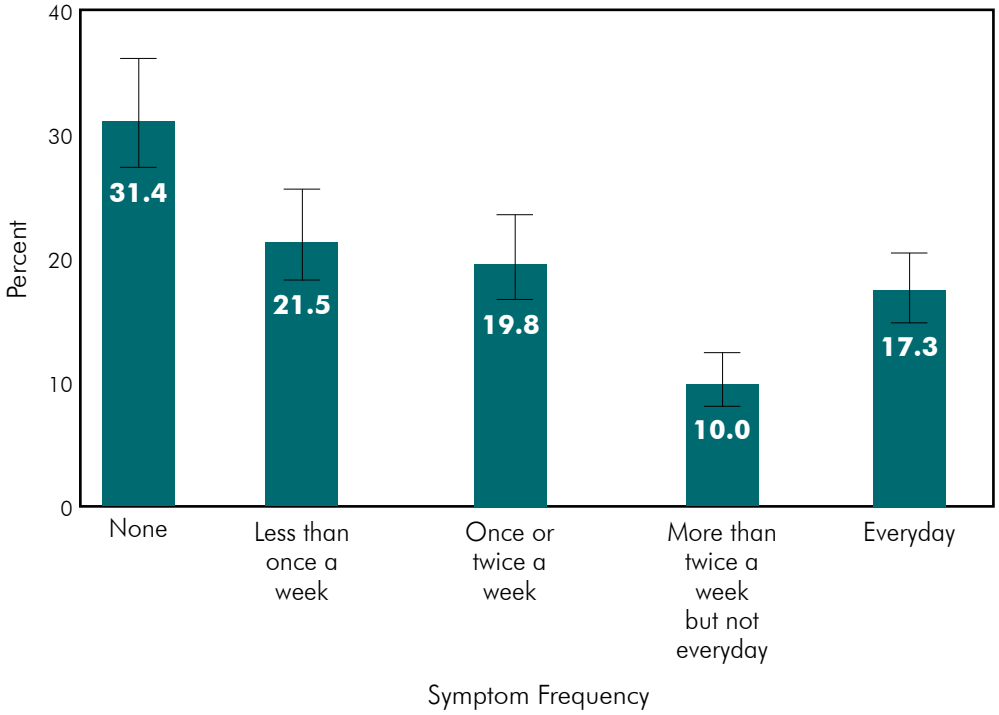
Data for the following sections come from the North Carolina Behavioral Risk Factor Surveillance System (N.C. BRFSS)[10]; North Carolina Child Health Assessment and Monitoring Program (N.C. CHAMP)[11]; North Carolina School Health Profiles[13]; National Survey of Children's Health[14]; and North Carolina Annual School Health Services Reports.[15] Statistical significance (i.e., non-overlapping confidence intervals) will be indicated wherever applicable and whenever a particular group is statistically different than the reference group (further description can be found in the Technical Notes). Data tables and web sites for the sources cited are placed in Appendix D.

Symptoms and Severity of Asthma among Adults

Daytime Symptoms

The following figure is based on responses to the question: "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?"

Figure 2-1. Frequency of Asthma Symptoms during the Past 30 Days among Adults with Current Asthma, North Carolina, 2008.



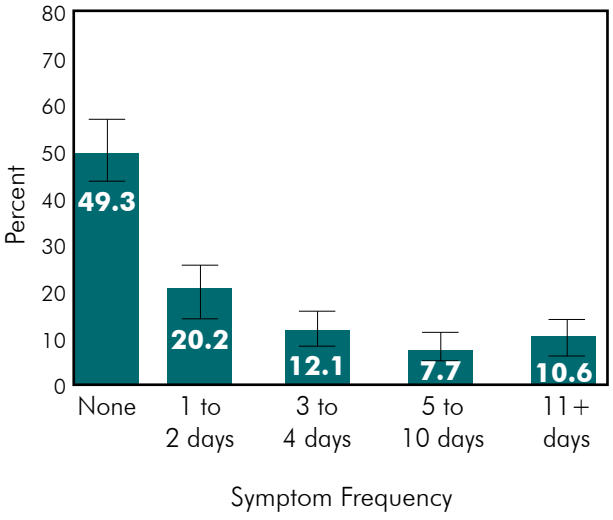
Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Nearly 69 percent of adults with current asthma reported having any symptoms of asthma during the past 30 days.
- Approximately 47 percent of adults with current asthma reported experiencing asthma symptoms once or more a week during the past 30 days.

Nighttime Symptoms

The following figure is based on responses to the question: "During the past 30 days, how many days did symptoms of asthma make it difficult for you to stay asleep?"

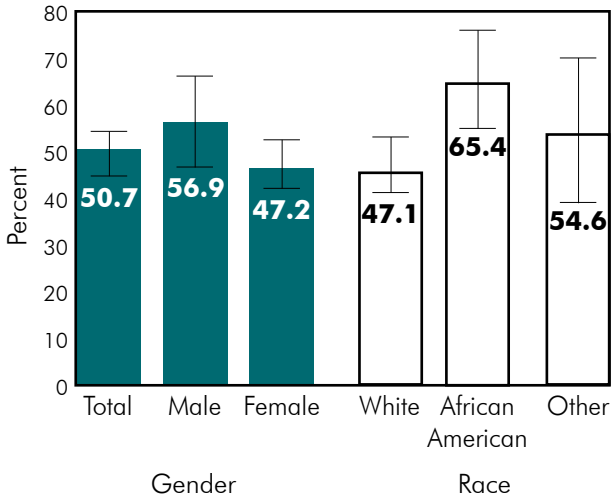
Figure 2-2. Frequency of Asthma Symptoms Affecting Sleep during the Past 30 Days among Adults with Current Asthma, North Carolina, 2008



Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Over 50 percent of adults with current asthma reported having asthma symptoms for at least one day that affected their sleep.
- Approximately 30 percent of adults with current asthma reported having asthma symptoms for three or more days that affected their sleep.

Figure 2-3. Adults with Current Asthma with Asthma Symptoms Affecting Sleep for One or More Days during the Past 30 Days, by Gender and Race, North Carolina, 2008



Note: Data for Other are based on a numerator of less than 50; interpret with caution.

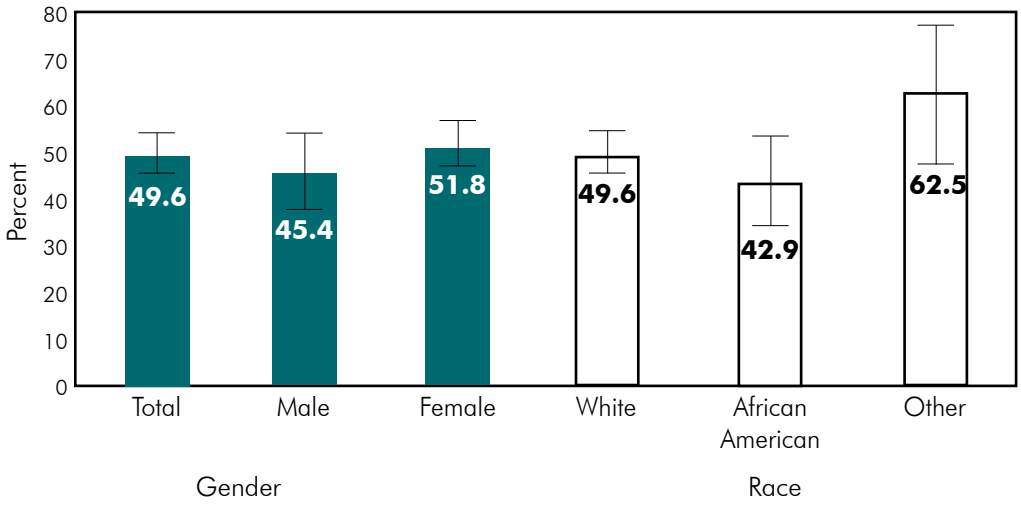
Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- More male adults (56.9%) than female adults (47.2%) reported that asthma symptoms made it difficult for them to sleep at least one night during the past 30 days.
- More African American adults (65.4%) than white adults (47.1%) reported that asthma symptoms made it difficult for them to sleep at least one night during the past 30 days (statistically significant; see Table 2-3 in Appendix D).

Asthma Attack Prevalence among Adults

Asthma attack prevalence – the number of people who had at least one asthma episode in the previous year – is a crude indicator of how many people have uncontrolled asthma and are at risk for a poor outcome, such as hospitalization. The N.C. BRFSS asked of adults: "During the past 12 months, have you had an episode of asthma or an asthma attack?"

Figure 2-4. Asthma Attack Prevalence among Adults with Current Asthma, by Gender and Race, North Carolina, 2008



Note: Data for Other are based on a numerator of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

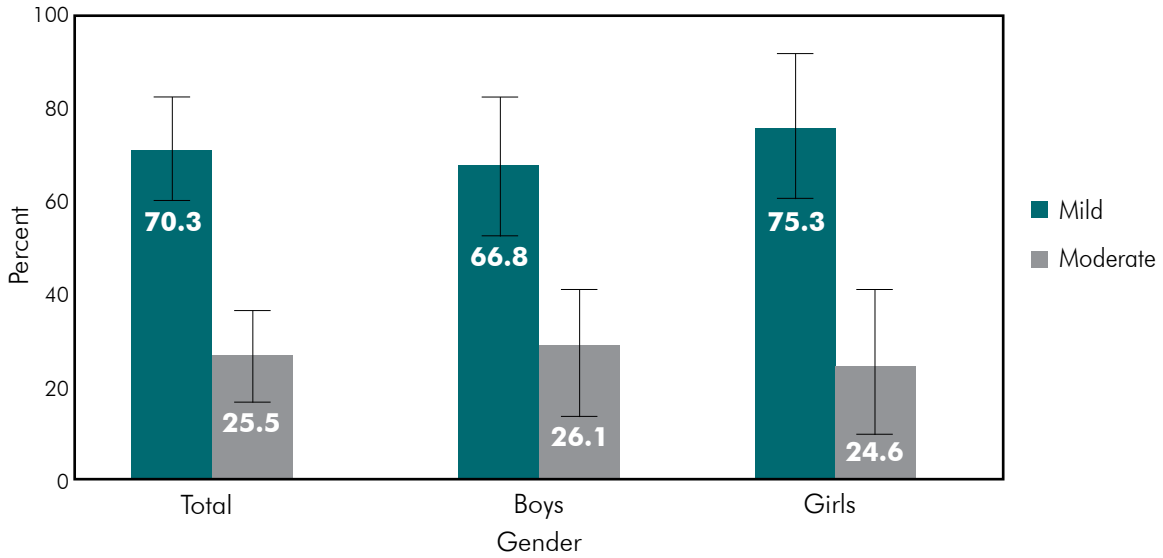
- Almost half (49.6%) of adults with current asthma experienced an asthma attack or episode in the past 12 months.
- Among adults with current asthma, more females (51.8%) than males (45.4%) reported having an asthma attack or episode in the past 12 months.
- Among adults with current asthma, more white adults (49.6%) than African American adults (42.9%) reported having an asthma attack or episode in the past 12 months.

Health-Related Quality of Life

Children

Data from the 2007 National Survey of Children's Health includes a question that addresses: "What level of asthma-related health difficulties do children with asthma experience?" Parents were asked: "Would you describe the health difficulties caused by your child's asthma as mild, moderate or severe?" (No definitions for mild, moderate or severe were given.)

Figure 2-5. Severity of Condition among Children with Current Asthma, North Carolina, 2007



Note: Responses for the "Severe" level were too small to meet standards of reliability or precision, and thus, have been omitted. "Moderate" level responses for total, boys and girls, and "Mild" level responses for girls are based numerators of less than 50; interpret with caution.

Source: 2007 National Survey of Children's Health, Maternal and Child Health Bureau, Health Resources and Services Administration

☐ Approximately 70.3 percent of parents of children with current asthma described the asthma-related difficulties experienced by their child as mild.

Adults

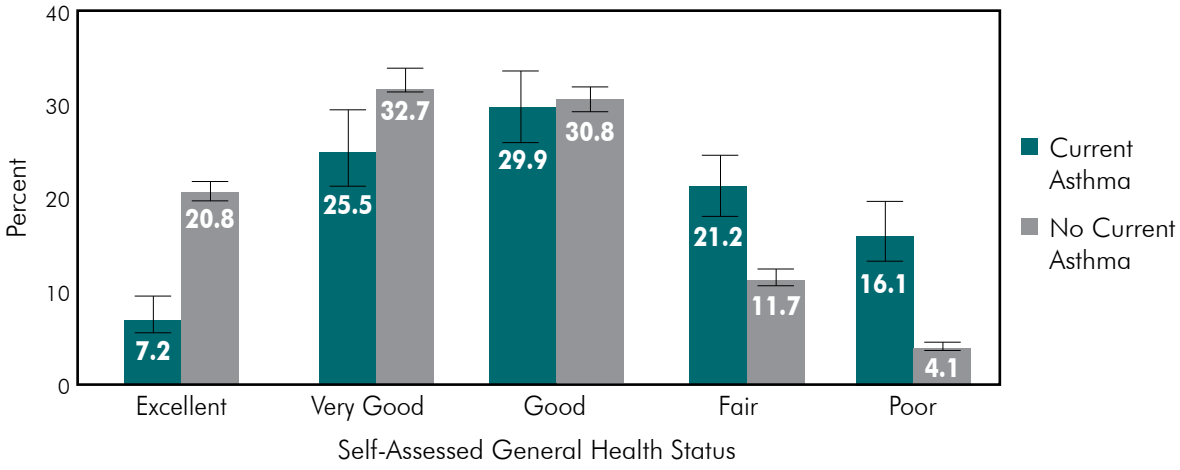
Asthma can have negative impacts on health-related quality of life and other everyday activities – that is, it can result in poorer overall, physical and mental health status. The N.C. BRFSS contains several health-related questions, including:

"Would you say that in general your health is: Excellent, Very Good, Good, Fair, or Poor?"

"Now thinking about your physical health, which includes physical illness and injury, for how many days during the past 30 days was your physical health not good?"

"Now thinking about your mental health, which includes stress, depression, and problems with emotions, for how many days during the past 30 days was your mental health not good?"

Figure 2-6. General Health Status among Adults with and without Current Asthma, North Carolina, 2008

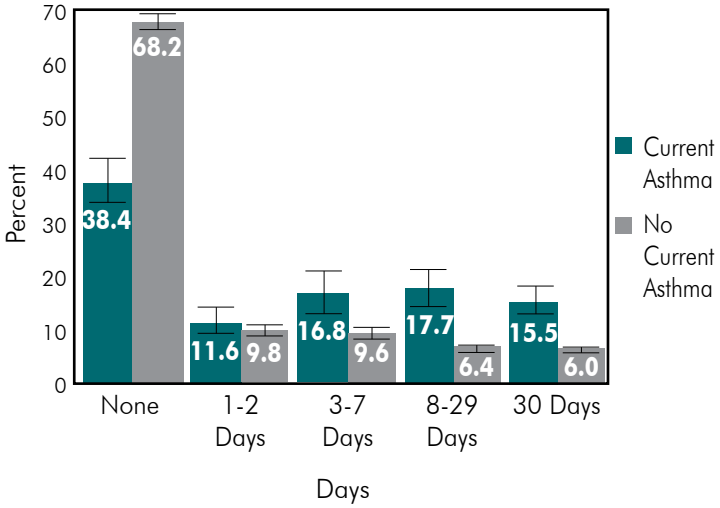


Note: Adults with "no current asthma" includes those who had ever been diagnosed with asthma (lifetime asthma) and those who had never been diagnosed with asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- More adults without current asthma than adults with current asthma reported their general health status as very good or excellent (statistically significant).
- More adults with current asthma than adults without current asthma reported their general health status as poor or fair (statistically significant).

Figure 2-7. Days with Poor Physical Health during the Past Month among Adults with and without Current Asthma, North Carolina, 2008

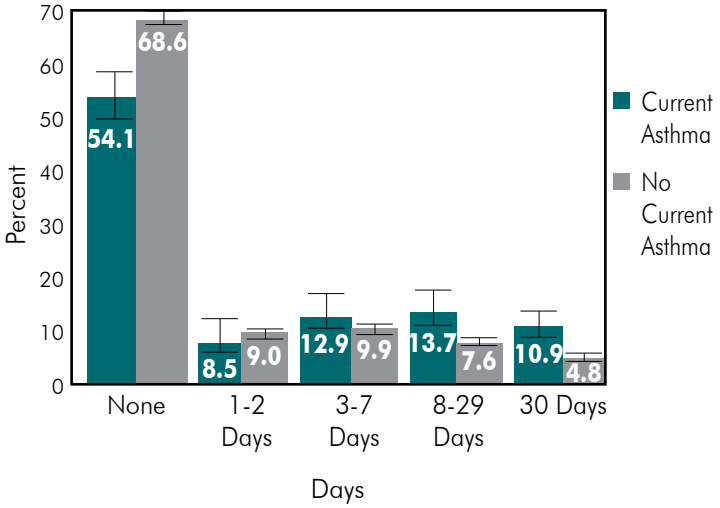


Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never been diagnosed with asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Of adults with current asthma, 38.4 percent reported having experienced no days in the past 30 days when their physical health status was poor compared to 68.2 percent of adults without current asthma (statistically significant).
- More adults with current asthma than adults without current asthma reported having experienced 3-7 days, 8-29 days, or 30 days when their physical health status was poor (statistically significant).

Figure 2-8. Days with Poor Mental Health during the Past Month among Adults with and without Current Asthma, North Carolina, 2008



Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never been diagnosed with asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Of adults with current asthma, 54.1 percent reported having experienced no days in the past 30 days when their mental health status was not good compared to 68.6 percent of adults without current asthma (statistically significant).
- More adults with current asthma than adults without current asthma reported having experienced 3-7 days, 8-29 days, or 30 days when their mental health status was not good (8-29 days and 30 days: statistically significant).

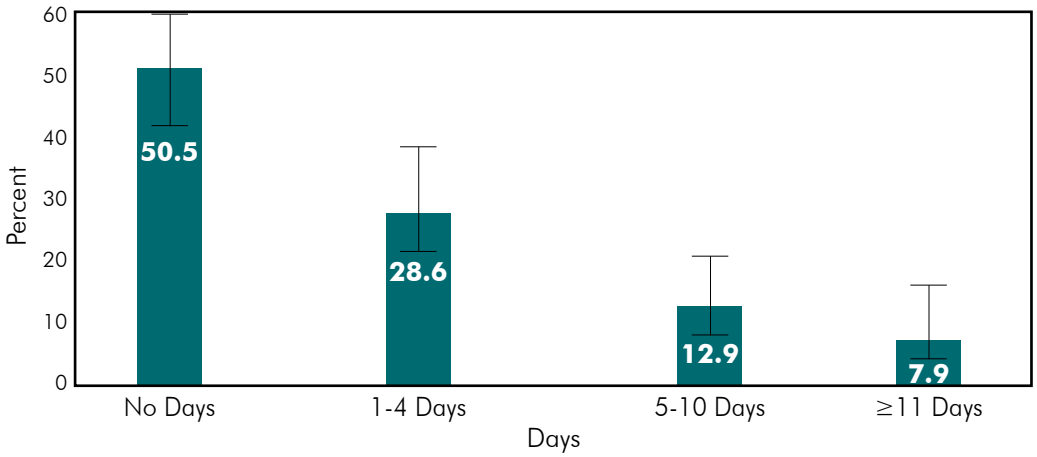
Missed Activity

Another perspective on quality of life is to examine missed activity or activity restriction, including missed school or work days due to asthma.

Children (All Ages)

The following figure is based on responses to the question, "During the past 12 months, how many days of day care or school did (the child) miss due to asthma?"

Figure 2-9. Days of Day Care or School Missed by Children with Current Asthma, North Carolina, 2010



Note: Data for 1-4 Days, 5-10 Days, and ≥11 Days groups are based on numerators of less than 50; interpret with caution.

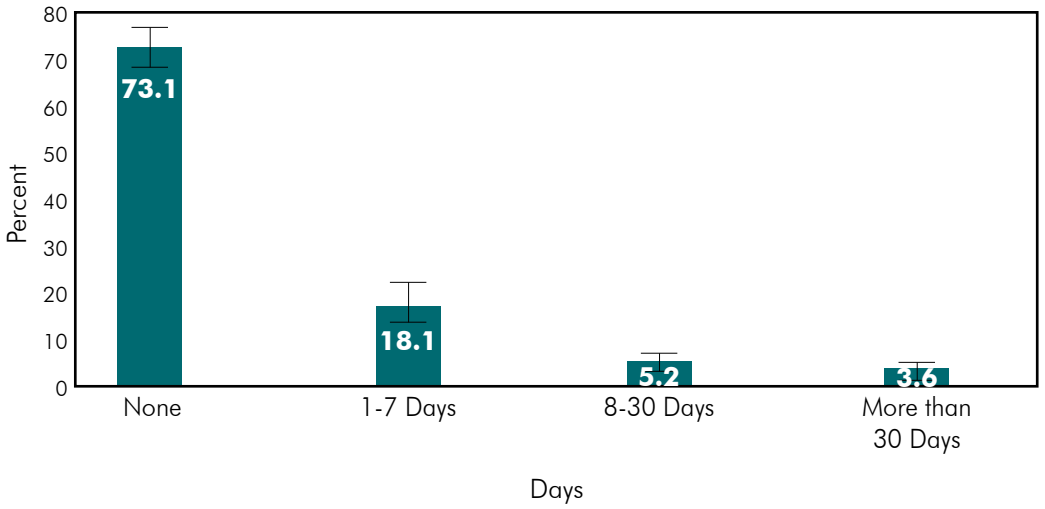
Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Among children with current asthma, approximately 49.5 percent missed at least one day of day care or school in the past year because of their asthma.

Adults

The following figure is based on responses to the question: "During the past 12 months, how many days were you unable to work or carry out your usual activities because of your asthma?"

Figure 2-10. Days Unable to Work or Carry Out Usual Activities Due to Asthma among Adults with Current Asthma, North Carolina, 2008



Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Approximately 27 percent of adults with current asthma were unable to work or carry out usual activities due to their asthma at least one day during the past 12 months.
- Almost 9 percent were unable to work or carry out usual activities for eight days or more during the past 12 months.

Asthma Action Plan

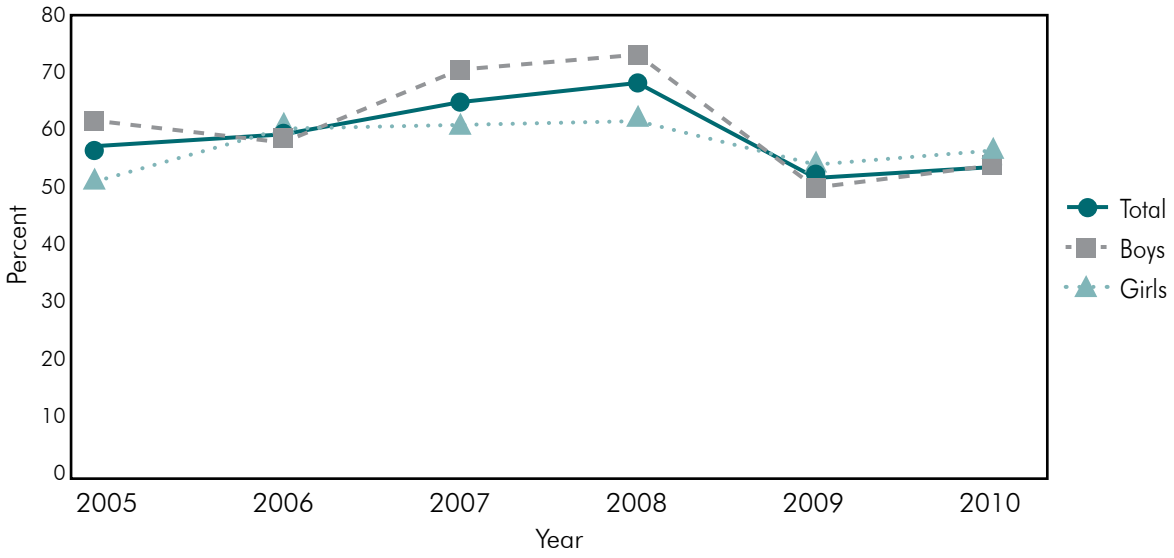
Current asthma treatment and management strategies include an asthma management or action plan that guides persons with asthma to self-manage or co-manage their condition by using medication and peak flow meter at home, child care, school, and/or work. Because of its critical role in asthma management, the *Expert Panel Report 3 (EPR-3): Guidelines for the Diagnosis and Management of Asthma* recommends that every person with asthma has an asthma action plan.[7] The asthma action plan should be developed jointly with the person with asthma and/or his/her primary care giver and with the healthcare provider.[16]

This plan should be used as part of an overall effort to educate children and adults in self-management.[7] An individualized asthma management plan should include strategies for: identifying and controlling or reducing indoor and outdoor asthma triggers; taking medication(s) as recommended by a healthcare professional; monitoring and recognizing early objective and subjective signs, and symptoms of an acute episode of asthma or of poorly controlled asthma; and providing a plan for what to do in case of an emergency. The plan should also include contact information for the healthcare provider and even for a local hospital. The plan helps the person with asthma, primary care giver and health care provider to establish a course of action for managing asthma.[17]

Children

The following figure is based on responses to the question: "Has a doctor or other health professional ever given you an asthma management plan for (the child)?"

Figure 2-11. Children with Current Asthma with an Asthma Action Plan, North Carolina, 2005-2010



Note: Data for girls in 2009 is based on a numerator less than 50; interpret with caution.

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

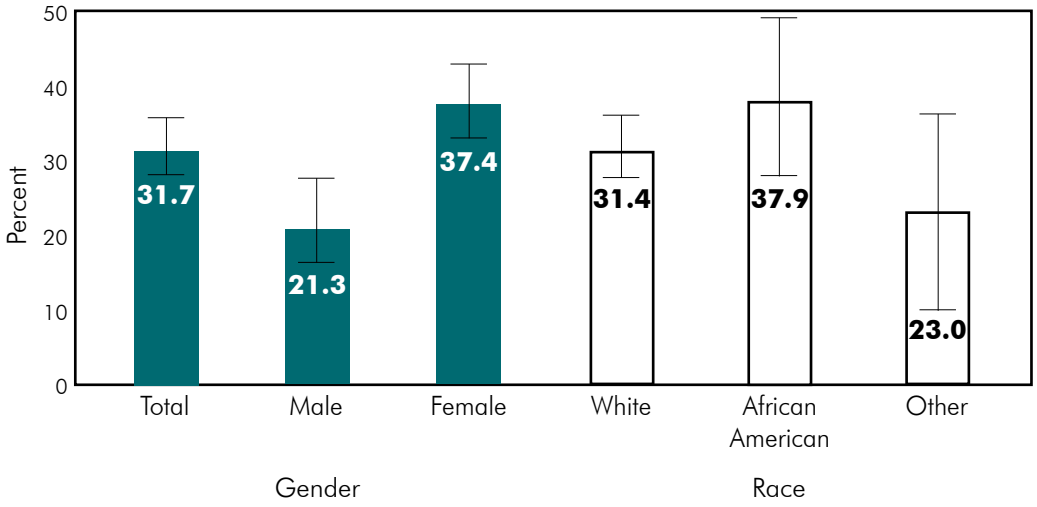
- An increase was observed in the total percentage of children in North Carolina who had an asthma action plan from 2005 (56.9%) to 2008 (65.8%); this percentage decreased to 57.1 percent in 2010.

Adults

The N.C. BRFSS collected data on asthma action plans among adults beginning in 2007 (29.9% had one). In 2008, the percentage of adults with an asthma action plan increased to 31.7 percent. The BRFSS Asthma Call-back Survey in 2009 found that 26.9 percent of adults with current asthma received an asthma action plan.

The following figure is based on responses to the question: "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?"

Figure 2-12. Adults with Current Asthma with an Asthma Action Plan, by Gender and Race, North Carolina, 2008



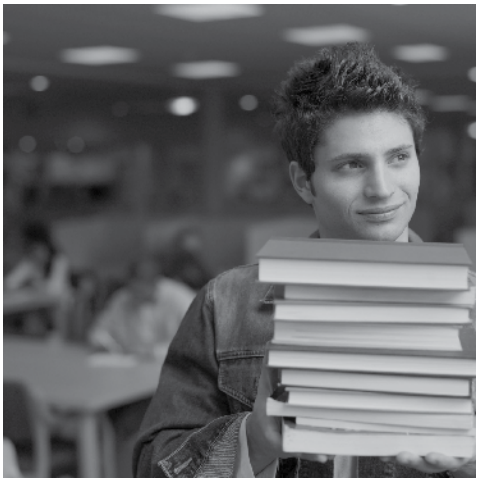
Note: Data for Other are based on a numerator of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Less than one-third (31.7%) of adults with current asthma had an asthma action plan.
- More female adults (37.4%) than male adults (21.3%) with current asthma had an asthma action plan (statistically significant).
- Compared with white adults (31.4%), more African American adults (37.9%) had an asthma action plan.

Asthma Management in Schools

Since 2005, students in North Carolina are permitted to carry and self-administer their asthma medication in schools, due to the passage of the "self-medication" law (Statue 115C-375.2). Presented below is the portion of the law that discusses asthma medication. The full text of the law can be found in Appendix E.



North Carolina Self-Medication Law

§ 115C-375.2. Possession and self-administration of asthma medication by students with asthma

(a) Local boards of education shall adopt a policy authorizing a student with asthma… to possess and self-administer asthma medication on school property during the school day, at school-sponsored activities, or while in transit to or from school or school-sponsored event…The policy shall include a requirement that the student's parent or guardian provide to the school:

1) Written authorization from the student's parent or guardian for the student to possess and self-administer asthma medication.

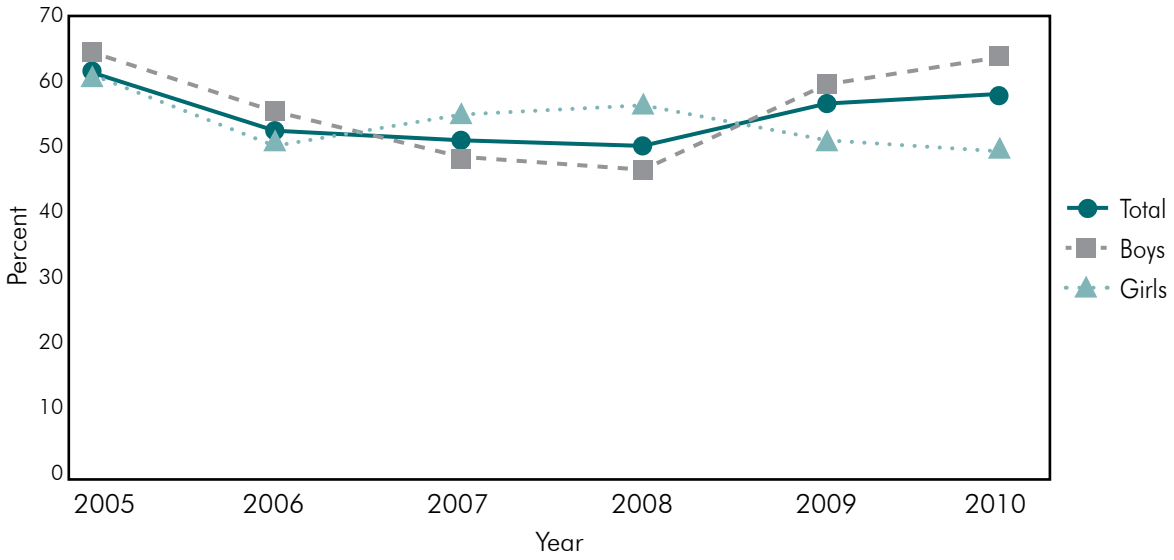
2) A written statement from the student's health care practitioner verifying that the student has asthma…and that the health care practitioner prescribed medication for use on school property during the school day, at school-sponsored activities, or while in transit to or from school or school-sponsored events.

3) A written statement from the student health care practitioner who prescribed the asthma medication that the student understands, has been instructed in self-administration of the asthma medication, and has demonstrated the skill level necessary to use the asthma medication and any device that is necessary to administer the asthma medication.

Self-Administration of Emergency Medication for Asthma at School

The N.C. CHAMP asked respondents (parents and guardians of children with current asthma) if: "At school, is your child allowed to self-administer emergency medication for asthma?" This question was asked of respondents using different parameters: 2005 & 2006 – applied to children ages five years and older enrolled in public school; 2007 & 2008 – applied to children ages one year and older; 2009 & 2010 – applied to children ages one year and older enrolled in school or daycare.

Figure 2-13. Self-Administration of Emergency Medication for Asthma at School, by Gender, North Carolina, 2005-2010

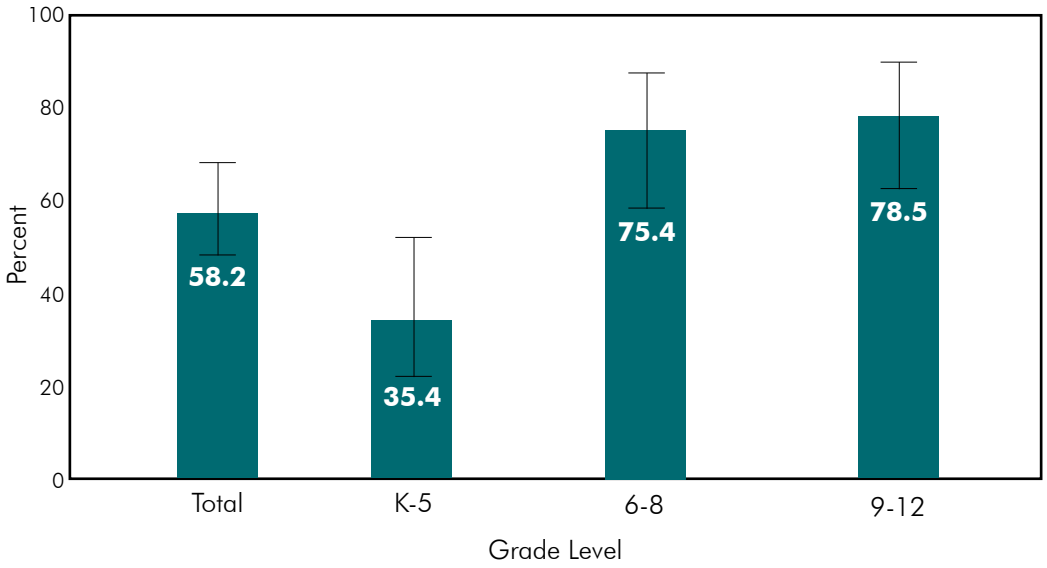


Note: Data for 2006 Girls are based on a numerator of less than 50; interpret with caution.

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- From 2005-2008, the total percentage of students in North Carolina allowed to self-administer emergency asthma medication at school decreased (61.2% to 52.1%); this percentage increased to 58.2 percent in 2010.

Figure 2-14. Self-Administration of Emergency Medication for Asthma at School, by Grade Level, North Carolina, 2010



Note: Data for K-5, 6-8, 9-12 grade levels are based on numerators of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

☐ In 2010, approximately 58 percent of students across all grade levels in North Carolina were allowed to self-administer emergency asthma medication at school.

Asthma Management in North Carolina Secondary Public Schools

The *School Health Profiles: Characteristics of Health Programs among Secondary Schools* is a publication based on biennial surveys of representative samples of middle and high school principals and lead health education teachers.[13] The *Profiles* provide information about school health policies and programs, including those that deal with asthma. The figure below presents the findings (based on weighted data) from the 2008 survey questions on asthma–related policies and programs in North Carolina. (Additional information about the *Profiles* can be found in Appendix A.)

Figure 2-15. Asthma-Related Policies and Programs in Secondary Public Schools, North Carolina, 2008

Asthma-related Policies and Programs	North Carolina % (95% C.I.)
Percentage of schools with a fulltime registered nurse who provides health services to students at school.	28.5 (24.5–32.9)
Percentage of schools that implemented a policy permitting students to carry and self administer asthma medications by communicating the policy to students, parents, and families, and by designating an individual responsible for implementing the policy.	52.7 (47.4 – 58.0)
Percentage of schools that had an asthma action plan on file for all students with known asthma*.	70.5 (65.9 – 74.8)
Percentage of schools that identified students with poorly controlled asthma by keeping track of them in at least three different ways.	67.1 (62.0 – 71.8)
Percentage of schools that provided intensive case management** for students with poorly controlled asthma at school.	29.3 (24.9 – 34.2)
Percentage of schools that required all school staff members to receive annual training on recognizing and responding to severe asthma symptoms.	68.4 (63.8 – 72.7)
Percentage of schools that provided parents and families with health information to increase parent and family knowledge of asthma.	19.8 (16.2 – 24.1)

Source: School Health Profiles 2008: Characteristics of Health Programs among Secondary Schools, Atlanta: Centers for Disease Control and Prevention, 2009

* Students with known asthma are those who are identified by the school to have a current diagnosis of asthma as reported on student emergency cards, medication records, health room visit information, emergency care plans, physical exam forms, parent notes, and other forms of health care clinician notification.

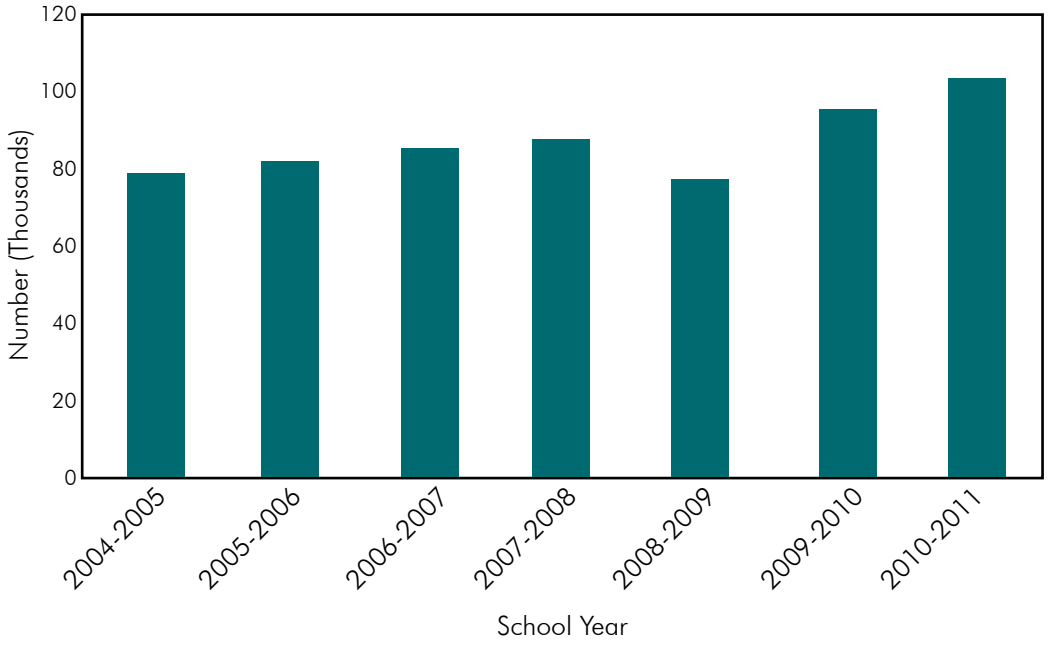
** Includes all nine specific services for students with poorly controlled asthma:
1. Provided referrals to primary healthcare clinicians or child health insurance programs.
2. Ensured an appropriate written asthma action plan is obtained.
3. Ensured access to and appropriate use of asthma medications, spacers, and peak flow meters at school.
4. Offered asthma education for the student with asthma and his/her family.
5. Minimized asthma triggers in the school environment.
6. Addressed social and emotional issues related to asthma.
7. Provided additional psychological counseling or support services as needed.
8. Ensured access to safe, enjoyable physical education and activity opportunities.
9. Ensured access to preventive medications before physical activity.

- In North Carolina, 70.5 percent of secondary schools had an asthma action plan on file for all students with known asthma.
- Nearly 30 percent of North Carolina secondary schools provided intensive case management for students with poorly controlled asthma at school.
- Over two-thirds (68.4%) of North Carolina secondary schools required all school staff members to receive annual training on recognizing and responding to severe asthma symptoms.

Asthma: A Major Chronic Illness Among School Age Students in North Carolina

Data from the *North Carolina Annual Report of School Health Services* indicate that asthma is a major chronic illness among school age students.[18] From 2004-2011, asthma accounted for 31-39 percent of all chronic health conditions reported by school nurses in all North Carolina public elementary, middle and high schools.

Figure 2-16. Number of Students in Grades K-12 with Asthma as Reported by School Nurses, North Carolina, 2004-2011



Note: According to the Children and Youth Branch, N.C. Division of Public Health, the decrease in the number of students with asthma for the 2008-2009 school year may be attributed to changes in the data collection method used.

Sources: 2004-2011 North Carolina Annual School Health Services Reports, North Carolina Healthy Schools

- The number of students with asthma increased by 30.9 percent from the 2004-2005 school year (77,593) to the 2010-2011 school year (101,599).

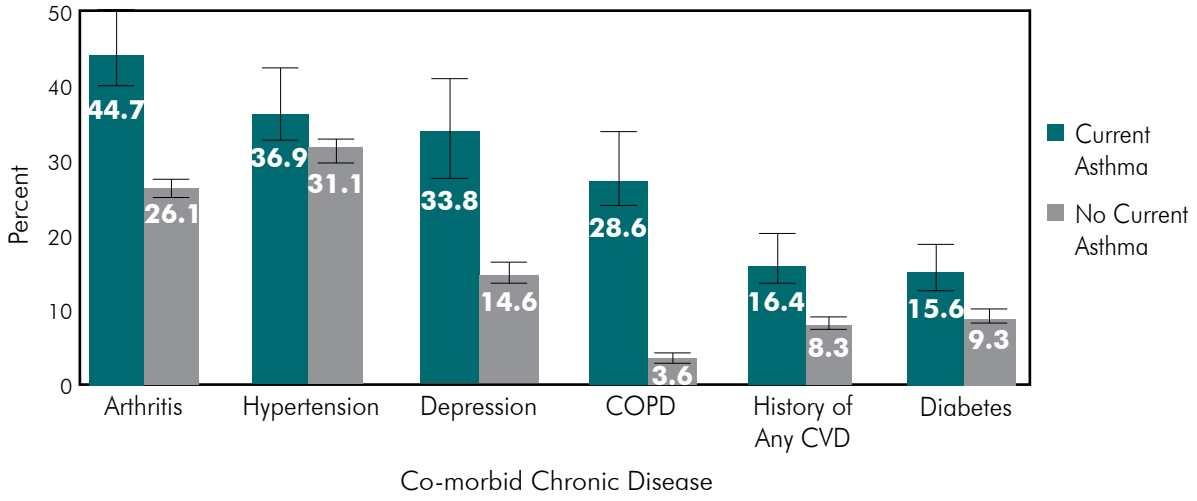
Asthma Co-morbidities

Co-morbidities in adults with asthma have been reported for various population groups, including chronic conditions, some of which are associated with systemic inflammation, such as chronic heart failure, diabetes, and arteriosclerosis. Their significance underscores the recent U.S. Department of Health and Human Services' initiative on multiple chronic conditions.[19] In addition, the NHLBI *Expert Panel Report 3 (EPR-3) Summary Report: Guidelines for the Diagnosis and Management of Asthma* encourages the identification and treatment of "co-morbid conditions that may impede asthma management" and that "if these conditions are treated appropriately, asthma control may improve."[6] The report lists cardiovascular disease, other chronic lung disease and chronic psychiatric disease as co-morbidities.

The N.C. BRFSS collects data that provide information on the prevalence of selected chronic diseases and among adults with current asthma. The following figures are based on responses to the N.C. BRFSS questions (not all questions were asked every year) on:

- **Arthritis (2009 N.C. BRFSS):** Have you ever been told by a doctor or other health professional that you have some form of arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia?
- **Hypertension (2009 N.C. BRFSS):** Have you ever been told by a doctor, nurse, or other health professional that you have high blood pressure?
- **Depression (2007 N.C. BRFSS):** Has a doctor or other healthcare provider EVER told you that you have a depressive disorder (including depression, major depression, dysthymia, or minor depression)?
- **Chronic obstructive pulmonary disease (2009 N.C. BRFSS):** Have you ever been told by a doctor or health professional that you have chronic obstructive pulmonary disease (COPD), emphysema or chronic bronchitis?
- **History of any cardiovascular diseases (2010 N.C. BRFSS):** Has a doctor, nurse, or other health professional ever told you that you had a heart attack, also called a myocardial infarction? Has a doctor, nurse, or other health professional ever told you that you had angina or coronary heart disease? Has a doctor, nurse, or other health professional ever told you that you had a stroke?
- **Diabetes (2010 N.C. BRFSS):** Have you ever been told by a doctor that you have diabetes?

Figure 2-17. Percentage of Selected Chronic Diseases among Adults with and without Current Asthma, North Carolina, 2007, 2009, 2010



Notes: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never had a diagnosis of asthma.

Source: 2007, 2009, 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Among adults with current asthma, the leading co-morbid chronic disease was arthritis (44.7%), followed by hypertension (36.9%), depression (33.8%), chronic obstructive pulmonary disease (28.6%), history of any cardiovascular diseases (16.4%), and diabetes (15.6%).
- Except for hypertension, adults with current asthma were more likely to have these co-morbid chronic diseases than adults without current asthma (statistically significant; non-overlapping 95 percent confidence intervals).
- Calculated prevalence odds ratios (ORs) indicated that adults with current asthma were more likely than adults without current asthma to have COPD (OR = 10.7), depression (OR = 3.0), arthritis (OR = 2.3), history of CVD (OR = 2.2), and diabetes, (OR = 1.8).

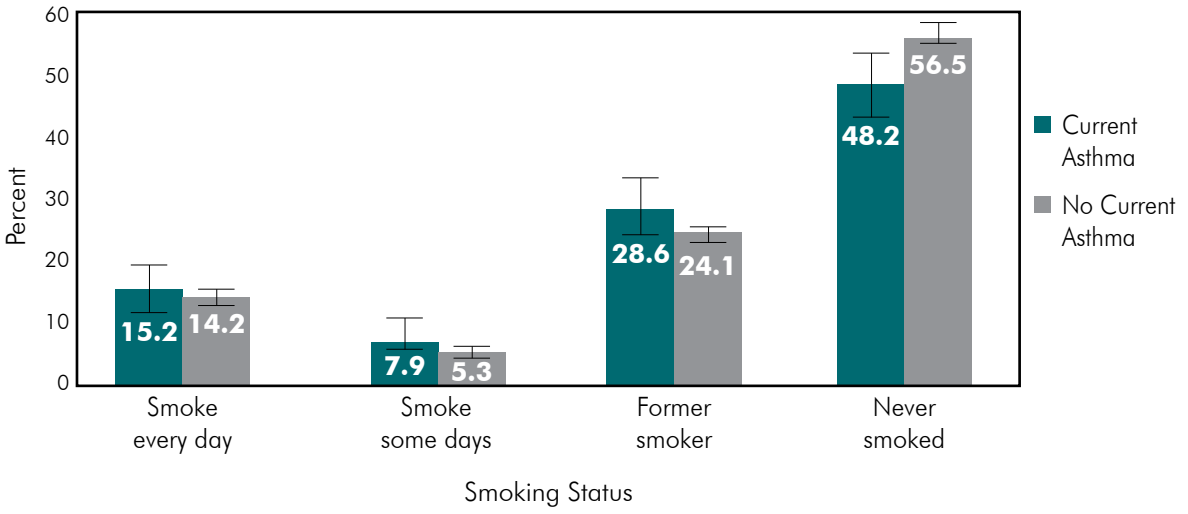
Tobacco Smoke: A Common Environmental Trigger

Current Smoking

According to the 2010 N.C. BRFSS, 19.8 percent of adults in North Carolina are current smokers (i.e., smoke every day, smoke some days). Tobacco smoke, as an environmental trigger, can have a significant impact on the person with asthma and may cause breathing difficulties. Should an asthma episode occur, the adverse health outcome may also require emergency medical attention and possibly hospitalization.

Data on current smoking are derived from the two tobacco use questions in the N.C. BRFSS: "Have you smoked at least 100 cigarettes in your entire life?" and "Do you now smoke cigarettes every day, some days or not at all?"

Figure 2-18. Smoking Status of Adults with and without Current Asthma, North Carolina, 2010



Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never had a diagnosis of asthma.

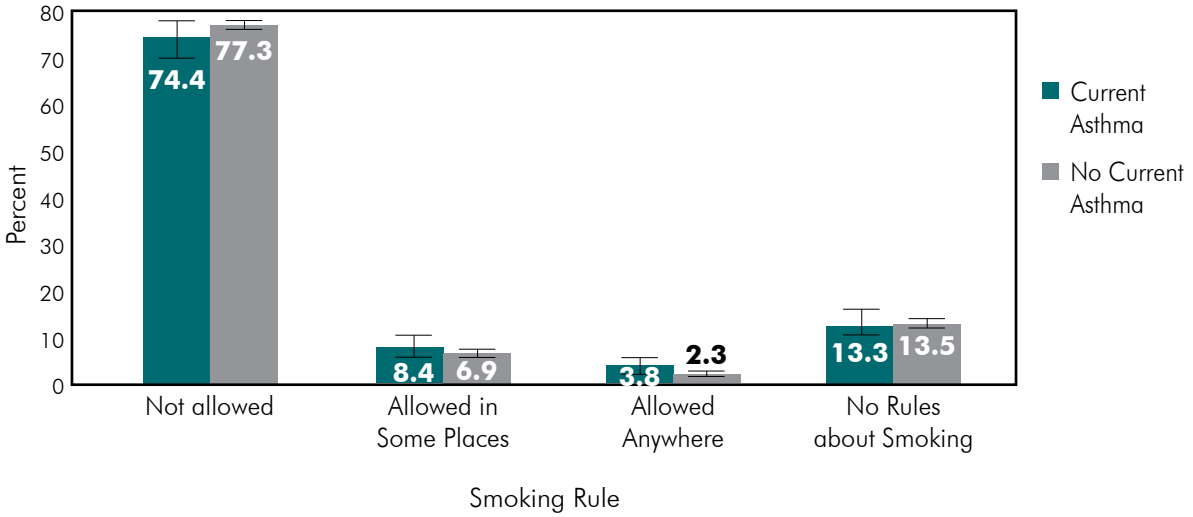
Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- More adults with current asthma (23.1%) than those without current asthma (19.5%) were current smokers.
- Among adults with current asthma, 28.6 percent were former smokers, while 24.1 percent of those without current asthma were former smokers.
- More adults without current asthma (56.5%) never smoked compared with those with current asthma (48.2%) (statistically significant).

Secondhand Smoke

Secondhand smoke is one of the most preventable indoor environmental triggers. The N.C. BRFSS asked adult respondents, "Which statement best describes the rules about smoking inside your home? (Not allowed anywhere inside home, allowed in some places/sometimes, allowed anywhere inside home, no rules about smoking inside home) Do not include decks, garages or porches."

Figure 2-19. Smoking Rules in Homes of Adults with and without Current Asthma, North Carolina, 2008



Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never had a diagnosis of asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Nearly 75 percent of adults with current asthma compared to 77.3 percent of those without current asthma reported that smoking was not allowed anywhere inside the home.
- Similar percentages of adults with current asthma (13.3%) and without current asthma (13.5%) reported that there were no rules about smoking inside the home.

Key Findings

- Nearly 69 percent of adults with current asthma in North Carolina reported having any symptoms of asthma during the past 30 days.
- About half of adults with current asthma reported experiencing asthma symptoms for at least one day during the past 30 days that made it difficult for them to stay asleep.
- Almost half of adults with current asthma reported having an asthma attack or episode in the past 12 months.
- More adults with current asthma than adults without current asthma reported that their general health status was poor or fair.
- Among children with current asthma, almost half missed at least one day of day care or school in the past year because of their asthma.
- Over one-fourth of adults with current asthma reported that they were unable to work or carry out usual activities due to their asthma at least one day during the past 12 months.
- In 2010, 57.1 percent of North Carolina children with current asthma had received an asthma management plan from their doctor or healthcare provider.
- In 2009, 26.9 percent of North Carolina adults with current asthma reported that they received an asthma management plan from their doctor or healthcare provider.
- Approximately 70 percent of North Carolina's secondary schools had an asthma action plan on file for all students with known asthma.
- Over two-thirds of North Carolina's secondary schools required all school staff members to receive annual training on recognizing and responding to severe asthma symptoms.
- Adults with current asthma were more likely to have COPD, arthritis, depression, history of CVD, and diabetes than adults without current asthma.
- Similar percentages of adults with (13.3%) and without (13.5%) current asthma reported that there were no rules about smoking inside their homes.

Healthcare Utilization and Cost of Asthma

Self-management of asthma also includes knowing when to visit a healthcare provider for routine checkups. However, when the symptoms are severe or when there is onset of an asthma episode or attack, the use of an emergency department is needed. Hospitalization for the more serious cases of asthma may also be necessary.

This chapter examines the following topics on asthma-related healthcare utilization and costs among children and adults in North Carolina: routine office visits, urgent treatment, emergency department visits, hospitalizations, health insurance coverage and cost of asthma. These utilization and cost issues provide the asthma community with additional information about the burden of asthma, which then can inform decision-makers about needed programs, policies and funding to address asthma in our society.

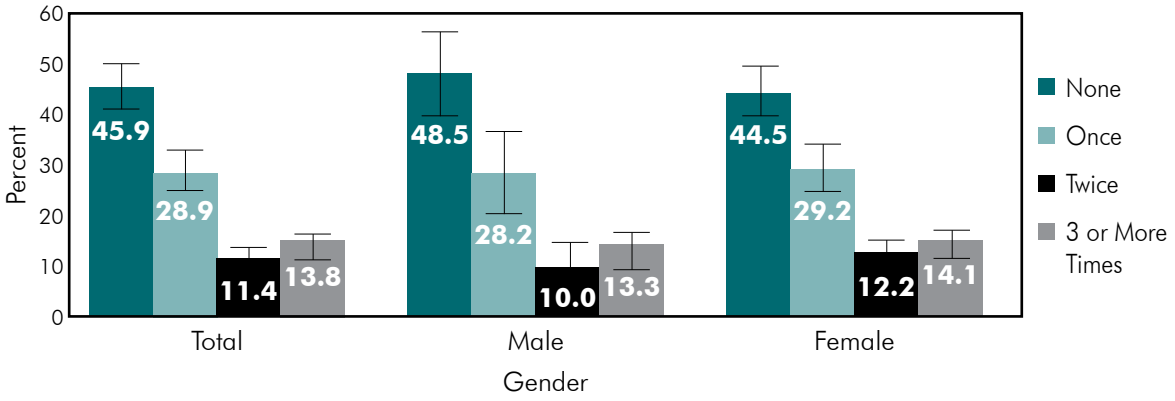
Data for the following sections come from the North Carolina Behavioral Risk Factor Surveillance System (N.C. BRFSS)[10]; North Carolina Child Health Assessment and Monitoring Program (N.C. CHAMP) [11]; North Carolina Disease Event Tracking and Epidemiologic Collection Tool (N.C. DETECT)[20]; North Carolina Hospital Discharge data[21]; North Carolina Division of Medical Assistance data[23] and National Center for Health Statistics.[22] Statistical significance (i.e., non-overlapping confidence intervals) will be indicated whenever applicable and whenever a particular group is statistically different than the reference group (further description can be found in the Technical Notes). Data tables and web sites for the sources cited are place in Appendix D.

Routine Office Visits

Routine checkups with a primary healthcare provider are essential for effective asthma management and control. The NHLBI *Expert Panel Report 3 (EPR-3) Summary Report: Guidelines for the Diagnosis and Management of Asthma* (October 2007) highlights assessment and management as one of the four core components of care.[7] When scheduling follow-up care, it is recommended that healthcare providers "schedule patients at 2- to 6-week intervals while gaining control; at 1-6 months intervals, depending on step of care required or duration of control, to monitor if sufficient control is maintained; at 3-month intervals if a step down in therapy is anticipated." In addition, "assess asthma control, medication techniques, written asthma action plan, patient adherence and concerns at every visit."

The following figure is based on responses to the question: "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?"

Figure 3-1. Frequency of Routine Checkup for Asthma during the Past 12 Months among Adults with Current Asthma, by Gender, North Carolina, 2008

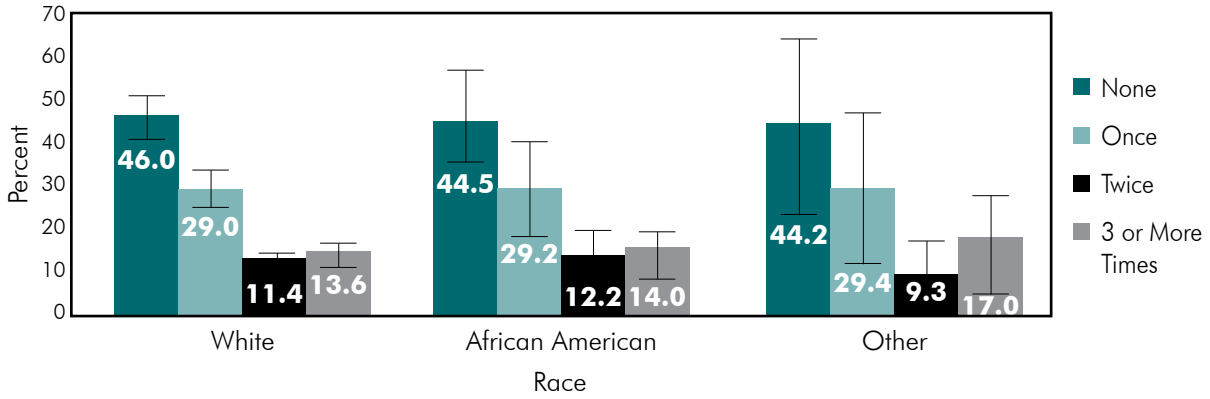


Note: Data for "Male, Twice" are based on a numerator of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- About 46 percent of adults with current asthma did not see a doctor or health professional for a routine checkup for their asthma in the past 12 months.
- Similar percentages of adult males (51.5%) and females (55.5%) reported seeing a doctor or health professional for a routine checkup for their asthma at least once in the past 12 months.

Figure 3-2. Frequency of Routine Checkup for Asthma during the Past 12 Months among Adults with Current Asthma, by Race, North Carolina, 2008



Note: Data for "African American, Twice, Three or more times," and "Other, None, Once, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

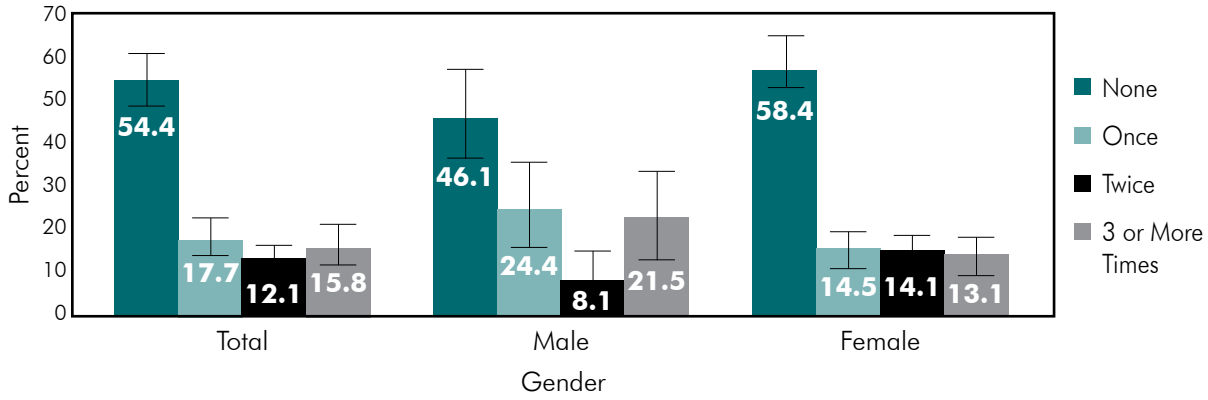
Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Similar percentages of white (54.0%) and African American (55.4%) adults reported seeing a doctor or health professional for a routine checkup for their asthma at least once in the past 12 months.

Urgent Treatment

Aside from obtaining a routine checkup for their asthma, people with asthma sometimes see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms. The following figure is based on responses to the question, "During the past 12 months, besides emergency room visits, how many times did you see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms?"

Figure 3-3. Frequency of Visits to a Healthcare Provider for Urgent Treatment of Asthma during the Past 12 Months among Adults with Current Asthma, by Gender, North Carolina, 2008

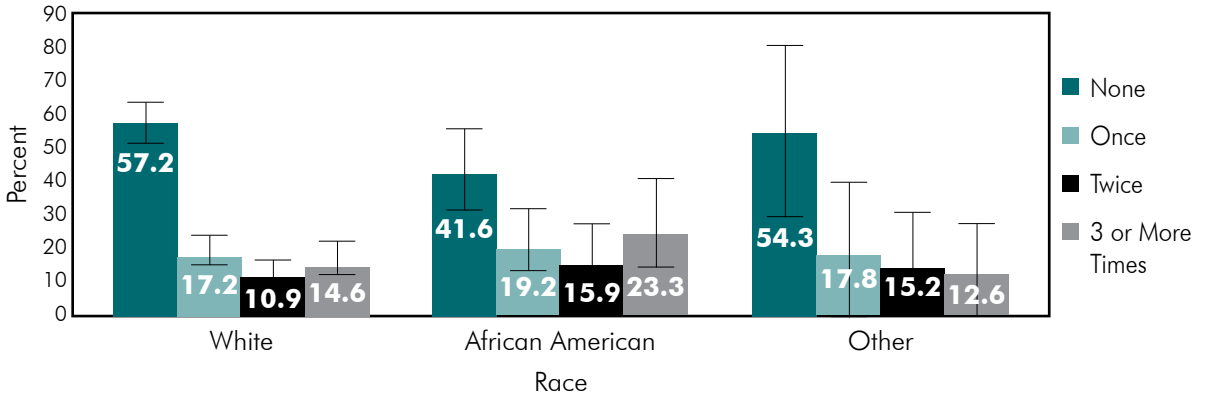


Note: Data for "Male, Twice" are based on a numerator of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- About 46 percent of adults with current asthma saw a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms in the past 12 months.

Figure 3-4. Frequency of Visits to a Healthcare Provider for Urgent Treatment of Asthma during the Past 12 Months among Adults with Current Asthma, by Race, North Carolina, 2008



Note: Data for "African American, None, Once, Twice, Three or more times," and "Other, None, Once, Twice, Three or more times," and "Other, None, Once, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

☐ Approximately 57.2 percent of white adults had no visits to a healthcare professional for urgent treatment of worsening asthma symptoms in the past 12 months.

Emergency Department Visits

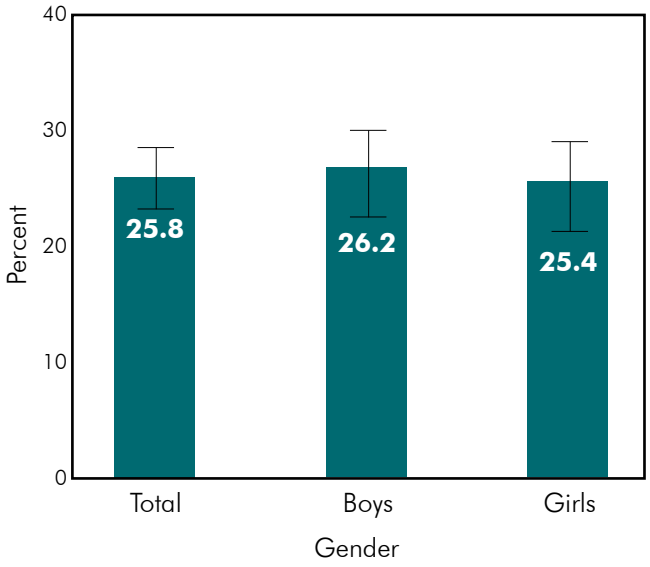
Emergency department visits for asthma are often preventable. When a visit to an emergency department is made, it is often an indication of inadequate long-term management of asthma and/or inadequate plans for management of exacerbations. For the period 2007-2009, emergency department visits due to asthma averaged annually 8.1 per 100 persons with asthma in the United States.[24] Children aged 0-17 years with asthma had a higher emergency department visit rate (10.7 per 100 persons with asthma, S.E.=0.9) than adults aged 18 and over (7.0 per 100 persons with asthma, S.E.=0.4).[24]

The following summarizes emergency department visits by children and adults. Data are from the N.C. CHAMP and N.C. BRFSS.

Children

Because of small sample sizes for individual years during which the N.C. CHAMP survey was conducted, data from 2005-2010 were combined and reported for the question asked of parents (or caregiver) of children with asthma, "During the past 12 months, has (the child) visited a hospital emergency room or urgent care clinic because of asthma?"

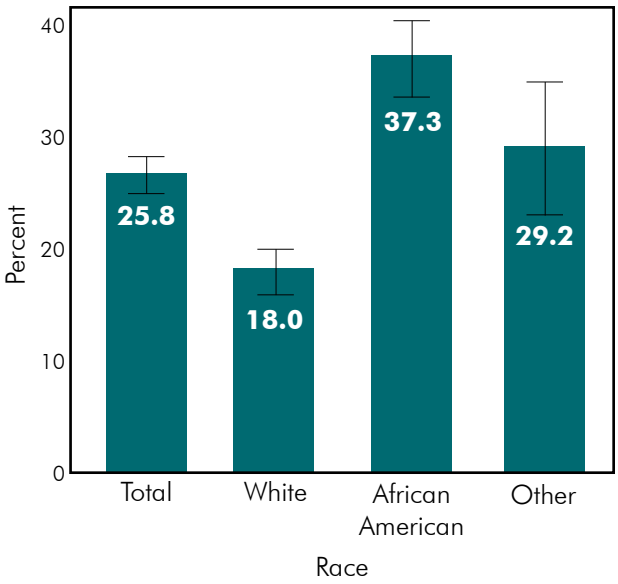
Figure 3-5. Emergency Department or Urgent Care Visits during the Past 12 Months among Children with Current Asthma, by Gender, North Carolina, 2005-2010



Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

- Nearly 26 percent of children with current asthma visited an emergency department or urgent care center during the past 12 months because of asthma.
- Similar proportions of boys (26.2%) and girls (25.4%) visited an emergency department or urgent care center in the past 12 months because of asthma.

Figure 3-6. Emergency Department or Urgent Care Visits during the Past 12 Months among Children with Current Asthma, by Race, North Carolina, 2005-2010



Note: Data for "Other Minorities" are based on a numerator of less than 50; interpret with caution.

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

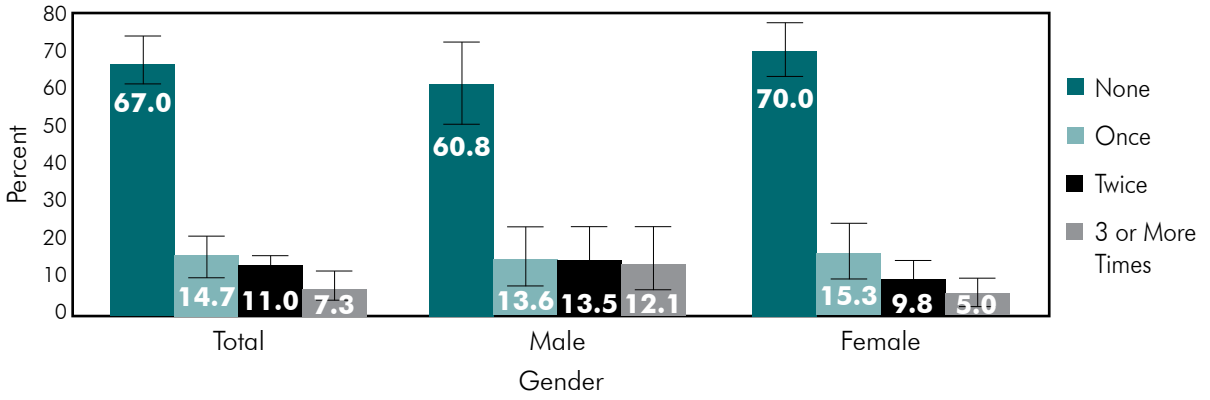
- More African American (37.3%) than white (18.0%) children visited an emergency department or urgent care center due to asthma (statistically significant).

Adults

For the period 2007-2009, gender and racial disparities were observed for emergency department visits due to asthma among adults in the United States. Males with asthma had a higher emergency department visit rate (8.7 per 100 persons with asthma, S.E.=0.4) than females with asthma (7.6 per 100 persons with asthma, S.E.=0.5).[24] African Americans with asthma had a higher emergency department visit rate (18.4 per 100 persons with asthma, S.E.=1.6) than whites with asthma (6.1 per 100 persons with asthma, S.E.=0.4).[24] Such differences were also seen among North Carolina adults.

The 2008 N.C. BRFSS asked adults with current asthma:, "During the past 12 months, how many times did you visit an emergency room or urgent care center because of asthma?"

Figure 3-7. Frequency of Emergency Department/Urgent Care Visits during the Past 12 Months among Adults with Current Asthma, by Gender, North Carolina, 2008

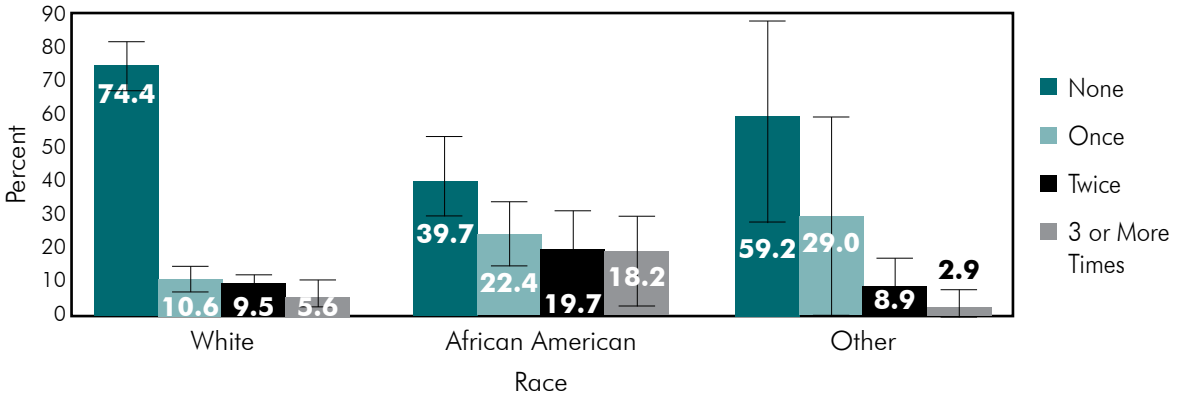


Note: Data for "Total, Three or more times," "Male, Once, Twice, Three or more times," and "Female, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Thirty-three percent of adults with current asthma visited an emergency department or urgent care center at least once in the past 12 months because of asthma.
- More males (39.2%) than females (30.0%) visited an emergency department or urgent care center at least once in the past 12 months because of asthma.

Figure 3-8. Frequency of Emergency Department/Urgent Care Visits during the Past 12 Months among Adults with Current Asthma, by Race, North Carolina, 2008



Note: Data for "Total, Three or more times," "White, Twice, Three or more times," and "African American, None, Once, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Nearly three-fourths of white adults (74.4%) had no emergency department or urgent care visits in the past 12 months because of asthma.

Emergency Department Visits by County

The North Carolina Disease Event Tracking and Epidemiologic Collection Tool (N.C. DETECT) is a comprehensive population-based and near real-time statewide emergency department database. In 2009, N.C. DETECT received data on an estimated 99.5 percent of all records from 24/7 acute care hospital-affiliated emergency departments in North Carolina.[20]

The 2009 age-adjusted rates per 10,000 for emergency department visits with a primary asthma code (ICD-9CM Code 493), by county, are presented in Appendix F.

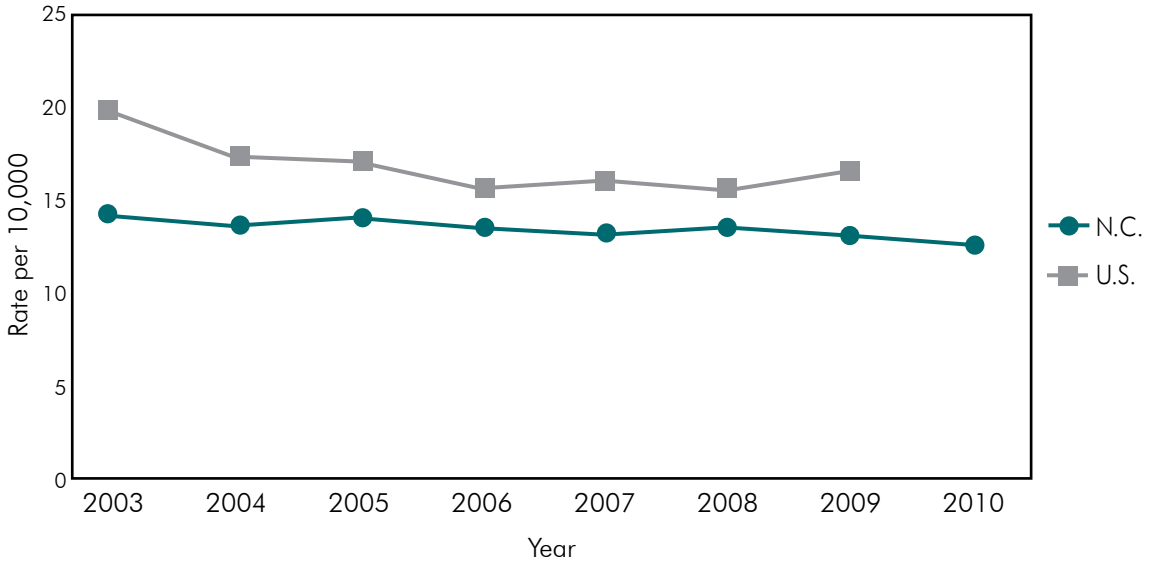
Hospitalizations

Hospitalizations due to asthma often result from uncontrolled asthma. Serious episodes may be avoided with good asthma management, ongoing education, and support for patients. Inpatient hospital services represent the single largest direct medical expenditure for asthma.

Hospitalization data for the United States can be obtained from the National Hospital Discharge Survey (NHDS),[22] which has been conducted annually from 1965-2010. These data contain information on characteristics of inpatients discharged from non-federal short-stay hospitals.

North Carolina hospital discharge data are comprised of hospitalization information such as diagnoses, date of admission and date of discharge, length of stay, patient information such as county of residence and gender, race (as of Jan. 1, 2010) patient status at discharge, payer and total amount billed for the hospital stay.

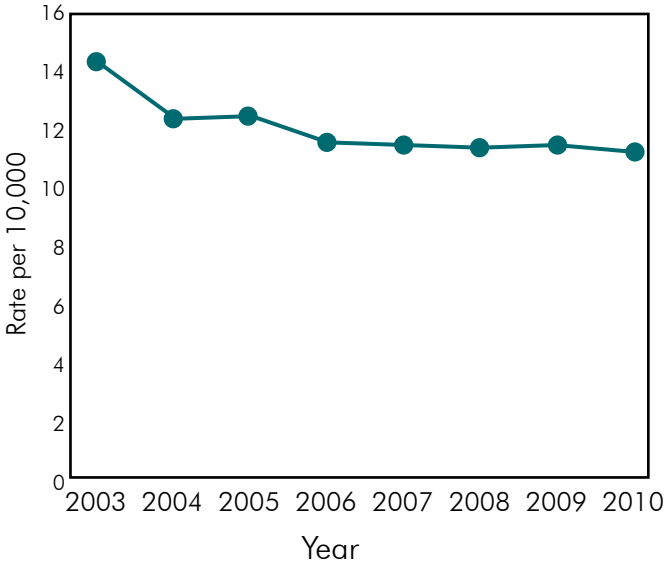
Figure 3-9. Hospitalization with a Primary Diagnosis of Asthma, All Ages, North Carolina and United States, 2003-2010



Sources: North Carolina: NC State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003- 2010; United States: Centers for Disease Control and Prevention, National Hospital Discharge Survey, 2003-2009.

- North Carolina hospital discharge rates for asthma as the primary diagnosis decreased from 2003 (14.3 per 10,000) to 2009 (11.7 per 10,000), a trend similar to the United States (2003-19.8 per 10,000; 2009-15.7 per 10,000, latest published data available).[21,22]
- For each of the years (2003-2009) for which hospital discharge data are available for the United States, the rates for North Carolina have been consistently lower than the national rates.

Figure 3-10. Hospitalizations with a Primary Diagnosis of Asthma, All Ages, North Carolina 2003-2010



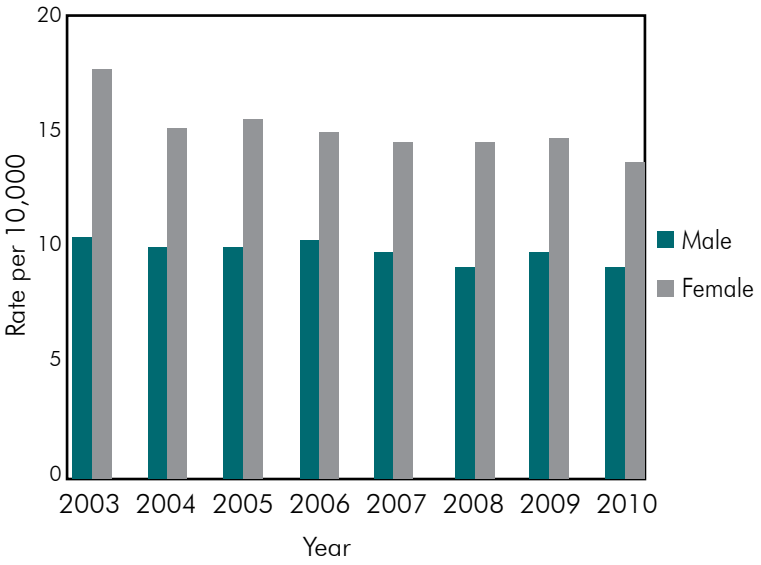
Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2010

- Hospitalization rates due to asthma as the primary diagnosis for all North Carolina residents for all ages decreased 23.1 percent from 2003 (14.3 per 10,000) to 2010 (11.0 per 10,000).

Hospitalization Rates by Gender

Hospitalization rates for asthma continued to be higher for females than for males, although a decrease for both genders was seen between 2003 and 2010.

Figure 3-11. Hospitalizations with a Primary Diagnosis of Asthma, by Gender, North Carolina, 2003-2010



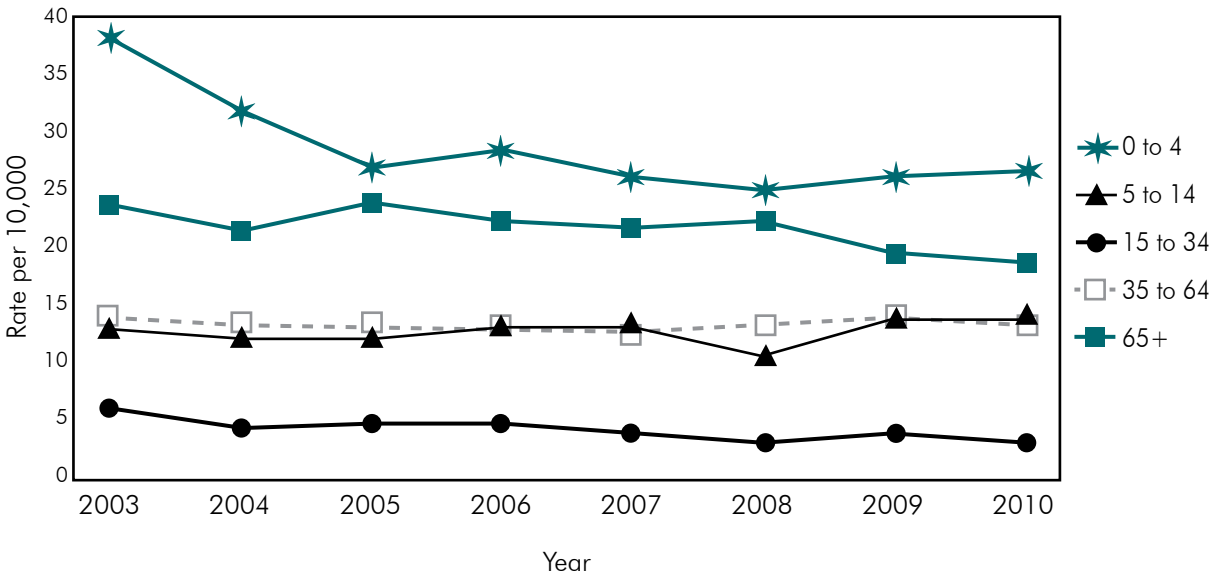
Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2010

- From 2003 to 2010, females had a greater decrease in hospitalization rates than males: 26.0 percent versus 19.2 percent, respectively.

Hospitalization Rates by Age

Between 2003 and 2010, asthma hospitalization rates have declined for every age group.

Figure 3-12. Hospitalizations with a Primary Diagnosis of Asthma, by Age, North Carolina, 2003-2010



Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2010

- The rates for the 0-4 age group declined by 30.7 percent; the 5-14 age group, 7.1 percent; the 15-34 age group, 37.3 percent; the 35-64 age group, 21.3 percent, and the rate for the 65+ age group, 26.1 percent.
- However, the rate for children up through age four continues to be higher than those for the other age groups, including an increase from 2008-2010.
- Adults age 65 and older have the second highest rates; a decrease is observed from 2008-2010.
- The 15-34 year age group had the lowest rates for all eight years.

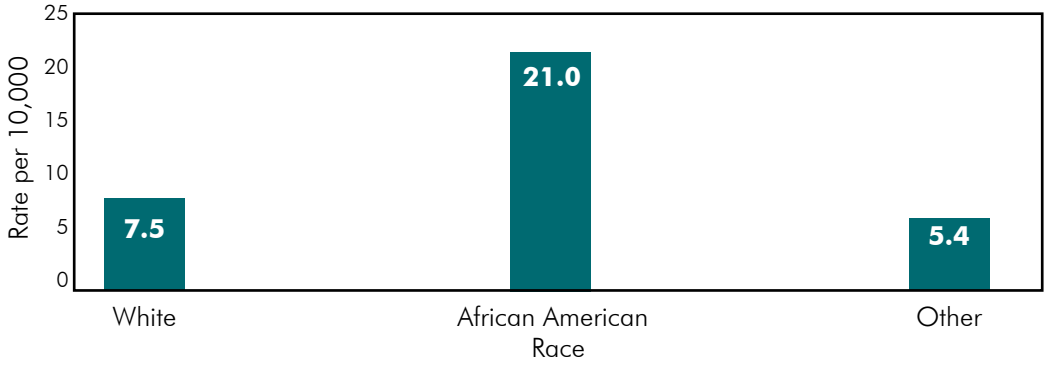
Race and Ethnicity

At the national level, hospital discharge data by race/ethnicity are available from the National Hospital Discharge Survey (NHDS) and show large racial and ethnic disparities.[22] For the three-year period 2001-2003, the at-risk-base hospitalization rate for blacks (4.2 per 100 with current asthma) was 2.5 times that for whites (1.7 per 100 with current asthma). A more recent analysis of 2007-2009 NHDS

data showed a decrease in the disparity, with the rate for blacks (2.8 per 100 with current asthma) being 2.2 times that for whites (1.3 per 100 with current asthma).

Up to 2010, the reporting of race has not been required for submission of hospital discharge data to the data processing contractor for the N.C. State Center for Health Statistics. However, as of January 1, 2010, these race/ethnicity variables are required of North Carolina hospitals in their reporting of discharge data under Session Law 2008-119, "An Act to Improve the Collection and Reporting of Race and Ethnicity Data to Public Health Officials and to the Statewide Data Processor." The data collected in the first year (2010) and presented below, are limited by the small percentage (3.6%) of residents who declined to provide the information or for whom this information was not available (also, see Table 3-13 in Appendix D). In addition, reporting for this information was not consistent from hospital to hospital.

Figure 3-13. Hospitalizations with a Primary Diagnosis of Asthma, by Race, North Carolina, 2010



Note: Other race includes American Indian, Asian, and other races

Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2010

- Among North Carolina residents discharged from the hospital with a primary diagnosis of asthma, whites accounted for 48.7 percent, African Americans, 42.6 percent, and other minorities, 8.6 percent.
- The asthma hospitalization rate among African Americans (21.0 per 10,000) was 2.8 times higher than whites (7.5 per 10,000) and 3.9 times higher than other minorities (5.4 per 10,000).

Hospitalization Rates by County

County-level asthma hospitalization discharge data are published annually by the N.C. State Center for Health Statistics. These counts and rates are presented for all ages and for the age group, 0-14 years. Data for 2010 can be found in Appendix F. A similar table for this report is also presented for North Carolina (total) and for children (<18 years) and adults (18+ years).

Aggregate Hospitalization Rates

To allow for meaningful comparisons between counties, aggregate data are presented as age-adjusted rates for North Carolina (total) and its 100 counties. Data for 2006-2010 are presented in Appendix F.

Health Care Utilization and Health Insurance Coverage

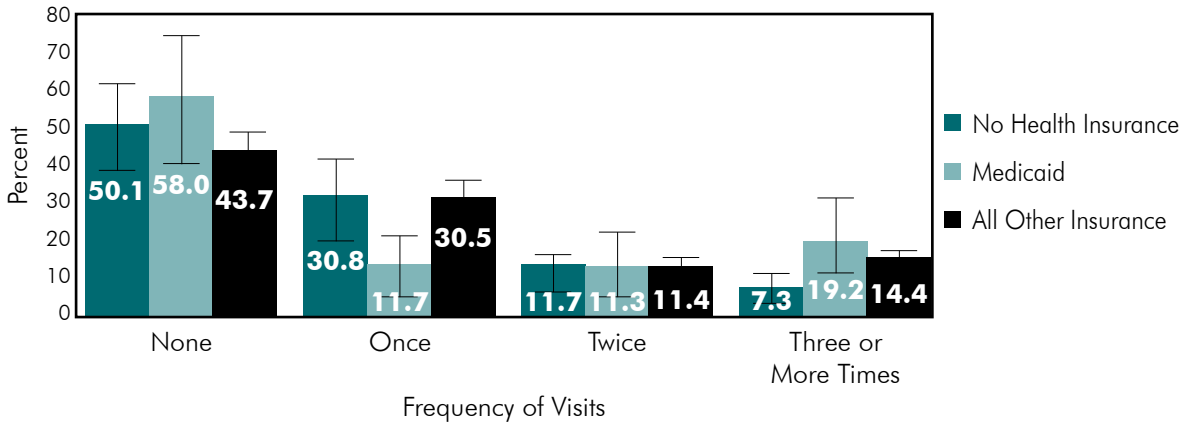
Inadequate or lack of health insurance impacts access to appropriate health care among people with asthma. Data from the 2008 BRFSS and from the North Carolina Division of Medical Assistance provide additional information regarding these issues.

According to the 2008 N.C. BRFSS, over 80 percent of adults with or without current asthma (81.6%, 82.2%, respectively) had health care coverage of some kind (included health insurance, prepaid plans such as health maintenance organizations, or government plans such as Medicare).[24] The following sections summarize healthcare utilization among adults with current asthma by health insurance coverage.

Routine Office Visits

Adults in North Carolina with current asthma were asked the N.C. BRFSS question, "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?" The following figure presents data from their responses, by health insurance coverage (no health insurance, Medicaid, or all other health insurance).

Figure 3-14. Frequency of Visits to a Health Professional for Routine Asthma Care among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008



Note: Data for "No Insurance, Once, Twice, Three or more times" and "Medicaid, None, Once, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

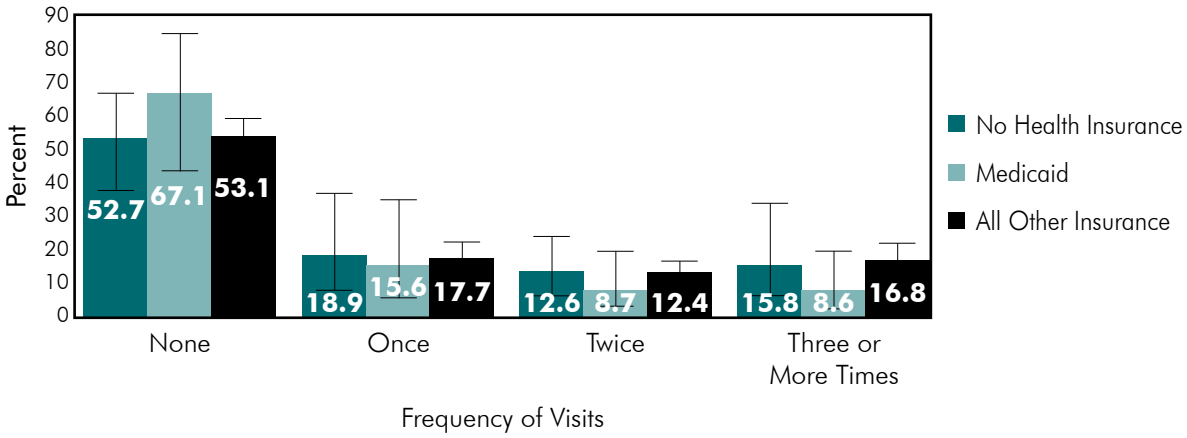
Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Among adults with current asthma and no health insurance, approximately half (50.1%) did not see a doctor or health professional for a routine checkup for their asthma in the past 12 months.

Urgent Treatment

The following figure is based on responses to the question, "During the past 12 months, besides the emergency room visits, how many times did you see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms?" and summarized by health insurance coverage.

Figure 3-15. Frequency of Visits to a Health Professional for Urgent Treatment of Asthma among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008



Note: Data for "No Insurance, Once, Twice, Three or more times" and "Medicaid, None, Once, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

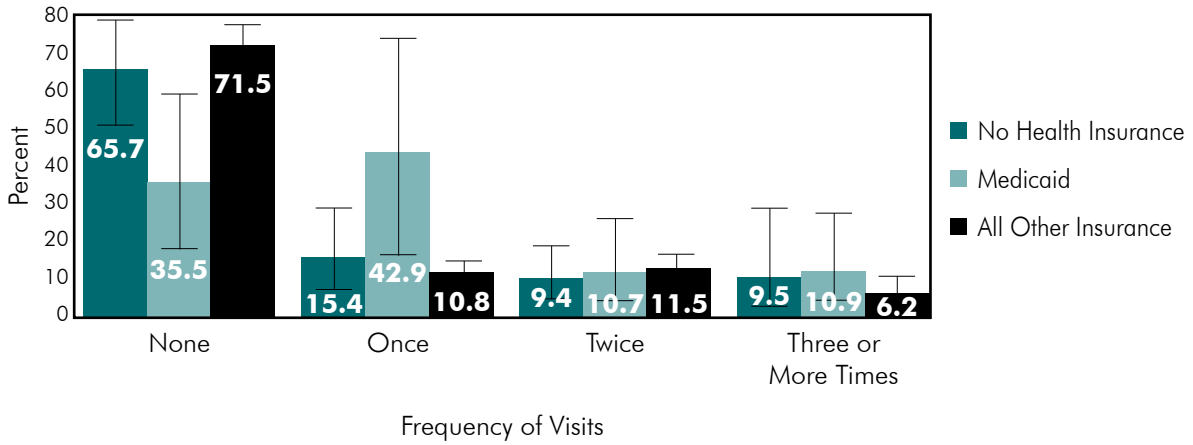
Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Over half (52.7%) of adults with current asthma and no health insurance made no visits to a health professional for urgent treatment of worsening asthma symptoms in the past 12 months.

Emergency Department Visits

The 2008 N.C. BRFSS survey asked the question, "During the past 12 months, how many times did you visit an emergency room or urgent care center because of your asthma?" The following figure presents data from their responses, by health insurance coverage.

Figure 3-16. Frequency of Visits to an Emergency Department Due to Asthma among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008



Note: Data for "No Insurance, Once, Twice, Three or more times," "Medicaid, None, Once, Twice, Three or more times," and "All Other Insurance, Twice, Three or more times" are based on numerators of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

- Almost two-thirds (65.7%) of adults with current asthma and no health insurance did not visit an emergency department due to asthma in the past 12 months.

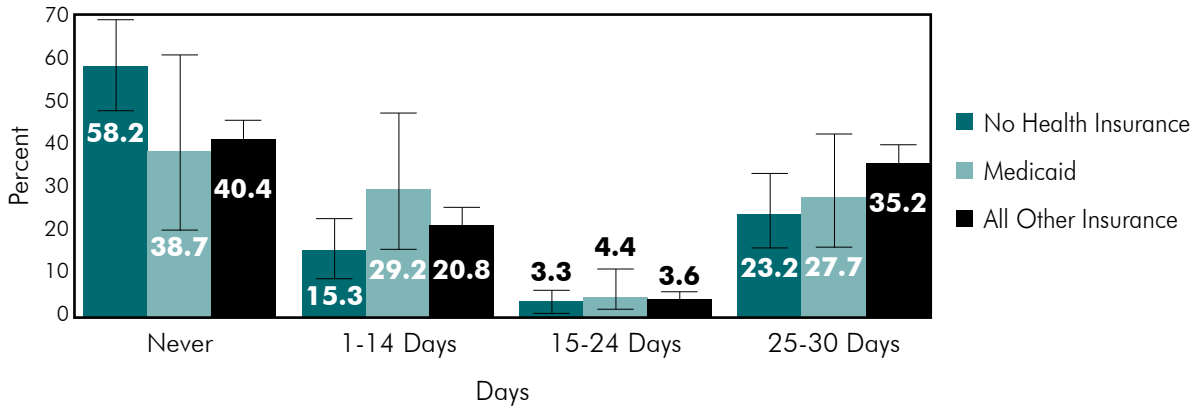
Disease Management Behaviors

Availability and type of health insurance affects disease management behaviors among people with asthma. Access to appropriate health care for treatment of asthma symptoms (including proper use of rescue and controller medications), development of an asthma action plan, and routine and follow-up care is important to an individual's management of his or her asthma. Many health insurance plans also provide helpful and supportive care models for addressing asthma management and improving the overall health status of people with asthma.

Long-term Control Medication Usage

The following figure is based on responses to the 2008 N.C. BRFSS question, "During the past 12 months, how many days did you take a prescription asthma medication to PREVENT an asthma attack from occurring?" and presented by health insurance coverage.

Figure 3-17. Frequency of Taking Medication to Prevent an Asthma Attack during Past 30 Days among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008



Note: Data for "No Insurance, 1-14 days, 15-24 days, 25-30 days," "Medicaid, Never, 1-14 days, 15-24 days, 25-30 days," and "All Other Insurance, 15-24 days" are based on numerators of less than 50; interpret with caution.

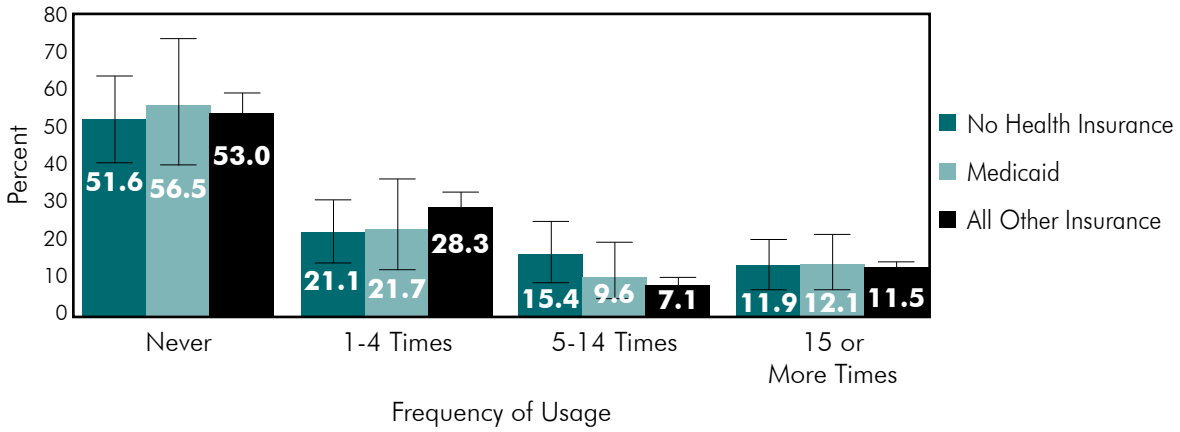
Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

☐ Approximately 58.2 percent of adults with current asthma and no health insurance reported never having taken medication to prevent an asthma attack in the past 30 days.

Quick Relief Medication Usage

The following figure is based on responses to the 2008 N.C. BRFSS question: "During the past 12 months, how often did you use a prescription asthma inhaler during an asthma attack to stop it?" and presented by health insurance coverage.

Figure 3-18. Frequency of Asthma Inhaler Usage during Past 30 Days among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008



Note: Data for "No Insurance, 1-4 times, 5-14 times, 15 or more times" and "Medicaid, Never, 1-4 times, 5-14 times, 15 or more times" are based on numerators of less than 50; interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

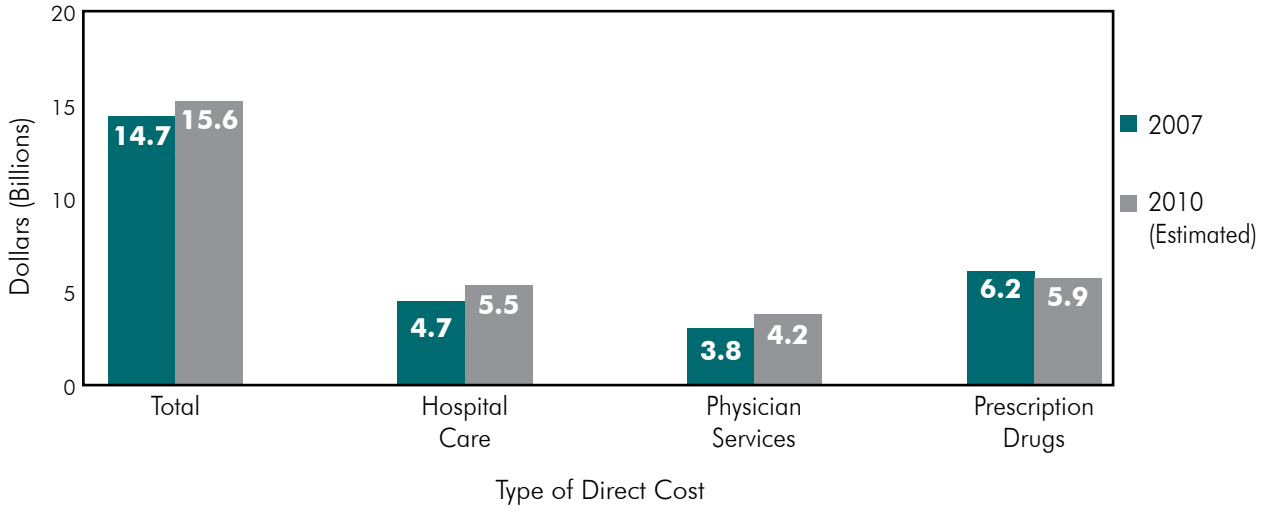
- Over half (51.6%) of adults with current asthma and no health insurance reported that they had never used an inhaler in the past 30 days during an asthma attack to stop it.

Cost of Asthma

Asthma is a significant economic burden at national, state, and local levels. According to the National Heart, Lung, and Blood Institute, in 2007, annual expenditures for health and lost productivity due to asthma as primary diagnosis totaled $19.7 billion in the United States. Of that amount, $14.7 billion were direct costs (including physician visits, hospital stays, and medications), $3.1 billion were morbidity-related, and $1.9 billion were mortality-related. Among the direct costs, prescription drugs totaled $6.2 billion, followed by hospital care ($4.7 billion) and physician services ($3.8 billion).[25]

The National Heart, Lung, and Blood Institute estimated asthma (as primary diagnosis) in the United States to cost $20.7 billion (direct costs, $15.6 billion; morbidity-related, $3.1 billion; mortality-related, $2.0 billion) in 2010.[26] The graph below presents 2007 direct costs and estimated 2010 direct costs.

Figure 3-19. Direct Cost of Asthma as Primary Diagnosis, United States, 2007 and 2010 (Estimated)



Sources: National Heart, Lung, and Blood Institute. Morbidity & Mortality: 2007 and 2009 Chart Books on Cardiovascular, Lung, and Blood Diseases, 2007, 2009

The Agency for Healthcare Research and Quality published the *Asthma Care Quality Improvement: A Resource Guide for State Action in 2006*, which provided estimates of the economic burden (including direct and indirect costs) of asthma for each of the fifty states.[27] For North Carolina in 2003, direct costs were estimated at over $362 million and indirect costs (including, but not limited to lost work days, school absenteeism, lost productivity, and lost earnings) were estimated at more than $269 million. The total estimated asthma cost for North Carolina for 2003 exceeded $631 million.

Inpatient Hospital Utilization and Charges

The North Carolina State Center for Health Statistics provides annual data on inpatient hospital utilization and charges by principal diagnosis for the state and by county of residence. The following table presents these data for 2003-2010.

Table 3-20. Inpatient Hospital Utilization and Charges for Asthma as Principal Diagnosis, North Carolina, 2003-2010*

NORTH CAROLINA RESIDENTS – Asthma as Principal Diagnosis and Year	Total Cases	Discharge Rate (Per 10,000 Pop)	Average Days Stay	Days Stay Rate (Per 1,000 Pop)	Total Charges	Average Charge Per Day	Average Charge Per Case
Asthma 2003	12,051	14.3	3.6	5.1	$90,415,459	$2,093	$7,503
Asthma 2004	10,783	12.6	3.6	4.6	$88,990,197	$2,278	$8,254
Asthma 2005	11,163	12.8	3.7	4.7	$100,936,167	$2,460	$9,042
Asthma 2006	10,533	11.8	3.6	4.3	$104,384,471	$2,728	$9,916
Asthma 2007	10,535	11.6	3.6	4.2	$110,321,725	$2,930	$10,478
Asthma 2008	10,689	11.5	3.5	4.1	$122,508,867	$3,237	$11,462
Asthma 2009	10,986	11.7	3.4	4.0	$132,504,720	$3,520	$12,061
Asthma 2010	10,471	11.0	3.2	3.5	$132,224,232	$3,913	$12,632

* Excludes newborns and discharges from out-of-state hospitals

Source: Inpatient Hospitalization and Charges by Principal Diagnosis of Asthma, North Carolina, 2003-2010, North Carolina State Center for Health Statistics (Data as of May 31, 2012)

- The Average Days Stay Rate (Per 1,000 Population) decreased by about 31 percent from 5.1 in 2003 to 3.5 in 2010.
- While the overall asthma hospital discharge rate has decreased from 2003 (14.3 per 10,000) to 2010 (11.0 per 10,000), the average charge per case has increased from $7,503 to $12,632 during that period.

Medicaid Costs

The North Carolina Division of Medical Assistance provides annual data for Medicaid recipients with asthma as primary diagnosis.[23] These data include claim counts and costs for outpatient physician services, inpatient hospital services, emergency department visits, all pharmacy-related services, and asthma medications. Data for 2008 are presented below.

Table 3-21. Asthma-related Healthcare Utilization Costs for All Medicaid Recipients with Asthma as Primary Diagnosis[1], Children Ages 0-17 Years, North Carolina, 2008

	Claim Count[2]	Recipient Count[2]	Total Cost	Average Cost Per Visit
Outpatient Physician	74,079	40,076	$6,061,001	$82
Inpatient (≥24 hours)	1,268	1,221	$2,494,099	$1,967
Inpatient (<24 hours)	624	594	$1,112,682	$1,783
Emergency Department	10,608	8,619	$18,224,185	$1,718
All Pharmacy (Rx Drugs)	4,635,057	624,018	$380,190,672	$82
Asthma Meds Only[3]	603,479	186,939	$39,169,024	$64

1 Recipients include all Medicaid (CCNC and fee-for-service); primary diagnosis = ICD-9: 493.xx

2 Claim and recipient counts are unduplicated for each place of service as well as for pharmacy

3 NDC codes used f or asthma medications

Source: N.C. Division of Medical Assistance, Data based on date of service, 1/1/08-12/31/08

Table 3-22. Asthma-related Healthcare Utilization Costs for all Medicaid Recipients with Asthma as Primary Diagnosis[1], Adults Ages ≥18 Years, North Carolina, 2008

	Claim Count[2]	Recipient Count[2]	Total Cost	Average Cost Per Visit
Outpatient Physician	28,397	15,074	$1,576,785	$56
Inpatient (≥24 hours)	1,206	1,140	$3,866,014	$3,206
Inpatient (<24 hours)	215	189	$574,732	$2,673
Emergency Department	7,619	5,402	$12,110,778	$1,590
All Pharmacy (Rx Drugs)	9,322,705	470,147	$643,102,858	$69
Asthma Meds Only[3]	301,557	85,974	$14,763,695	$49

1 Recipients include all Medicaid (CCNC and fee-for-service); primary diagnosis = ICD-9: 493.xx

2 Claim and recipient counts are unduplicated for each place of service as well as for pharmacy

3 NDC codes used f or asthma medications

Source: N.C. Division of Medical Assistance, Data based on date of service, 1/1/08-12/31/08

- Children had higher average costs per visit than adults for outpatient services ($82 vs. $56), emergency department visits ($1,718 vs. $1,590), all pharmacy prescription drugs ($82 vs. $69), and asthma medications only ($64 vs. $49).
- Adults had higher average cost per visit than children for inpatient services <24 hours: $2,673 vs. $1,783; ≥24 hours: $3,206 vs. $1,967.

Key Findings

- About 46 percent of adults in North Carolina with current asthma did not see a doctor or other health professional for a routine checkup for their asthma in the past 12 months.
- About 46 percent of adults with current asthma saw a doctor or other health professional for urgent treatment of worsening asthma symptoms in the past 12 months.
- Nearly 26 percent of children in North Carolina with current asthma visited an emergency department (ED) or urgent care center during the past 12 months because of their asthma.
- Thirty-three percent of adults in North Carolina with current asthma visited an ED or urgent care center at least once in the past 12 months because of their asthma.
- From 2003-2009, asthma hospitalization rates in North Carolina have been consistently lower than the national rates.
- Hospitalization rates due to asthma as the primary diagnosis for all North Carolina residents for all ages decreased 23.1 percent from 2003 (14.3 per 10,000) to 2010 (11.0 per 10,000).
- Among adults with current asthma and no health insurance, approximately half (50.1%) did not see a doctor or health professional for a routine checkup for their asthma in the past 12 months.
- Over half (52.7%) of adults with current asthma and no health insurance made no visits to a health professional for urgent treatment of worsening asthma symptoms in the past 12 months.
- Approximately 58.2 percent of adults with current asthma and no health insurance reported never having taken medication to prevent an asthma attack at least once in the past 30 days.
- Over half (51.6%) of adults with current asthma and no health insurance reported that they had never used an inhaler in the past 30 days during an asthma attack to stop it.
- While the overall asthma hospital discharge rate has decreased from 2003 (14.3 per 10,000) to 2010 (11.0 per 10,000), the average charge per case has increased from $7,503 to $12,632 during that period.
- Among Medicaid recipients, children had higher average costs per visit than adults for outpatient services, ED visits, all pharmacy prescription drugs, and asthma medications.
- Among Medicaid recipients, adults had higher average cost per visit than children for inpatient services (<24 hours and 24+ hours).

Mortality

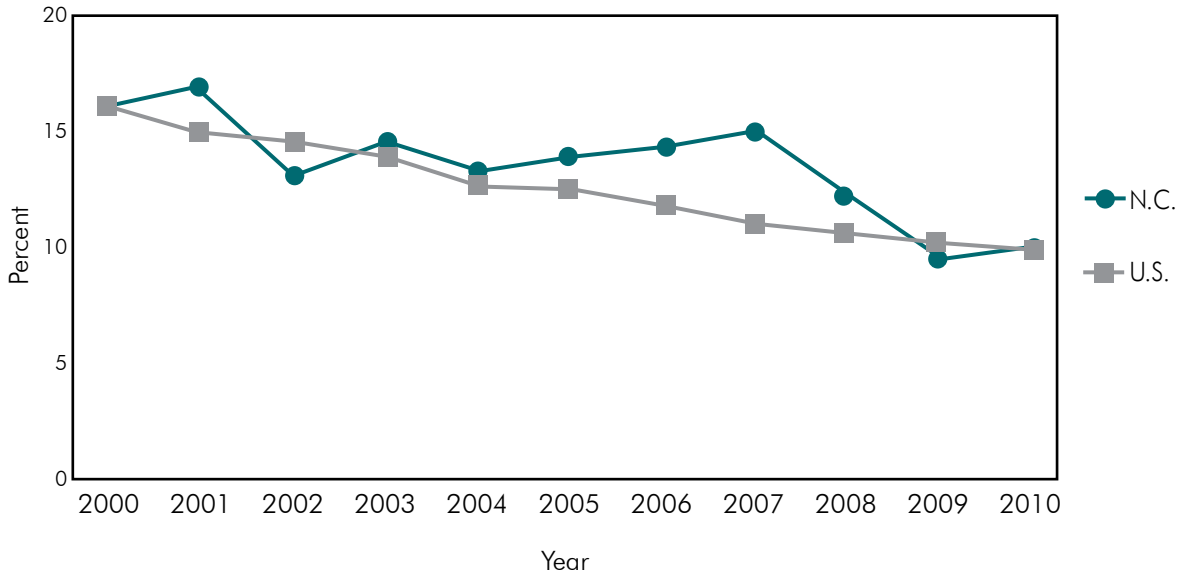
Good asthma management is important for reducing symptoms of asthma and maintaining quality of life. Deaths due to asthma, while not common, may be prevented with successful disease management. According to the National Center for Health Statistics, 3,355 persons in the United States died due to an underlying cause of asthma in 2010.[28] Data from the N.C. State Center for Health Statistics (Detailed Mortality Statistics) indicate that in 2010, 102 persons in North Carolina died due to an underlying cause of asthma. The age-adjusted rate of 10.3 per million population, was the lowest rate observed since 1995 in North Carolina.[29] Because of its rarity, asthma as an underlying cause of death, was not among the 17 leading causes of death in North Carolina in 2010. In fact, it ranked below the sub-category: Cancer of the Larynx, which had an age-adjusted death rate of 12.0 per million based on combined mortality data from 2006-2010.[30]

This section includes a comparison of North Carolina's asthma mortality rates with those for the United States and summaries of North Carolina data, by demographic characteristics (age, gender, and race).

North Carolina and United States

North Carolina's asthma mortality rates decreased by 35.6 percent from 2000-2010, while nationally, these rates decreased by 37.9 percent during the same period.

Figure 4-1. Age-Adjusted Asthma Mortality Rates, North Carolina and United States, 2000-2010



Note: Direct age-adjustment using the Standard 2000 United States population; asthma listed as the underlying cause of death (ICD-10 codes J45-J46); all ages included

Sources: North Carolina State Center for Health Statistics, 2000-2010. United States: CDC Wonder, National Center for Health Statistics, CDC, 2000-2010; National Vital Statistics Reports, Vol. 60, No. 4, 2010

- In general, North Carolina's asthma mortality rates were higher than those for the United States.
- The highest North Carolina rate (17.4 per million) was in 2001, and its lowest (9.7 per million) was in 2009, with an uptick in 2007.

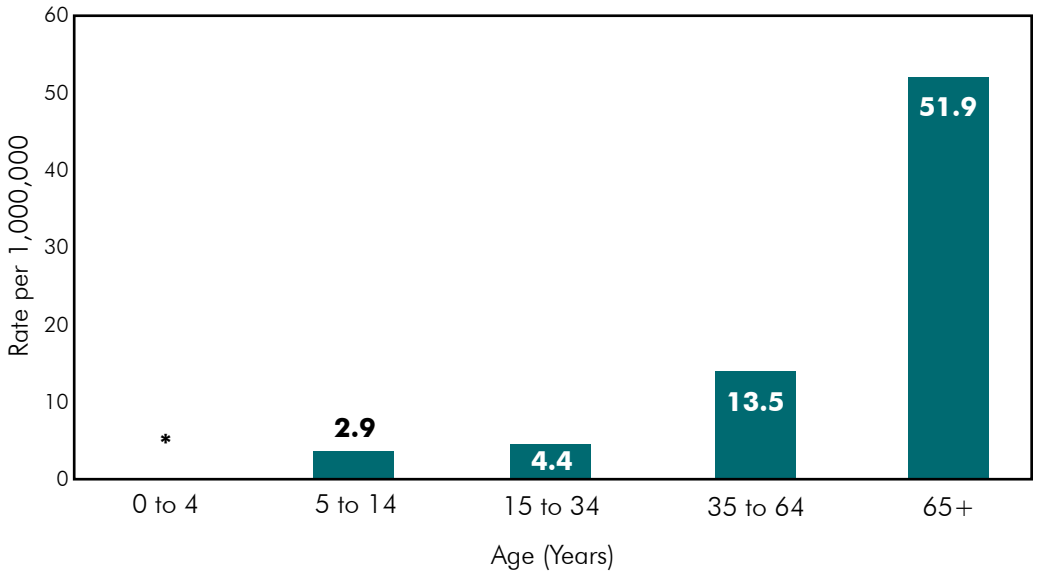
North Carolina Data

The following graphs present mortality due to asthma as the underlying cause of death in North Carolina. Three demographic categories will be highlighted: age, gender, and race. Due to small numbers, asthma mortality will be presented using combined data for 2000 through 2010.

Age

Asthma mortality increases with age.

Figure 4-2. Age-Specific Asthma Mortality Rates, North Carolina, 2000-2010



* Rate suppressed due to small numbers

Note: Asthma listed as the underlying cause of death (ICD-10 codes J45-J46); rate for the 0 to 4 year age group is based on the number of deaths of less than 20 – interpret with caution.

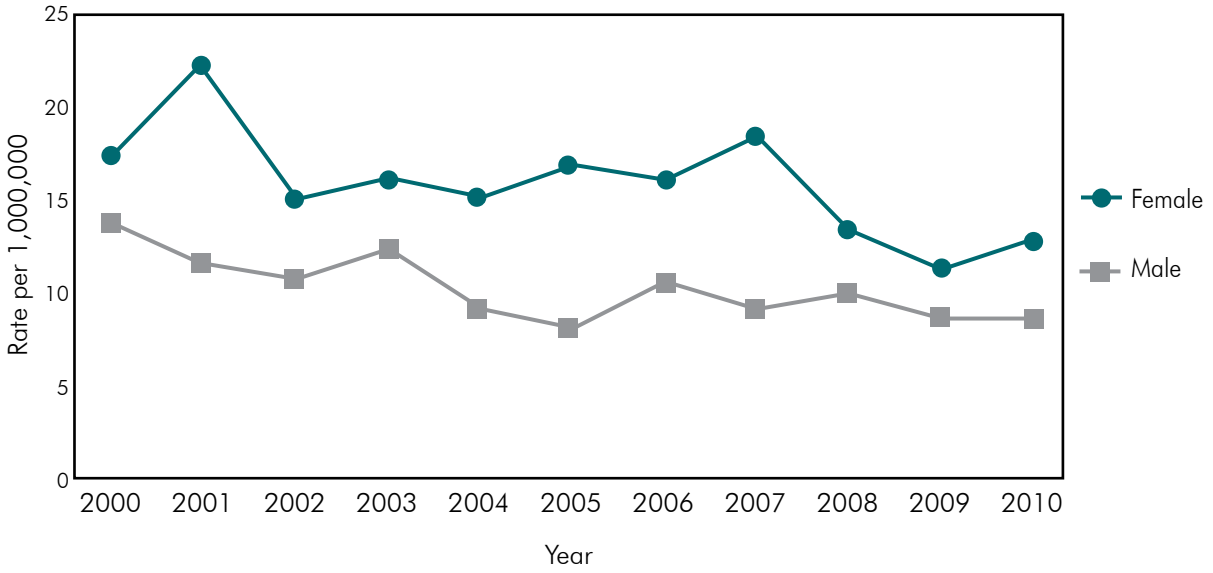
Source: North Carolina State Center for Health Statistics, 2000-2010

- The mortality rate for persons aged 65 years and older (51.9 per million) was nearly four times higher than the younger adult age group (35 to 64 years: 13.5 per million) (see Table 4-2 in Appendix D).

Gender

Asthma mortality is higher among females than males.

Figure 4-3. Age-Adjusted Asthma Mortality Rates, by Gender, North Carolina, 2000-2010

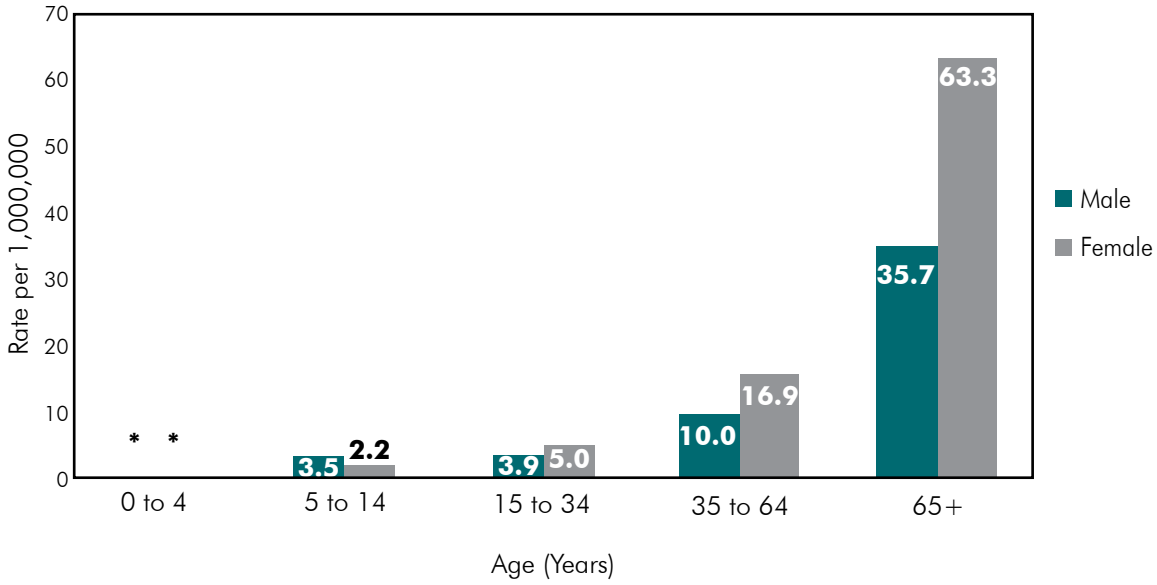


Note: Direct age-adjustment using the Standard 2000 United States population; asthma listed as the underlying cause of death (ICD-10 codes J45-J46) all ages included

Source: North Carolina State Center for Health Statistics, 2000-2010

- From 2000-2010, the asthma mortality rate for males reached a low of 8.2 per million in 2005 from a high of 13.7 per million in 2000.
- Among females during the same period, the asthma mortality rate reached a low of 10.3 per million in 2009 from a high of 22.2 per million in 2001 (see Table 4-3 in Appendix D).

Figure 4-4. Asthma Mortality, by Age and Gender, North Carolina, 2000-2010



* Rates suppressed due to small numbers

Note: Asthma listed as the underlying cause of death (ICD-10 codes J45-J46); rate for "Female, 5 to 14 Years" based on a number of deaths of less than 20 – interpret with caution.

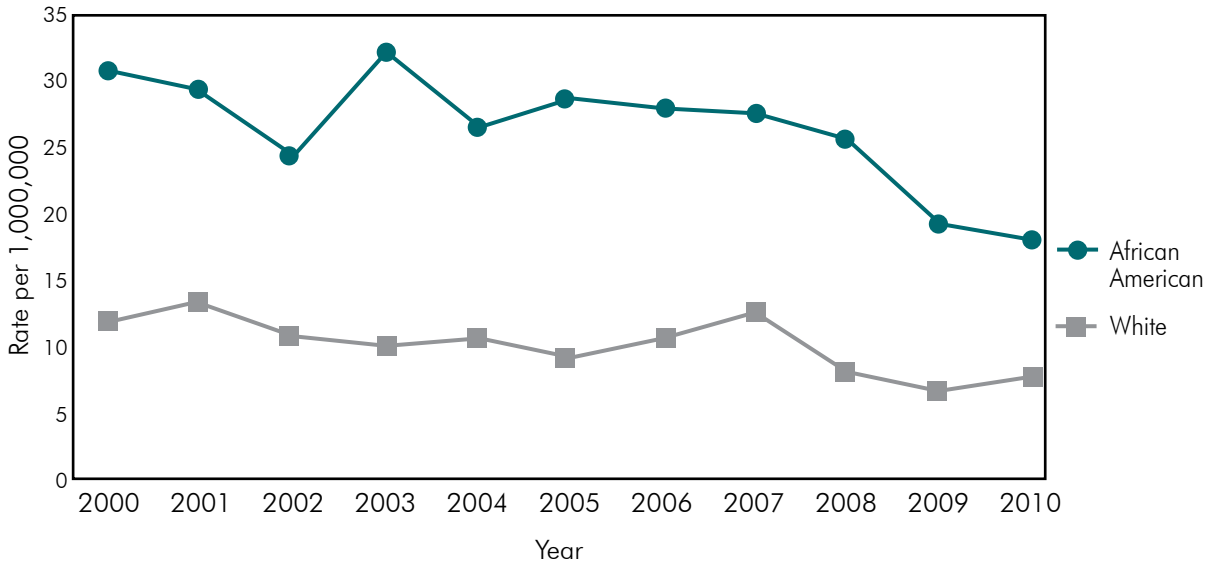
Source: North Carolina State Center for Health Statistics, 2000-2010

- In the age groups 15 to 34 years, 35 to 64 years, and 65+ years, females have higher asthma mortality rates than males.
- The rates for females in the age groups 35 to 64 years and 65+ years (16.9 per million and 63.3 per million, respectively) are approximately 1.7 and 1.8 times those of the corresponding rates for males (see Table 4-4 in Appendix D).

Race

Asthma mortality is higher among African Americans compared with whites. Because of the small number of deaths due to asthma among minority race groups other than African Americans, only data for whites and African Americans from 2000-2010 are summarized below.

Figure 4-5. Age-Adjusted Asthma Mortality, by Race, North Carolina, 2000-2010

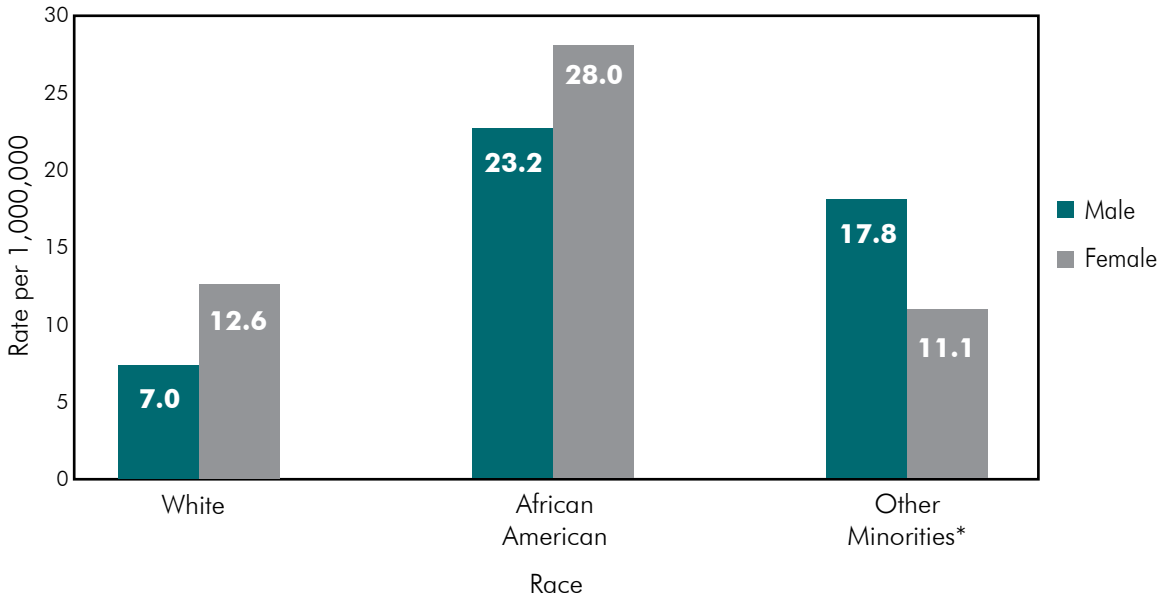


Note: Direct age-adjustment using the Standard 2000 United States population; asthma listed as the primary cause of death (ICD-10 codes J45.x or J46.xsame comment); all ages included.

Source: North Carolina State Center for Health Statistics, 2000-2010

- African Americans continue to have higher asthma mortality rates than whites in North Carolina.
- From 2000-2010, the asthma mortality rate for African Americans decreased by 46.4 percent, while the rate for whites decreased by 33.9 percent (see Table 4-5 in Appendix D).
- The rate for African Americans (16.5 per million) was the lowest in 2010, from a high of 32.4 per million in 2003.
- The rate for whites (6.8 per million) was the lowest in 2009, from a high of 13.6 per million in 2001 (see Table 4-5 in Appendix D).

Figure 4-6. Age-Adjusted Asthma Mortality, by Race and Gender, North Carolina, 2000-2010



* Other Minorities include Asian, and American Indian and Alaskan Native.

Note: Rates for "Other Minorities, Males and Females," based on numbers of deaths of less than 20 – interpret with caution.

Source: North Carolina State Center for Health Statistics, 2001-2010

- African American females had the highest rate (28.0 per million), followed by African American males (23.2 per million), white females (12.6 per million), and white males (7.0 per million) (see Table 4-6 in Appendix D).

Key Findings

- In general, North Carolina's asthma mortality rates were higher than those for the United States from 2001-2010.
- The mortality rate for persons aged 65 years and older (51.9 per million) was nearly four times higher than the younger age adult group (35 to 64 years: 13.5 per million).
- Asthma mortality is higher among females than males in North Carolina.
- African Americans continue to have higher asthma mortality rates than whites in North Carolina.

Healthy People 2010

Healthy People 2010 was developed to serve as a roadmap for improving the health of all people in the United States during the first decade of the 21st century. It was designed to achieve two overarching goals: (1) increase quality and years of healthy life; and, (2) eliminate health disparities. Progress towards achieving these goals is monitored through meeting targeted objectives in priority areas such as asthma. Each objective was developed with a target to be achieved by the year 2010.[3] Below are the asthma-related Healthy People 2010 objectives and associated targets for the United States (Figure 5-1).

Figure 5-1. Healthy People 2010 Asthma-Related Objectives and Targets

Healthy People 2010 Asthma-Related Objectives	2010 Targets
1-9a. Reduce pediatric asthma hospitalization rate. (Rate per 10,000)	< 18 years: 17.3/10,000
24-1. Reduce asthma deaths. (Rate per 1,000,000)	0-4 years: 1.0/million 5-14 years: 1.0/million 15-34 years: 2.0/million 35-64 years: 9.0/million 65+ years: 60.0/million
24-2. Reduce hospitalizations for asthma. (Rate per 10,000)	0-4 years: 25.0/10,000 5-64 years: 7.7/10,000 65+ years: 11.0/10,000
24-3. Reduce hospital emergency department visits for asthma. (Rate per 10,000)	0-4 years: 80.0/10,000 5-64 years: 50.0/10,000 65+ years: 15.0/10,000
24-4. Reduce activity limitations among persons with asthma. (Percent)	6.0 percent
24-5. Reduce the number of school or work days missed by persons with asthma due to asthma. (Days)	2.0 days
24-6. 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. (Percent)	30.0 percent
24-7. Increase the proportion of persons with asthma who receive appropriate asthma care according to the NAEPP Guidelines. (Percent)	
a. Persons with asthma who receive written asthma management plans from their health care provider.	38.0 percent
b. Persons with asthma with prescribed inhalers who receive instruction on how to use them properly.	98.8 percent
c. Persons with asthma who receive education about recognizing early signs and symptoms of asthma episodes and how to respond appropriately.	71.0 percent
d. Persons with asthma who receive medication regimens that prevent the need for more than one canister of short-acting inhaled beta agonists per month for relief of symptoms.	92.0 percent
e. Persons with asthma who receive follow-up medical care for long-term management of asthma after any hospitalization due to asthma.	87 percent
f. Persons with asthma who receive assistance with assessing and reducing exposure to environmental risk factors in their home, school and work environments.	50 percent

North Carolina Progress

A comparison of North Carolina's progress towards *Healthy People 2010* objectives and United States targets for 2010 are presented below (Figure 5-2). For the remaining *Healthy People 2010* objectives related to asthma, no comparable data are available to measure these objectives at the state level.

Figure 5-2. Selected Healthy People 2010 Asthma-Related Objectives, North Carolina and United States

Objective	North Carolina Progress	Healthy People 2010 Target	North Carolina Compared to U.S.
1-9a. Reduce pediatric asthma hospital admissions rate (Rate per 10,000)			
Age 0-17 years	14.4[1]	17.3	Above[2]
24-1. Reduce asthma deaths (Rate per 1,000,000)			
Age 0-4 years	1.6*	1.0	Below
5-14	3.9*	1.0	Below
15-34	2.3*	2.0	Below
35-64	13.3	9.0	Below
65+	31.6	60.0	Above
24-2. Reduce hospitalizations for asthma (Rate per 10,000)			
Age 0-4 years	26.5	25.0	Below
5-64 (age-adjusted)	7.0	7.7	Above
65+ (age-adjusted)	2.2	11.0	Above
24-3. Reduce hospital emergency department visits for asthma. (Rate per 10,000)			
Age 0-4 years	102.0	80.0	Below
5-64	49.8	50.0	About the same
65+	23.3	15.0	Below

[1] Rate based on hospital discharge data.
[2] Above = better than HP 2010 target; Below = did not reach HP 2010 target; About the same = ±5% of target.
* Rates for North Carolina asthma deaths among persons aged 0-4, 5-14, and 15-34 years are based on numerators of less than 20; interpret with caution.

Sources: Objective 1-9a: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2010; Objective 24-1: N.C. State Center for Health Statistics, Detailed Mortality Statistics 2010; Objective 24-2: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2010; Objective 24-3: N.C. DETECT, Asthma Emergency Department Visit Data, 2009.

Source for Healthy People 2010 Targets: Centers for Disease Control and Prevention, Healthy People 2010 Final Review, Access to Quality Health Services (Objective 1-9), Respiratory Diseases (Objectives 24-1, 24-2, 24-3). Web site: http://www.cdc.gov/nchs/healthy_people/hp2010/hp2010_final_review.htm.

Other Asthma Measures

Although not directly comparable to Healthy People 2010 objectives (due to differences in data collection methods), below is a summary of estimates of other measures of asthma-related outcome and management based on the N.C. BRFSS Asthma Call-back Survey[30] and N.C. CHAMP conducted in 2009.

Adults

Among North Carolina adults with current asthma responding to the N.C. BRFSS Asthma Call-back Survey in 2009,

Reported limitations in their usual activities due to asthma.	60.4%
Reported that they have taken an asthma management course.	5.2%
Reported that they have ever received an asthma action plan from their doctor or other health professional.	26.9%
Reported having been advised to make environmental changes at home, school or work to improve their asthma.	38.8%

N.C. BRFSS Asthma Call-back Survey questions:
"During the past 12 months, would you say you limited your usual activities due to asthma not at all, a little, a moderate amount, or a lot?"
"Have you ever taken a course or class on how to manage your asthma?"
"Has a doctor or other health professional EVER given you an asthma action plan?"
"Has a health professional ever advised you to change things in your home, school or work to improve your asthma?"

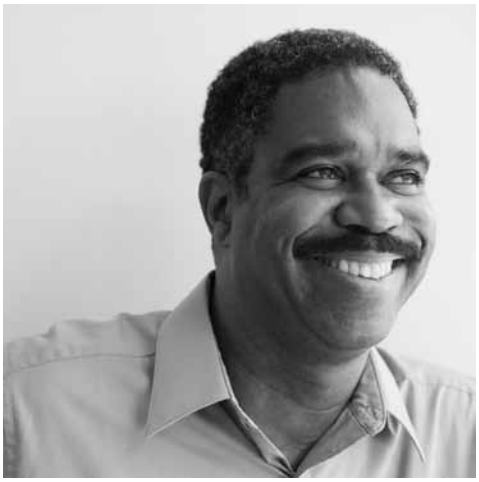
Children

Among North Carolina adults responding to the N.C. CHAMP Survey in 2009:

Reported that either they or their child have taken a course or class on how to manage his/her asthma.	38.0%
Reported that their child has received an asthma management plan.	57.0%
Reported that either they or their child have been taught how to recognize early signs or symptoms of an asthma episode.	88.0%

N.C. CHAMP questions;
"Have you or (CHILD) ever taken a course of class on how to manage (his/her) asthma?"
"Has a doctor or other health professional ever given you an asthma management plan for (CHILD)?"
"Has a doctor or other health professional ever taught you or (CHILD) how to recognize early signs or symptoms of an asthma episode?"

Discussion



From 2005-2010, North Carolina's asthma prevalence rates among children were higher than the national child asthma rates, while the North Carolina asthma prevalence rates among adults were lower than the national adult asthma prevalence rates. During this time period, child current asthma prevalence in North Carolina was higher than the nation, except in 2008, when the North Carolina rate (8.2%) dropped below the national rate (9%). In 2010, the North Carolina rate was 10.3 percent, while the United States rate was 8.4 percent. Adult current asthma prevalence was lower than the United States for the same six-year period; in 2010, the North Carolina rate was 7.5 percent, while the national rate was 8.6 percent.

There were differences in asthma prevalence rates based on gender. Boys had higher current asthma prevalence rates than girls. This pattern reversed during puberty when high school girls had higher current asthma rates than high school boys. Among adults, females had higher current asthma prevalence rates than males. In addition to gender, specific age groups consistently exhibited higher current asthma prevalence rates than others. For example, youth, ages 11-13 years, had significantly higher current asthma prevalence rates than those in the 5-10 and 14-17 age groups. Among adults, persons aged 65-74 years have the highest rates, followed by persons aged 55-64 years, 18-24 years, 35-44 years, 45-54 years, and 75 years and older.

Racial disparities in asthma prevalence were pronounced in North Carolina. From 2005-2010, African American adults had higher lifetime and current asthma prevalence rates than white adults. In 2010, North Carolina African American adults were 27 percent more likely to have been diagnosed with asthma than white adults; nationally, this percentage was about 17 percent.[8] African American children in North Carolina had higher lifetime and current asthma prevalence than white children (22.1% vs.14.6%, 17.4% vs. 7.4%, respectively). Current asthma prevalence rates for North Carolina adults and children were higher than national

rates. Researchers estimated that in the United States, African American adults and children are 20 percent and 47 percent, respectively, more likely to have current asthma than their white counterparts.[8]

In 2010, North Carolina adult lifetime and current prevalence rates decreased with increased educational level (less than high school: 18.1%, 11.5%; high school of G.E.D.: 12.7%, 7.5%; some post-high school: 11.8%, 6.9%; college graduate: 11.0%, 6.3%).

Additionally, low income households were disproportionately affected by asthma. North Carolina adults with an annual household income of less than $15,000 had higher asthma prevalence rates than all other income groups. This is similar to national trends, which showed that asthma prevalence was higher for persons in groups with lower income-to-poverty level ratios.[24]

Since 2005, North Carolina collected data regarding asthma management behavior, including routine visits to a healthcare provider, asthma management in schools, and having asthma management plans. Based on North Carolina Behavioral Risk Factor Surveillance Survey (BRFSS) data, in 2008, approximately 54 percent of adults with current asthma reported that they saw a health professional for a routine checkup for their asthma in the past 12 months. Data from the 2010 North Carolina Child Health Assessment and Monitoring Program (CHAMP) showed that approximately 58 percent of children were allowed to self-administer emergency asthma medication at school in 2010. In 2008, 70.5 percent of North Carolina secondary schools had asthma action plans on file for all students with known asthma. Also, in 2008, more than two-thirds (68.4%) of North Carolina secondary schools required all school staff members to receive annual training on recognizing and responding to severe asthma symptoms. During the 2010-2011 school year, school nurses reported that asthma was the most common chronic health condition among North Carolina public school students in grades K-12, accounting for 34.8 percent of all chronic health conditions.

Having an asthma management plan is essential to the self-management of an individual's condition. In 2008, approximately 66 percent of North Carolina children with asthma had an asthma management plan. The percentage decreased to 57.1 percent in 2010. This is twice the percentage (31.7%) reported by adults with current asthma. Slightly more boys than girls had an asthma management plan, while significantly more female adults (37.4%) than male adults (21.3%) had one.

When persons with asthma are unable to control their disease, visits to an emergency department, urgent care center or hospital are often the result. Overall, slightly more children (25.8%, 2005-2010 data) than adults (33.0%, 2008 data) reported having been to an emergency department during the past 12 months because of asthma. African American children (37.3%) had more emergency department visits for asthma than white children (18.0%). From 2003-2009, North Carolina's rates of hospitalization due to a primary cause of asthma decreased by 18.2 percent in comparison to the percentage decrease of 20.7 percent for the nation. Disparities were present by: gender (females had higher rates than males), age (children ages 0-4 years and persons 65 years and older had higher rates than other age groups), and race (African Americans had a rate almost three times higher than whites and almost four times higher than other minorities).

Access to health care, including asthma medication used, among persons with asthma provided another perspective on asthma outcomes due to poorly controlled asthma.

A major component of this was inadequate or lack of health insurance coverage, with disparities evident among persons with asthma in North Carolina. More adults with current asthma and Medicaid or other health insurance coverage than adults with no health insurance reported having taken medication to prevent an asthma attack. Healthcare utilization costs, as reflected in hospitalization charges due to asthma, added to the understanding of the burden of asthma in North Carolina. Although the rate of hospital visit average length of stay (days per 1,000 population) decreased by 31 percent from 2003-2010, the average charge per case increased from $7,503 to $12,632 during that same period. Average cost per visit for inpatient hospital services among Medicaid recipients was $2,429; adult costs were 1.6 times higher than costs for children.

Nationally, asthma mortality rates declined steadily from 2000-2010, resulting in a decrease of about 38 percent.[27,31] Although North Carolina rates decreased more than national rates (55%) during that period, North Carolina rates remained higher overall than the national rates. Among North Carolina residents, persons 65 years and older, female adults, and African Americans were disproportionately affected by asthma. The asthma mortality rate for persons aged 65 and older was 3.8 times higher than the age group, 35-64 years. Females in those two age groups (65 years and older, 35-64 years) had asthma mortality rates that were 1.8 and 1.7 times higher than the rates for males in those groups. African American females had the highest asthma mortality rate, followed by African American males, white females, and white males.

North Carolina data was better than the *Healthy People 2010* (HP2010) targets for:

- Reduce pediatric asthma hospital admissions rate: persons 0-17 years.
- Reduce asthma deaths: persons 65 years and older.
- Reduce hospitalizations for asthma: persons 5-65 years and 65 years and older.

Data from 2009 indicate that the state is also close to the HP2010 target – reduce hospital emergency department visits for asthma – among persons aged 5-64 years.

Data from the Asthma Call-back Survey (ACBS) provided additional information about the health and experiences of persons with asthma.[30] With the availability of 2009 ACBS data, a deeper understanding of the asthma burden was used to address other HP2010 asthma objectives, including: 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 received formal patient education; and increase the proportion of persons with asthma who received appropriate asthma care according to the National Asthma Education and Prevention Program Guidelines.

Limitations

Although the North Carolina Program was fortunate to have access to rich data sources such as the N.C. BRFSS, N.C. CHAMP, N.C. State Center for Health Statistics hospital discharge data set, N.C. DETECT data set, N.C. Annual School Health Services Reports, and Medicaid data from the N.C. Division of Public Health to complete this report, there were significant gaps in the data as well as other limitations.

For example, since estimates of North Carolina's asthma prevalence are based on responses to telephone surveys of a representative sample of the entire state population, it is difficult to collect enough data to generate reliable estimates by county. For the same reason, asthma prevalence data for some racial/ethnic groups (e.g., Native Americans) and age groups (e.g., children under the age of five years) are limited. In addition, changes to the BRFSS survey asthma questions and data collection protocol over the years, created challenges for analyzing the results and presenting accurate trends over time.

Another gap is the absence of race/ethnicity information from emergency department data from N.C. DETECT.

Next Steps

The North Carolina Asthma Program utilized data from this document to support the updating of the North Carolina State Asthma Plan, 2013-2018. The updated Plan will continue to address the burden of asthma in North Carolina with special emphasis on the groups at highest risk for poorly controlled asthma: children under the age of five years, persons 65 years and older, females, African Americans, persons with less than a high school education, and persons living in households with an annual income of less than $15,000. The plan will also provide methods for addressing the limitations discussed above.

The North Carolina Asthma Program will continue to conduct surveillance and monitor asthma across the state, while exploring new data sources, such as the N.C. Division of Aging and Adult Services and American Indian community resources. The state will strengthen its collaboration with partners and stakeholders, including the N.C. Department of Public Instruction (e.g., obtaining school absenteeism data related to asthma) and N.C. Division of Air Quality (e.g., obtaining air quality data). It will analyze data from the asthma call-back survey to add to its knowledge of asthma among adults with respect to its prevalence, control and management, healthcare outcomes and mortality. It will examine data from the N.C. DETECT and N.C. State Center for Health Statistics hospital discharge data sets to identify repeat visits by persons with asthma to the emergency department or hospital. This additional information will allow it to better address the various issues regarding the burden of asthma in North Carolina.

Lastly, with the advent and availability of social media technology, we will explore new ways to disseminate asthma surveillance data to the general public and asthma community. Timely, efficient, and effective methods can help support and drive public health policy and action in the near future.

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Technical Notes

Prevalence

Prevalence is defined as the number of affected persons present in the population at a specific time divided by the number of persons in the population at that time. It is used to describe the health burden on a specific population.[1]

$$\textbf{Prevalence} = \frac{\text{\# of cases of a disease present in the population at a specified time}}{\text{\# of persons in the population at that specified time}}$$

Lifetime Asthma prevalence: The proportion of people in a population who have ever been diagnosed with asthma by a health professional.

Current asthma prevalence: The proportion of people in a population who currently (still) have asthma.

Rates Based on Small Numbers

Much of the data reported in this document come from surveys based on random samples of a population and therefore, is subject to error due to sampling variability. Likewise, rates and percentages derived from these data are also estimates subject to error. These random errors may be substantial when the measure (e.g., rate or percentage) has a small number of cases in the numerator.[2]

For asthma prevalence data, the N.C. State Center for Health Statistics (N.C. SCHS) and CDC note that when the sample size is less than 50, estimates are not precise and should be interpreted with caution. For asthma hospitalization discharge and mortality data, the N.C. SCHS urges that they be interpreted with caution when the sample size is less than 20.

Confidence Intervals for Proportions

The confidence interval represents the range within which the true magnitude of effect lies with a certain degree of assurance. A 95 percent confidence interval (95% CI) states that we are 95 percent certain that the true measure lies within this specified range.[3]

For example, the estimated current asthma prevalence among North Carolina white children (from a random sample of the population) is 7.4 percent, with a 95 percent CI of 5.9 to 9.3 percent. This means that we are 95 percent confident that the true prevalence of current asthma for North Carolina white children is no less than 5.9 percent, and no greater than 9.3 percent. A 95 percent CI uses a multiplier of 1.96.

The formula for the 95 percent confidence interval is:

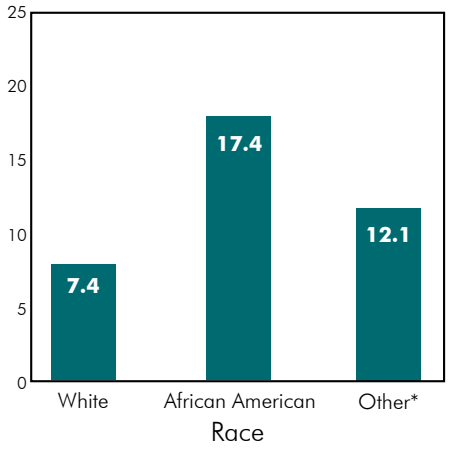
$$p \pm 1.96\sqrt{\frac{pq}{n}}$$

Where: p = proportion
n = sample size
q = 1-p (for small values of p (≤ .01) q is small and may be ignored)[2]

Statistical Significance

The 95 percent confidence interval (95% CI) can also be used to determine if the difference between two groups is statistically significant. When the confidence intervals do not overlap, the difference between two groups is considered to be statistically significant and likely not due to chance. When they do overlap, we can not conclude that they are significantly different. In this report, "statistically significant" is noted when the confidence intervals do not overlap. This can also be seen visually, as indicated by error bars found within figures in the report.

Example – Current Asthma Prevalence among Children, by Race, North Carolina, 2010



	Race		
	White	**African American**	**Other***
%	7.4	17.4	12.1
95% C.I.	(5.9-9.3)	(13.0-22.8)	(7.6-18.9)

* "Other" race includes Asian, Native Hawaiian or other Pacific Islander, American Indians or Alaskan Native or other.

Note: Prevalence data for the "Other" group are based on a numerator of less than 50; interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Current asthma prevalence among African American children is 17.4 percent with a 95 percent CI of 13.0-22.8 percent. For white children, current asthma prevalence is 7.4 percent with a 95 percent CI of 5.9-9.3 percent. This confidence interval does not overlap with the confidence interval for African American children – the upper limit for white children (9.3%) is still less than the lower limit for African American children (13.0%). Therefore, we can conclude that the difference in prevalence is statistically significant or that African American children have significantly higher current asthma prevalence than white children.

Age Adjustment

Populations often differ in age distribution. Therefore, it is often important to control for the differences among the age distributions of populations when making comparisons among rates for a specific event (e.g., hospitalization, death) to assess the relative risk of that event. A CDC publication on age adjustment states: "Age adjustment, using the direct method, is the application of observed age-specific rates to a standard age distribution to eliminate differences in crude rates in populations of interest that result from differences in the population's age distribution."[4]

The direct method of age adjustment is frequently used to compare the hospitalization or mortality rates of different populations, by controlling for differences in age distribution. Sum the products of the age-specific hospitalization or death rates and the proportion of the standard population in that age group across all age groups of interest. This weighted sum is represented in the following formula for 10 age groups:

Where: p_i = the age specific rate for age group i.
w_i = the weight; the proportion of the standard population in age group i.[5]

$$\text{Age adjusted death rate} = \sum_{i=1}^{10} w_i p_i$$

Odds Ratio

In a study where participants are selected on the basis of their disease status, as in the N.C. BRFSS, the relative risk can be estimated by calculating the ratio of the odds of exposure among the cases to that among the controls. In this document, cases are considered persons who have either lifetime or current asthma, and exposure is gender.[3]

Example – based on the whether a female has a greater odds of having asthma than a male.

	Has Asthma	Does Not Have Asthma
Female	A	B
Male	C	D

Odds Ratio (OR) = Odds that an exposed person (female) develops the disease (asthma).
Odds that a non-exposed person (male) develops the disease (asthma).

OR = A*D/B*C

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Appendix A. Data Sources

Behavioral Risk Factor Survey System – National and State Data

According to CDC, "the Behavioral Risk Factor Surveillance System (BRFSS) is the world's largest, on-going telephone health survey system, tracking health conditions and risk behaviors in the United States yearly since 1984. Currently, data are collected monthly in all 50 states, the District of Columbia, Puerto Rico, the U.S. Virgin Islands and Guam."[1]

The Asthma Call-back Survey (ACBS), an in-depth asthma survey developed and funded by the Air Pollution and Respiratory Health Branch in the National Center for Environmental Health, complements the two core asthma prevalence questions in the BRFSS survey.[2] It is conducted with BRFSS respondents who report an asthma diagnosis. The ACBS was piloted in three states in 2005 and has been conducted each year since. A majority of states participate in the ACBS each year. North Carolina has participated in the ACBS since 2009.

Detailed Mortality Statistics

Mortality statistics for asthma as a primary cause of death are obtained for the North Carolina State Center for Health Statistics, which are published on their website. The counts of deaths for each cause are shown for the race-sex and age categories. Race categories are white (W) and minority (M); minority deaths are predominately Black (over 98%) in North Carolina. The cause of death is the underlying cause classified according to the 10th revision of the International Classification of Diseases (ICD-10).[3]

Hospitalization Data

The North Carolina Asthma Program receives hospitalization data from the State Center for Health Statistics.[4] North Carolina hospitals are required to "submit information necessary for a review and comparison of charges, utilization patterns, and quality of medical services" (Senate Bill 345 (article 11A, 131E-214)) to a private contractor that currently acts as the statewide data processor. The patient-level information the hospitals submit is drawn from their billing databases. Several types of hospitals are not included, such as: military and veteran hospitals, ambulatories, specialty hospitals, rehabilitation facilities, psychiatric facilities, and prison hospitals.

The North Carolina hospital discharge data are comprised of hospitalization information such as diagnoses; date of admittance and date of discharge; length of stay; information on the patient such as county of residence and gender; patient status at discharge; payer; and total amount billed for the hospital stay. As of Jan. 1, 2010, race/ethnicity information was required of North Carolina hospitals in the reporting of discharge data under Session Law 2008-119, "An Act to Improve the Collection and Reporting of Race and Ethnicity Data to Public Health Officials and to the Statewide Data Processor."[5] Hospital discharge data report on hospital stays, and do not provide enough information to identify individual patients. Therefore, it can not be determined if the same person was admitted to the hospital once or several times during the reporting period.

Morbidity & Mortality: Chart Book on Cardiovascular, Lung, and Blood Diseases, 2007 and 2009

The NHLBI Chart Book is a biennial compilation of data on the size and trends of morbidity and mortality from the cardiovascular, lung, and blood diseases. While most charts describe national prevalence, hospitalizations, and mortality statistics, some of them provide additional information by state or country. Risk factors estimates and the economic costs of these diseases are also included. Most of the data used in the 2007 and 2009 editions of this publication were obtained from the National Center for Health Statistics.[6,7]

National Survey of Children's Health, 2007

The National Survey of Children's Health is sponsored 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 telephone survey of households with children less than 18 years of age. The purpose of this survey is to estimate national and state level prevalence for a variety of physical, emotional, and behavioral health indicators in combination with information on the child's family context and neighborhood environment. The respondent was a parent or guardian who knew the most about the selected child's health.[8]

North Carolina Behavior Risk Factor Surveillance System (N.C. BRFSS)

The N.C. BRFSS is a random telephone survey of state residents aged 18 and older in households with telephones. BRFSS was initially developed in the early 1980's by the Centers for Disease Control and Prevention (CDC) in collaboration with state health departments and is currently conducted in all 50 states, the District of Columbia and three United States territories. The North Carolina Division of Public Health has participated in the BRFSS since 1987. Through BRFSS, information is collected in a routine, standardized manner at the state level on a variety of health behaviors and preventive health practices related to the leading causes of death and disability such as cardiovascular disease, cancer, diabetes, asthma, and injuries. BRFSS interviews are conducted monthly and data are analyzed annually.[9]

North Carolina Child Health Assessment and Monitoring Program (CHAMP)

The Child Health Assessment and Monitoring Program (CHAMP) survey was developed in the fall of 2004 and implemented in January 2005. CHAMP is the first survey of its kind in North Carolina to measure the health characteristics of children, up to age 17. Eligible children for the CHAMP survey are drawn each month from the BRFSS (Behavioral Risk Factor Surveillance System) telephone survey of adults, ages 18 and older. All adult respondents with children living in their households are invited to participate in the CHAMP survey. One child is randomly selected from the household and the adult most knowledgeable about the health of the selected child is interviewed in a follow-up survey. All questions about the selected child are answered only by the most knowledgeable adult. CHAMP surveys are revised each year to meet the child health surveillance needs of North Carolina.[10]

CHAMP, by collecting data for young children, contributes to a seamless health data system for all North Carolina citizens from birth to old age. Questions on the CHAMP survey pertain to a wide variety of health-related topics, including breast feeding, early childhood development,

access to health care, oral health, mental health, physical health, nutrition, physical activity, family involvement and parent opinion on topics such as tobacco and childhood obesity. Collected annually, the CHAMP survey data helps: monitor child health status and identify child health problems; evaluate child health programs and services; assist health professionals to make evidence-based decisions, policies and plans; and monitor progress towards selected health targets, such as Healthy People 2020 asthma objectives.[11]

North Carolina Disease Event Tracking and Epidemiologic Collection Tool (N.C. DETECT)

N.C. DETECT provides public health officials and hospital users with the capacity for statewide early event detection and timely public health surveillance. N.C. DETECT uses data from various sources to provide syndrome-based monitoring, including: hospital emergency departments (EDs), the Carolina Poison Center (CPC), urgent care centers and emergency medical services. This statewide, user-driven surveillance system can track ED visits by primary and secondary diagnoses on near real-time basis. N.C. DETECT data cover a spectrum of diseases and other health-related episodes, including infectious disease, chronic disease, injury and environmental health, among others.[12]

North Carolina Division of Medical Assistance – Medicaid Data

The North Carolina Division of Medical Assistance (N.C. DMA) manages the state's Medicaid program and provides annual data and reports.[13] N.C. DMA's Medicaid data include: active eligibility case loads counts, annual reports, authorized eligibles by county, county specific snapshots for North Carolina Medicaid services, and statistics from the Medicaid annual reports, along with several dashboard publications. Since 2009, N.C. DMA has provided the Asthma Program with asthma-related data for Medicaid recipients.

School Health Profiles – Principal's Survey

The School Health Profiles is a biennial survey conducted by state and local education and health agencies among middle and high school principals. Profiles monitors the current status of: school health education requirements and content, physical education requirements, asthma management activities, food service, competitive foods practices and policies, family and community involvement in school health programs, and school health policies on HIV and AIDS prevention, tobacco-use prevention, violence prevention, and physical activity. The data profiles are conducted among a sample of secondary schools in a state or school district, and profiles data are collected from the principal and lead health education teachers at each sampled school using self-administered questionnaires.[14]

North Carolina's School Health Education Profile: Principal's Survey was sent to a randomly selected 402 middle and high schools across the state. Of the 281 completed surveys that were returned and eligible for analysis, 158 were middle schools, 111 were high schools, and 12 were junior/senior combined schools.[15]

School Health Services Report for Public Schools

The Annual School Health Services Report includes data submitted by school nurses, based on their knowledge of health services provided by school nurses and other health professionals in their schools from North Carolina Public

Schools only. It does not include data from state residential, private, charter or federal schools. The purpose of this survey is to get an overall view of school health services, to identify conditions and situations affecting students in North Carolina (including chronic disease and injuries), to gain a profile of the student to nurse ratio across the state, and to identify health policies in schools.[16]

Youth Risk Behavior Surveillance System (YRBSS)

The Youth Risk Behavior Surveillance System monitors six categories of priority health-risk behaviors among youth and young adults. The YRBS includes a national school-based survey conducted by CDC and state and local school–based surveys conducted by state and local education and health agencies. The YRBS data are used to: measure progress toward achieving 15 national health objectives for Healthy People 2010 and three of the 10 leading health indicators, to assess trends in priority health-risk behaviors among high school students, and to evaluate the impact of broad school and community interventions at the national, state, and local levels.[17]

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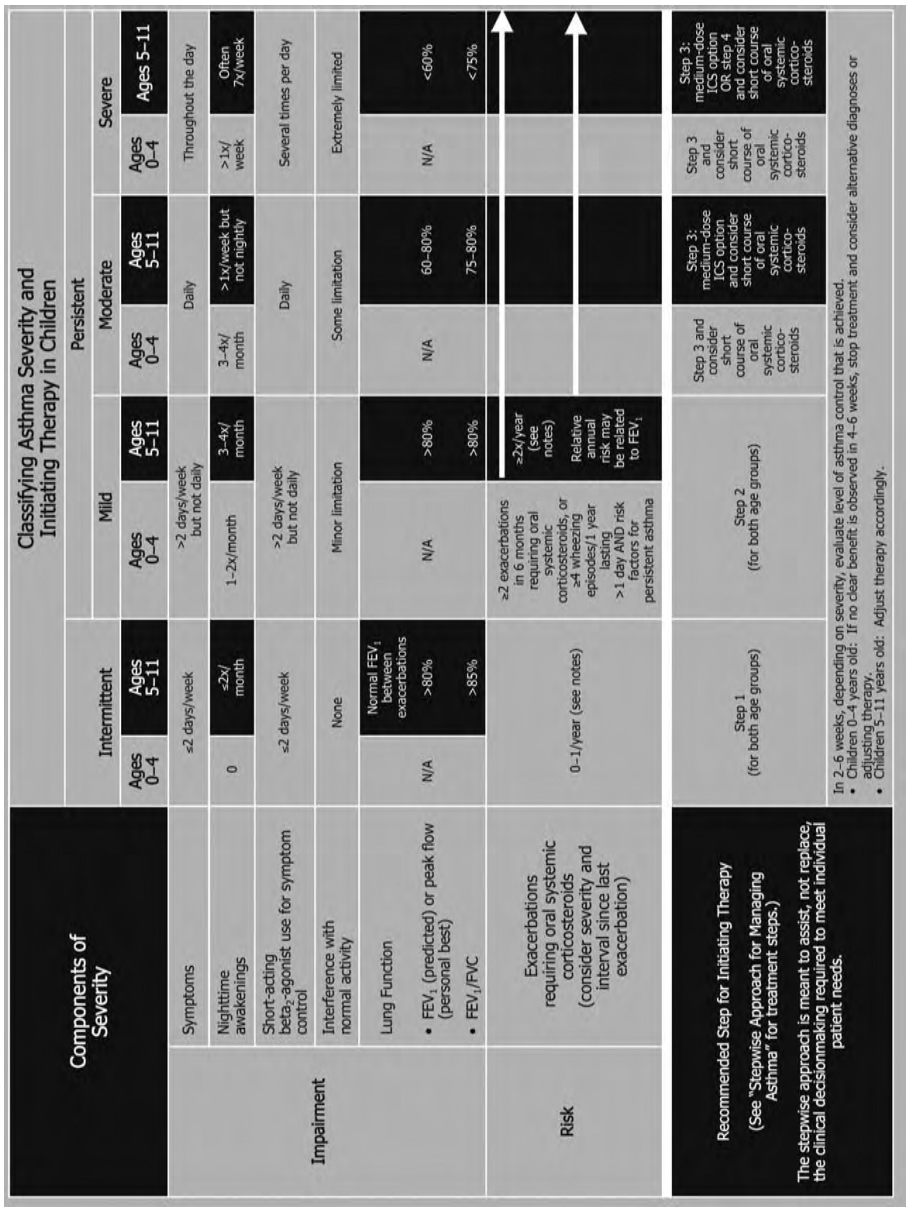
Appendix B. Population Distribution of North Carolina, 2010

	Children 0-17 Years Old		Adults 18+ Years Old		Total Population	
	Number	**Percent**	**Number**	**Percent**	**Number**	**Percent**
Total	2,281,635	100.00%	7,253,848	100.0%	9,535,483	100.0%
Sex						
Male	1,167,303	51.2%	3,478,189	47.9%	4,645,492	48.7%
Female	1,114,332	48.8%	3,775,659	52.1%	4,889,991	51.3%
Race						
White, non-Hispanic	1,303,440	57.1%	5,005,677	69.0%	6,309,117	66.2%
African-American, non-Hispanic	575,578	25.2%	1,507,135	20.8%	2,082,713	21.8%
Hispanic	307,790	13.5%	492,330	6.8%	800,120	8.4%
Other, non-Hispanic	94,827	4.2%	248,706	3.4%	343,533	3.6%
Age Group						
0 – 4 years	632,040	27.7%%			632,040	6.6%
5 – 9 years	635,945	27.9%%			635,945	6.7%
10 – 14 years	631,104	27.7%%			631,104	6.6%
15 – 17 years	382,546	16.8%%			382,546	4.0%
18 – 24 years			938,618	12.9%	938,518	9.8%
25 – 34 years			1,246,593	17.2%	1,246,593	13.1%
35 – 44 years			1,327,151	18.3%	1,327,151	13.9%
45 – 54 years			1,368,646	18.9%	1,368,646	14.4%
55 – 64 years			1,138,761	15.7%	1,138,761	11.9%
65+ years			1,234,079	17.0%	1,234,079	12.9%

Source: N.C. State Center for Health Statistics. North Carolina Population Estimates. Available from: http://www.schs.state.nc.us/schs/data/population/nchspop.cfm.

Appendix C: Tables from *Expert Panel Report 3 (EPR-3) Summary Report: Guidelines for the Diagnosis and Management of Asthma*

FIGURE 11. CLASSIFYING ASTHMA SEVERITY AND INITIATING THERAPY IN CHILDREN



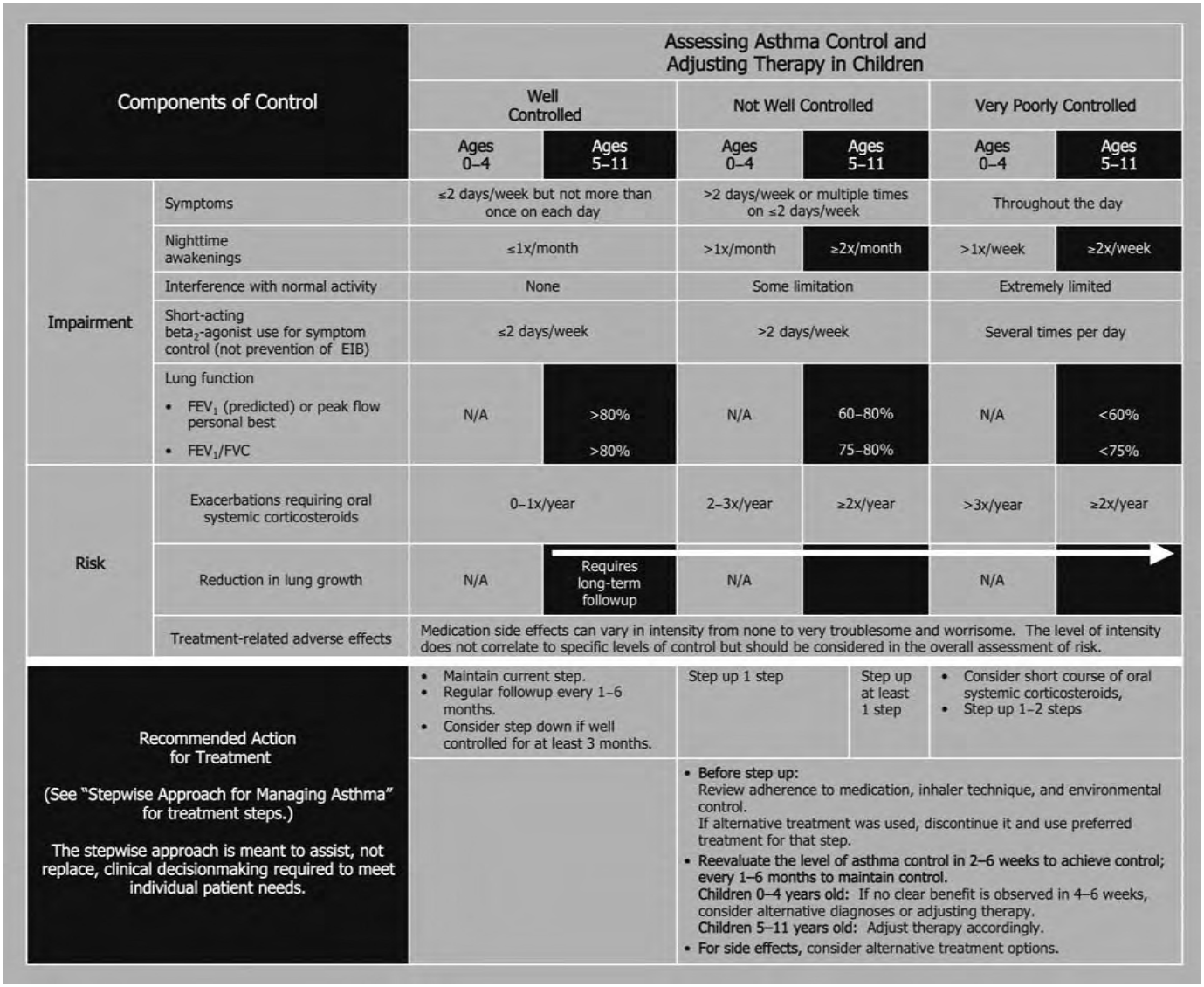
Key: FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; ICS, inhaled corticosteroids; ICU, intensive care unit; N/A, not applicable

Notes:

- Level of severity is determined by both impairment and risk. Assess impairment domain by caregiver's recall of previous 2–4 weeks. Assign severity to the most severe category in which any feature occurs.
- Frequency and severity of exacerbations may fluctuate over time for patients in any severity category. At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and severe exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients with ≥2 exacerbations described above may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.

Source: National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.

FIGURE 12. ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY IN CHILDREN



Components of Control		Assessing Asthma Control and Adjusting Therapy in Children					
		Well Controlled		Not Well Controlled		Very Poorly Controlled	
		Ages 0–4	Ages 5–11	Ages 0–4	Ages 5–11	Ages 0–4	Ages 5–11
Impairment	Symptoms	≤2 days/week but not more than once on each day		>2 days/week or multiple times on ≤2 days/week		Throughout the day	
	Nighttime awakenings	≤1x/month		>1x/month	≥2x/month	>1x/week	≥2x/week
	Interference with normal activity	None		Some limitation		Extremely limited	
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week		>2 days/week		Several times per day	
	Lung function • FEV_1 (predicted) or peak flow personal best • FEV_1/FVC	N/A	>80% >80%	N/A	60–80% 75–80%	N/A	<60% <75%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1x/year		2–3x/year	≥2x/year	>3x/year	≥2x/year
	Reduction in lung growth	N/A	Requires long-term followup	N/A		N/A	
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.					
Recommended Action for Treatment (See "Stepwise Approach for Managing Asthma" for treatment steps.) The stepwise approach is meant to assist, not replace, clinical decisionmaking required to meet individual patient needs.		• Maintain current step. • Regular followup every 1–6 months. • Consider step down if well controlled for at least 3 months.		Step up 1 step	Step up at least 1 step	• Consider short course of oral systemic corticosteroids, • Step up 1–2 steps	
				• **Before step up:** Review adherence to medication, inhaler technique, and environmental control. If alternative treatment was used, discontinue it and use preferred treatment for that step. • **Reevaluate the level of asthma control in 2–6 weeks to achieve control; every 1–6 months to maintain control.** **Children 0–4 years old:** If no clear benefit is observed in 4–6 weeks, consider alternative diagnoses or adjusting therapy. **Children 5–11 years old:** Adjust therapy accordingly. • **For side effects,** consider alternative treatment options.		

Key: EIB, exercise-induced bronchospasm, FEV_1, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit; N/A, not applicable

Notes:

- The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient's or caregiver's recall of previous 2–4 weeks. Symptom assessment for longer periods should reflect a global assessment, such as whether the patient's asthma is better or worse since the last visit.
- At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma control. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate poorer disease control.

Source: National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.

FIGURE 13. STEPWISE APPROACH FOR MANAGING ASTHMA LONG TERM IN CHILDREN, 0–4 YEARS OF AGE AND 5–11 YEARS OF AGE

Step up if needed (first check inhaler technique, adherence, environmental control, and comorbid conditions)

Assess control

Step down if possible (and asthma is well controlled at least 3 months)

		Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Notes
Children 0–4 Years of Age		Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 3 care or higher is required. Consider consultation at step 2.					
	Preferred	SABA PRN	Low-dose ICS	Medium-dose ICS	Medium-dose ICS + LABA or Montelukast	High-dose ICS + LABA or Montelukast	High-dose ICS + LABA or Montelukast + Oral corticosteriods ICS	• The stepwise approach is meant to assist, not replace, the clinical decisionmaking required to meet individual patient needs. • If an alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up. • If clear benefit is not observed within 4–6 weeks, and patient's/family's medication technique and adherence are satisfactory, consider adjusting therapy or an alternative diagnosis. • Studies on children 0–4 years of age are limited. Step 2 preferred therapy is based on Evidence A. All other recommendations are based on expert opinion and extrapolation from studies in older children. • Clinicians who administer immunotherapy should be prepared and equipped to identify and treat anaphylaxis that may occur. **Key: Alphabetical listing is used when more than one treatment option is listed within either preferred or alternative therapy.** ICS, inhaled corticosteroid; LABA, inhaled long-acting beta$_2$-agonist; LTRA, leukotriene receptor antagonist; oral corticosteroids, oral systemic corticosteroids; SABA, inhaled short-acting beta$_2$-agonist
	Alternative		Cromolyn *or* Montelukast					
	Quick-Relief Medication	Each Step: Patient Education and Environmental Control • SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms. • With viral respiratory symptoms: SABA q 4–6 hours up to 24 hours (longer with physician consult). Consider short course of oral systemic corticosteroids if exacerbation is severe or patient has history of previous severe exacerbations. Caution: Frequent use of SABA may indicate the need to step up treatment. See text for recommendations on initiating daily long-term-control therapy.						
Children 5–11 Years of Age		Intermittent Asthma	Persistent Asthma: Daily Medication Consult with asthma specialist if step 4 care or higher is required. Consider consultation at step 3.					
	Preferred	SABA PRN	Low-dose ICS + LABA, LTRA, or Theophylline OR	Low-dose ICS + LABA, LTRA, or Theophylline	Medium-dose ICS + LABA	High-dose ICS + LABA	High-dose ICS + LABA + Oral corticosteroids	• The stepwise approach is meant to assist, not replace, the clinical decisionmaking required to meet individual patient needs. • If an alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up. • Theophylline is a less desirable alternative due to the need to monitor serum concentration levels. • Steps 1 and 2 medications are based on Evidence A. Step 3 ICS and ICS plus adjunctive therapy are based on Evidence B for efficacy of each treatment and extrapolation from comparator trials in older children and adults—comparator trials are not available for this age group; steps 4–6 are based on expert opinion and extrapolation from studies in older children and adults. • Immunotherapy for steps 2–4 is based on Evidence B for house-dust mites, animal danders, and pollens; evidence is weak or lacking for molds and cockroaches. Evidence is strongest for immunotherapy with single allergens. The role of allergy in asthma is greater in children than adults. • Clinicians who administer immunotherapy should be prepared and equipped to identify and treat anaphylaxis that may occur. **Key: Alphabetical listing is used when more than one treatment option is listed within either preferred or alternative therapy.** ICS, inhaled corticosteroid; LABA, inhaled long-acting beta$_2$-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta$_2$-agonist
	Alternative		Cromolyn, LTRA, Nedocromil, or Theophylline	Medium-dose ICS	Medium-dose ICS + LTRA or Theophylline	High-dose ICS + LTRA or Theophylline	High-dose ICS + LTRA or Theophylline + oral corticosteroids	
		Each Step: Patient Education, Environmental Control, and Management of Comorbidities Steps 2–4: Consider subcutaneous allergen immunotherapy for patients who have persistent, allergic asthma.						
	Quick-Relief Medication	• SABA as needed for symptoms. Intensity of treatment depends on severity of symptoms: up to 3 treatments at 20-minute intervals as needed. Short course of oral systemic corticosteroids may be needed. Caution: Increasing use of SABA or use >2 days a week for symptom relief (not prevention of EIB) generally indicates inadequate control and the need to step up treatment.						

Source: National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.

FIGURE 14. CLASSIFYING ASTHMA SEVERITY AND INITIATING TREATMENT IN YOUTHS 12 YEARS OF AGE AND ADULTS

Assessing severity and initiating treatment for patients who are not currently taking long-term control medications

Components of Severity		Classification of Asthma Severity ≥12 years of age			
		Intermittent	Persistent: Mild	Persistent: Moderate	Persistent: Severe
Impairment Normal FEV_1/FVC: 8–19 yr 85% 20 –39 yr 80% 40 –59 yr 75% 60 –80 yr 70%	Symptoms	≤2 days/week	>2 days/week but not daily	Daily	Throughout the day
	Nighttime awakenings	≤2x/month	3–4x/month	>1x/week but not nightly	Often 7x/week
	Short-acting $beta_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week but not daily, and not more than 1x on any day	Daily	Several times per day
	Interference with normal activity	None	Minor limitation	Some limitation	Extremely limited
	Lung function	• Normal FEV_1 between exacerbations • FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 >80% predicted • FEV_1/FVC normal	• FEV_1 >60% but <80% predicted • FEV_1/FVC reduced 5%	• FEV_1 <60% predicted • FEV_1/FVC reduced >5%
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year (see note)	≥2/year (see note)		
		Consider severity and interval since last exacerbation. Frequency and severity may fluctuate over time for patients in any severity category. Relative annual risk of exacerbations may be related to FEV_1.			
Recommended Step for Initiating Treatment (See "Stepwise Approach for Managing Asthma" for treatment steps.)		Step 1	Step 2	Step 3 and consider short course of oral systemic corticosteroids	Step 4 or 5
		In 2–6 weeks, evaluate level of asthma control that is achieved and adjust therapy accordingly.			

Key: EIB, exercise-induced bronchospasm, FEV1, forced expiratory volume in 1 second; FVC, forced vital capacity; ICU, intensive care unit

Notes:

- The stepwise approach is meant to assist, not replace, the clinical decisionmaking required to meet individual patient needs.
- Level of severity is determined by assessment of both impairment and risk. Assess impairment domain by patient's/caregiver's recall of previous 2–4 weeks and spirometry. Assign severity to the most severe category in which any feature occurs.
- At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma severity. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate greater underlying disease severity. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have persistent asthma, even in the absence of impairment levels consistent with persistent asthma.

Source: National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.

FIGURE 15. ASSESSING ASTHMA CONTROL AND ADJUSTING THERAPY IN YOUTHS ≥12 YEARS OF AGE AND ADULTS

Components of Control		Classification of Asthma Control (≥12 years of age)		
		Well Controlled	Not Well Controlled	Very Poorly Controlled
Impairment	Symptoms	≤2 days/week	>2 days/week	Throughout the day
	Nighttime awakenings	≤2x/month	1–3x/week	≥4x/week
	Interference with normal activity	None	Some limitation	Extremely limited
	Short-acting beta$_2$-agonist use for symptom control (not prevention of EIB)	≤2 days/week	>2 days/week	Several times per day
	FEV_1 or peak flow	>80% predicted/ personal best	60–80% predicted/ personal best	<60% predicted/ personal best
	Validated questionnaires ATAQ ACQ ACT	 0 ≤0.75* ≥20	 1–2 ≥1.5 16–19	 3–4 N/A ≤15
Risk	Exacerbations requiring oral systemic corticosteroids	0–1/year	≥2/year (see note)	
		Consider severity and interval since last exacerbation		
	Progressive loss of lung function	Evaluation requires long-term followup care.		
	Treatment-related adverse effects	Medication side effects can vary in intensity from none to very troublesome and worrisome. The level of intensity does not correlate to specific levels of control but should be considered in the overall assessment of risk.		
Recommended Action for Treatment (See "Stepwise Approach for Managing Asthma" for treatment steps.)		• Maintain current step. • Regular followup at every 1–6 months to maintain control. • Consider step down if well controlled for at least 3 months.	• Step up 1 step. • Reevaluate in 2–6 weeks. • For side effects, consider alternative treatment options.	• Consider short course of oral systemic corticosteroids. • Step up 1–2 steps. • Reevaluate in 2 weeks. • For side effects, consider alternative treatment options.

*ACQ values of 0.76–1.4 are indeterminate regarding well-controlled asthma.
Key: EIB, exercise-induced bronchospasm; ICU, intensive care unit

Notes:

- The stepwise approach is meant to assist, not replace, the clinical decisionmaking required to meet individual patient needs.
- The level of control is based on the most severe impairment or risk category. Assess impairment domain by patient's recall of previous 2–4 weeks and by spirometry/or peak flow measures. Symptom assessment for longer periods should reflect a global assessment, such as inquiring whether the patient's asthma is better or worse since the last visit.
- At present, there are inadequate data to correspond frequencies of exacerbations with different levels of asthma control. In general, more frequent and intense exacerbations (e.g., requiring urgent, unscheduled care, hospitalization, or ICU admission) indicate poorer disease control. For treatment purposes, patients who had ≥2 exacerbations requiring oral systemic corticosteroids in the past year may be considered the same as patients who have not-well-controlled asthma, even in the absence of impairment levels consistent with not-well-controlled asthma.
  ATAQ = Asthma Therapy Assessment Questionnaire©
  ACQ = Asthma Control Questionnaire©
  ACT = Asthma Control Test™
  Minimal Important Difference: 1.0 for the ATAQ; 0.5 for the ACQ; not determined for the ACT.

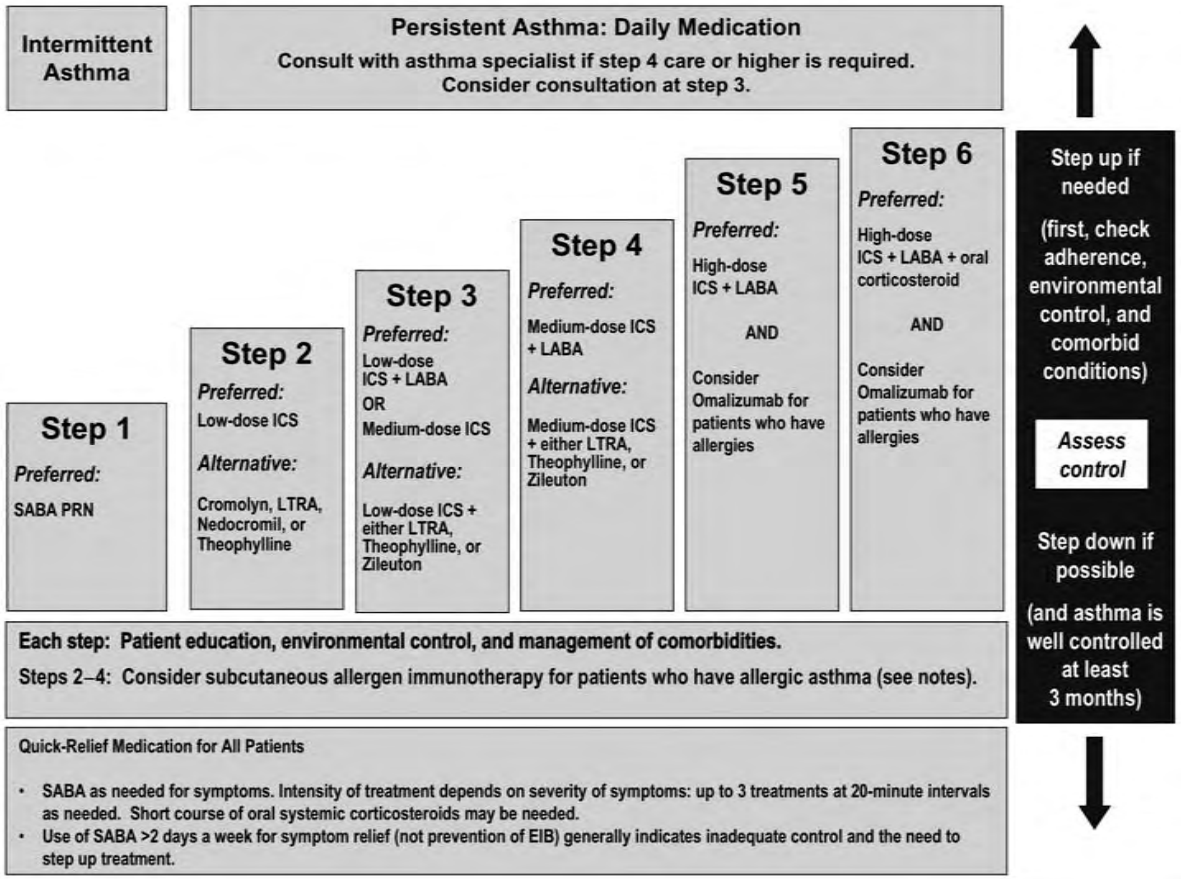
Before step up in therapy:

— Review adherence to medication, inhaler technique, environmental control, and comorbid conditions.

— If an alternative treatment option was used in a step, discontinue and use the preferred treatment for that step.

Source: National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.

FIGURE 16. STEPWISE APPROACH FOR MANAGING ASTHMA IN YOUTHS ≥12 YEARS OF AGE AND ADULTS



Key: **Alphabetical order is used when more than one treatment option is listed within either preferred or alternative therapy.** ICS, inhaled corticosteroid; LABA, long-acting inhaled beta$_2$-agonist; LTRA, leukotriene receptor antagonist; SABA, inhaled short-acting beta$_2$-agonist

Notes:

- The stepwise approach is meant to assist, not replace, the clinical decisionmaking required to meet individual patient needs.
- If alternative treatment is used and response is inadequate, discontinue it and use the preferred treatment before stepping up.
- Zileuton is a less desirable alternative due to limited studies as adjunctive therapy and the need to monitor liver function. Theophylline requires monitoring of serum concentration levels.
- In step 6, before oral corticosteroids are introduced, a trial of high-dose ICS + LABA + either LTRA, theophylline, or zileuton may be considered, although this approach has not been studied in clinical trials.
- Step 1, 2, and 3 preferred therapies are based on Evidence A; step 3 alternative therapy is based on Evidence A for LTRA, Evidence B for theophylline, and Evidence D for zileuton. Step 4 preferred therapy is based on Evidence B, and alternative therapy is based on Evidence B for LTRA and theophylline and Evidence D zileuton. Step 5 preferred therapy is based on Evidence B. Step 6 preferred therapy is based on (EPR—2 1997) and Evidence B for omalizumab.
- Immunotherapy for steps 2–4 is based on Evidence B for house-dust mites, animal danders, and pollens; evidence is weak or lacking for molds and cockroaches. Evidence is strongest for immunotherapy with single allergens. The role of allergy in asthma is greater in children than in adults.
- Clinicians who administer immunotherapy or omalizumab should be prepared and equipped to identify and treat anaphylaxis that may occur.

Source: National Heart, Lung, and Blood Institute. Expert Panel Report 3: Guidelines for the Diagnosis and Management of Asthma. Summary Report 2007.

Appendix D: Data Tables

Asthma Prevalence

Table 1-1. Lifetime Asthma Prevalence among Children, North Carolina and United States, 2005-2010

		Year					
		2005	**2006**	**2007**	**2008**	**2009**	**2010**
N.C.	**%**	17.8	17.1	15.7	14.2	15.5	16.8
	95% C.I.	(16.4-19.4)	(15.4-18.9)	(14.0-17.5)	(12.7-15.9)	(13.6-17.6)	(14.8-18.9)
U.S.	**%**	12.9	12.8	13.5	13.3	13.2	12.6
	95% C.I.	(12.4-13.4)	(12.3-13.4)	(13.0-14.1)	(12.8-13.7)	(12.8-13.7)	(12.1-13.2)

Sources: N.C.: 2005-2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics
U.S.: 2005-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-2. Lifetime Asthma Prevalence among Children, by Gender, North Carolina and United States, 2010

		Gender	
		Boys	**Girls**
N.C.	**%**	17.9	15.4
	95% C.I.	(15.0-21.2)	(12.8-18.5)
U.S.	**%**	14.7	10.7
	95% C.I.	(13.9-15.5)	(10.0-11.4)

Sources: N.C.: 2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics
U.S.: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-3. Lifetime Asthma Prevalence among Children, by Race, North Carolina, 2010

	Race		
	White	**African American**	**Other**
%	14.6	22.1	18.4
95% C.I.	(12.4-17.1)	(17.3-27.8)	(12.6-26.0)

Note: "Other" race includes Asian, Native Hawaiian or other Pacific Islanders, American Indian or Alaskan Native or other. Prevalence data for this group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 1-4. Lifetime Asthma Prevalence among Children, by Age Group, North Carolina, 2010

	Age Group (Years)			
	<5	**5-10**	**11-13**	**14-17**
%	8.3	16.2	25.3	20.1
95% C.I.	(5.5-12.3)	(12.8-20.2)	(19.9-31.5)	(16.3-24.4)

Note: Asked only for children 1 year and older; prevalence data for the 0-4 year age group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 1-5. Lifetime Asthma Prevalence among Children, by Grade Level, North Carolina, 2010

	Grade Level			
	Not in School	**K – 5th**	**6th – 8th**	**9th – 12th**
%	8.7	16.4	25.0	20.6
95% C.I.	(5.9-12.6)	(13.0-20.5)	(19.8-31.2)	(16.6-25.2)

Note: Children Not in School are less than three years of age. Prevalence data for this group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. CHAMP, N.C. State Center for Health Statistics

Table 1-6. Lifetime Asthma Prevalence among Children, by Insurance Coverage, North Carolina, 2010

	Health Insurance			
	Private	**Public**	**Other**	**No Health Insurance**
%	14.0	23.1	9.2	12.9
95% C.I.	(11.7-16.7)	(19.1-27.7)	(5.4-15.4)	(6.5-24.0)

Note: Health insurance categories: **Private** = State Employee Health Plan, Blue Cross/Blue Shield of North Carolina, or other private health insurance plan purchased from an employer or directly from insurance company. **Public** = Medicaid, Carolina ACCESS, Health Check, or NC Health Choice (a free or reduced price comprehensive healthcare program for children in North Carolina). **Other** = CHAMPUS, TRI CARE, Indian Health Services or other type not otherwise listed. Prevalence data for the Other and No Health Insurance groups are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 1-7. Lifetime Asthma Prevalence among Middle School Students, by Gender, North Carolina, 2007

	Gender		
	Total	**Boys**	**Girls**
%	20.3	21.8	18.7
95% C.I.	(18.2-22.5)	(19.0-24.9)	(16.1-21.6)

Source: Middle School Reports, 2007 N.C. Youth Risk Behavior Survey

Table 1-8. Lifetime Asthma Prevalence among Middle School Students, by Grade Level, North Carolina, 2007

	Grade Level			
	Total	**6th**	**7th**	**8th**
%	20.3	17.8	23.1	19.8
95% C.I.	(18.2-22.5)	(15.9-19.8)	(19.0-27.7)	(16.5-23.7)

Source: Middle School Reports, 2007 N.C. Youth Risk Behavior Survey

Table 1-9. Lifetime Asthma Prevalence among Middle School Students, by Race/Ethnicity, North Carolina, 2007

	Race/Ethnicity				
	Total	**African American Non-Hispanic**	**Hispanic/ Latino**	**White Non-Hispanic**	**All Other Races**
%	20.3	22.2	14.1	20.0	22.4
95% C.I.	(18.2-22.5)	(18.8-26.0)	(10.9-19.0)	(17.3-22.9)	(10.3-42.0)

Source: Middle School Reports, 2007 N.C. Youth Risk Behavior Survey

Table 1-10. Lifetime Asthma Prevalence among High School Students, United States and North Carolina, 2005-2009

		Gender		
		2005	**2007**	**2009**
U.S. High School	**%**	17.1	20.3	22.0
	95% C.I.	(16.2-18.1)	(19.2-21.4)	(20.8-23.1)
N.C. High School	**%**	20.1	20.3	21.8
	95% C.I.	(18.0-22.3)	(18.1-22.8)	(20.0-23.7)

Sources: U.S. & N.C. High School: Youth Online: 2005-2009 High School Youth Risk Behavior Survey
N.C. Middle School: 2005-2009 N.C. Youth Risk Behavior Survey

Table 1-11. Lifetime Asthma Prevalence among High School Students, by Gender, North Carolina, 2005-2009

		Gender		
		2005	**2007**	**2009**
Boys	**%**	21.8	20.1	22.3
	95% C.I.	(19.0-24.5)	(17.8-22.6)	(20.0-24.7)
Girls	**%**	18.4	20.6	21.3
	95% C.I.	(15.9-21.0)	(17.3-24.3)	(19.0-23.8)

Sources: High School Reports, 2005-2009 N.C. Youth Risk Behavior Survey

Table 1-12. Lifetime Asthma Prevalence among High School Students, by Grade Level, North Carolina, 2005-2009

		Year		
		2005	**2007**	**2009**
9th	**%**	20.7	21.9	23.5
	95% C.I.	(18.2-23.3)	(18.9-25.2)	(21.0-26.2)
10th	**%**	20.2	22.2	20.5
	95% C.I.	(15.7-24.6)	(17.8-27.3)	(16.9-24.6)
11th	**%**	18.9	19.7	22.5
	95% C.I.	(15.0-22.8)	(15.9-24.2)	(18.5-27.1)
12th	**%**	19.5	15.9	19.7
	95% C.I.	(13.1-25.8)	(12.5-19.9)	(16.0-24.0)

Sources: High School Reports, 2005-2009 N.C. Youth Risk Behavior Survey

Table 1-13. Lifetime Asthma Prevalence among High School Students, by Race/Ethnicity, North Carolina, 2005-2009

		Year		
		2005	**2007**	**2009**
White Non-Hispanic	**%**	16.2	18.6	19.9
	95% C.I.	(14.3-18.0)	(17.0-20.3)	(17.9-22.0)
African American Non-Hispanic	**%**	28.1	23.1	24.8
	95% C.I.	(22.0-34.2)	(17.7-29.6)	(21.3-28.7)
Hispanic/ Latino	**%**	16.3	14.4	23.5
	95% C.I.	(11.1-21.5)	(9.0-22.0)	(17.6-30.7)
All Other Races	**%**	21.2	30.7	24.2
	95% C.I.	(15.0-27.3)	(21.5-41.6)	(15.8-35.2)

Source: High School Reports, 2005-2009 N.C. Youth Risk Behavior Survey

Table 1-14. Lifetime Asthma Prevalence among Children, North Carolina and United States, 2001-2010

						Year					
		2001	**2002**	**2003**	**2004**	**2005**	**2006**	**2007**	**2008**	**2009**	**2010**
N.C.	**%**	10.1	10.9	11.3	13.2	10.1	10.9	12.1	11.7	12.9	12.6
	95% C.I.	(8.8-11.3)	(9.7-12.1)	(10.3-12.3)	(12.4-14.0)	(9.5-10.7)	(10.2-11.6)	(11.2-13.0)	(10.9-12.5)	(11.9-14.0)	(11.6-13.6)
U.S.	**%**	11.0	11.8	11.9	13.3	12.5	12.8	12.9	13.3	13.4	13.5
	95% C.I.	(10.8-11.2)	(11.6-12.0)	(11.6-12.1)	(13.1-13.6)	(12.2-12.7)	(12.5-13.0)	(12.7-13.2)	(13.1-13.5)	(13.1-13.6)	(13.3-13.7)

Source: 2001-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-15. Lifetime Asthma Prevalence among Adults, by Gender, North Carolina and United States, 2010

		Gender	
		Male	**Female**
N.C.	**%**	11.1	14.0
	95% C.I.	(9.4-12.9)	(12.8-15.1)
U.S.	**%**	11.7	15.1
	95% C.I.	(11.4-12.1)	(14.9-15.4)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-16. Lifetime Asthma Prevalence among Adults, by Race, North Carolina, 2010

	Race			
	White	**African American**	**Native American**	**Other**
%	12.2	15.5	16.4	13.4
95% C.I.	(11.1-13.3)	(12.8-18.6)	(19.5-25.6)	(6.0-17.2)

Note: "Other" race includes Native Hawaiian or other Pacific Islanders, not specified, or no preferred race. Prevalence data for this group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 1-17. Lifetime Asthma Prevalence among Adults, by Race/Ethnicity, North Carolina and United States, 2010

		Race/Ethnicity				
		White Non-Hispanic	**African American Non-Hispanic**	**Other Non-Hispanic**	**Multi-race Non-Hispanic**	**Hispanic**
N.C.	**%**	12.1	15.3	10.5	22.3	10.1
	95% C.I.	(11.0-13.3)	(12.3-18.2)	(5.9-15.1)	(11.8-32.8)	(5.0-15.2)
U.S.	**%**	13.5	15.6	11.3	22.3	11.6
	95% C.I.	(13.3-13.7)	(14.8-16.3)	(10.2-12.3)	(20.4-24.1)	(10.9-12.3)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-18. Lifetime Asthma Prevalence among Adults, by Age Group, North Carolina, 2010

	Age Group (Years)						
	18-24	**25-34**	**35-44**	**45-54**	**55-64**	**65-74**	**75+**
%	18.3	13.1	10.8	11.2	12.5	13.2	10.4
95% C.I.	(13.4-24.5)	(10.4-16.4)	(9.1-12.7)	(9.6-13.1)	(11.0-14.2)	(11.3-15.2)	(8.5-12.7)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-19. Lifetime Asthma Prevalence among Adults, by Educational Level, North Carolina, 2010

	Educational Level			
	Less than High School	**High School or G.E.D.**	**Some Post-High School**	**College Graduate**
%	18.1	12.7	11.8	11.0
95% C.I.	(14.9-21.7)	(10.7-15.0)	(10.1-13.7)	(9.5-12.7)

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 1-20. Lifetime Asthma Prevalence among Adults, by Annual Household Income, North Carolina, 2010

	Annual Household Income					
	<$15,000	**$15,000-24,999**	**$25,000-34,999**	**$35,000-49,999**	**$50,000-74,999**	**$75,000+**
%	18.5	16.0	11.8	11.3	10.4	10.2
95% C.I.	(15.7-21.7)	(13.1-19.4)	(9.4-14.6)	(8.9-14.2)	(8.3-13.0)	(8.5-12.3)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-21. Age at First Diagnosis of Asthma among Adults, by Gender, North Carolina, 2008

		Age at First Diagnosis (Years)			
		<11	**11-19**	**20-39**	**40+**
Males	**%**	40.3	16.6	19.3	23.9
	95% C.I.	(31.8-49.4)	(10.3-25.5)	(14.1-25.7)	(18.9-29.8)
Females	**%**	31.5	15.2	25.8	27.5
	95% C.I.	(27.0-36.5)	(11.0-20.5)	(22.0-30.0)	(23.9-31.4)

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 1-22. Current Asthma Prevalence among Children, North Carolina and United States, 2005-2010

		Year					
		2005	**2006**	**2007**	**2008**	**2009**	**2010**
N.C.	**%**	11.5	10.8	9.8	8.2	10.1	10.3
	95% C.I.	(10.3-12.9)	(19.5-12.4)	(8.4-11.3)	(7.1-9.5)	(8.5-11.9)	(8.7-12.1)
U.S.	**%**	9.0	9.0	8.9	9.0	8.6	8.4
	95% C.I.	(8.6-9.4)	(8.5-9.5)	(8.5-9.4)	(8.6-9.4)	(8.2-9.0)	(8.0-8.8)

Sources: N.C.: 2005-2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics
U.S.: 2005-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-23. Current Asthma Prevalence among Children, by Gender, North Carolina and United States, 2010

		Gender	
		Boys	Girls
N.C.	%	11.4	9.2
	95% C.I.	(9.0-14.3)	(7.2-11.6)
U.S.	%	9.8	7.0
	95% C.I.	(9.1-10.4)	(6.5-7.6)

Sources: N.C.: 2010 Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics
U.S.: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-24. Current Asthma Prevalence among Children, by Race, North Carolina, 2010

	Race		
	White	African American	Other
%	7.4	17.4	12.1
95% C.I.	(5.9-9.3)	(13.0-22.8)	(7.6-18.9)

Note: "Other" race includes Asian, Native Hawaiian or other Pacific Islanders, American Indian or Alaskan Native or other. Prevalence data for this group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 1-25. Current Asthma Prevalence among Children, by Age Group, North Carolina, 2010

	Age Group (Years)			
	<5	5-10	11-13	14-17
%	5.4	10.5	19.5	8.2
95% C.I.	(3.3-8.7)	(7.7-14.0)	(14.6-25.6)	(5.9-11.3)

Note: Asked only for children 1 year and older; prevalence data for the 0-4 year age group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 1-26. Current Asthma Prevalence among Children, by Grade Level, North Carolina, 2010

	Grade Level			
	Not in School	K – 5th	6th – 8th	9th – 12th
%	6.0	10.6	18.2	8.7
95% C.I.	(3.8-9.4)	(7.8-14.2)	(13.4-24.2)	(6.3-12.0)

Note: Children Not in School are those not yet in kindergarten. Prevalence data for this group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. CHAMP, N.C. State Center for Health Statistics

Table 1-27. Current Asthma Prevalence among Children, by Insurance Coverage, North Carolina, 2010

	Health Insurance			
	Private	**Public**	**Other**	**No Health Insurance**
%	7.6	15.5	5.8	6.8
95% C.I.	(5.9-9.7)	(12.1-19.7)	(2.9-11.2)	(2.1-19.9)

Note: Health insurance categories: **Private** = State Employee Health Plan, Blue Cross/Blue Shield of North Carolina, or other private health insurance plan purchased from an employer or directly from insurance company. **Public** = Medicaid, Carolina ACCESS, Health Check, or NC Health Choice (a free or reduced price comprehensive healthcare program for children in North Carolina). **Other** = CHAMPUS, TRI CARE, Indian Health Services or other type not otherwise listed. Prevalence data for the Other and No Health Insurance groups are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 1-28. Current Asthma Prevalence among High School Students, North Carolina and United States, 2007-2009

		Year	
		2007	**2009**
U.S. High School	**%**	10.9	10.8
	95% C.I.	(10.1-11.9)	(9.9-11.7)
N.C. High School	**%**	9.5	10.8
	95% C.I.	(8.2-11.0)	(9.3-12.4)

Sources: Youth Online: 2007 and 2009 High School Youth Risk Behavior Survey

Table 1-29. Current Asthma Prevalence among High School Students, by Gender, North Carolina, 2007-2009

		Gender	
		2007	**2009**
Boys	**%**	6.4	9.3
	95% C.I.	(5.1-8.1)	(7.6-11.3)
Girls	**%**	12.6	12.2
	95% C.I.	(10.3-15.3)	(10.6-14.1)

Sources: Youth Online: 2007 and 2009 High School Youth Risk Behavior Survey

Table 1-30. Current Asthma Prevalence among High School Students, by Grade Level, North Carolina, 2007-2009

		Year	
		2007	**2009**
9th	**%**	10.6	12.4
	95% C.I.	(8.4-13.4)	(10.6-14.4)
10th	**%**	9.0	9.5
	95% C.I.	(6.7-12.1)	(6.9-13.0)
11th	**%**	9.3	10.6
	95% C.I.	(6.1-13.9)	(7.8-14.2)
12th	**%**	8.5	10.4
	95% C.I.	(6.0-11.9)	(7.7-13.9)

Sources: Youth Online: 2007 and 2009 High School Youth Risk Behavior Survey

Table 1-31. Current Asthma Prevalence among High School Students, by Race/Ethnicity, North Carolina, 2007-2009

		Year	
		2007	**2009**
White Non-Hispanic	**%**	8.6	9.9
	95% C.I.	(7.6-9.7)	(8.5-11.5)
African American Non-Hispanic	**%**	11.7	12.5
	95% C.I.	(8.5-15.8)	(10.0-15.6)
Hispanic/Latino	**%**	3.9	10.0
	95% C.I.	(1.9-7.9)	(4.9-19.4)
All Other Races	**%**	14.8	13.5
	95% C.I.	(6.2-31.3)	(6.9-24.8)

Source: High School Reports, 2007-2009 N.C. Youth Risk Behavior Survey

Table 1-32. Current Asthma Prevalence among Adults, North Carolina and United States, 2001-2010

		Year									
		2001	2002	2003	2004	2005	2006	2007	2008	2009	2010
N.C.	%	6.4	6.5	7.1	7.5	6.5	6.8	7.8	7.6	7.8	7.5
	95% C.I.	(5.4-7.4)	(5.5-7.4)	(6.3-7.9)	(7.0-8.1)	(6.0-7.0)	(6.2-7.3)	(7.1-8.5)	(7.0-8.2)	(7.0-8.6)	(6.7-8.2)
U.S.	%	7.2	7.5	7.7	8.1	7.9	8.2	8.2	8.5	8.4	8.6
	95% C.I.	(7.0-7.4)	(7.3-7.7)	(7.5-7.9)	(7.9-8.3)	(7.7-8.0)	(8.0-8.4)	(8.1-8.4)	(8.3-8.7)	(8.3-8.6)	(8.5-8.8)

Source: 2001-2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-33. Current Asthma Prevalence among Adults, by Gender, North Carolina and United States, 2010

		Gender	
		Male	Female
N.C.	%	5.3	9.6
	95% C.I.	(4.3-6.5)	(8.6-10.6)
U.S.	%	6.5	10.7
	95% C.I.	(6.2-6.7)	(10.5-10.9)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-34. Current Asthma Prevalence among Adults, by Race, North Carolina, 2010

	Race			
	White	African American	Native American	Other
%	7.3	9.9	7.7	7.6
95% C.I.	(6.5-8.0)	(7.8-12.6)	(4.7-11.9)	(2.3-9.8)

Note: "Other" race includes Native Hawaiian or other Pacific Islanders, not specified, or no preferred race. Prevalence data for this group are based on a numerator of less than 50, interpret with caution.

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 1-35. Current Asthma Prevalence among Adults, by Race/Ethnicity, North Carolina and United States, 2010

		Race/Ethnicity				
		White Non-Hispanic	African American Non-Hispanic	Other Non-Hispanic	Multi-race Non-Hispanic	Hispanic
N.C.	%	7.2	9.8	6.0	13.3	4.0
	95% C.I.	(6.4-8.0)	(7.4-12.2)	(2.4-9.5)	(6.4-20.2)	(1.4-6.6)
U.S.	%	8.6	10.5	6.8	14.8	7.2
	95% C.I.	(8.5-8.8)	(9.9-11.2)	(6.1-7.6)	(13.3-16.3)	(6.6-7.8)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-36. Current Asthma Prevalence among Adults, by Age Group, North Carolina, 2010

	Age Group (Years)						
	18-24	25-34	35-44	45-54	55-64	65-74	75+
%	7.8	6.4	7.7	7.3	8.0	8.8	7.0
95% C.I.	(4.9-12.2)	(4.6-8.8)	(6.2-9.4)	(6.2-9.4)	(6.8-9.4)	(7.4-10.4)	(5.5-9.0)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Table 1-37. Current Asthma Prevalence among Adults, by Educational Level, North Carolina, 2010

	Educational Level			
	Less than High School	High School or G.E.D.	Some Post-High School	College Graduate
%	11.5	7.5	6.9	6.3
95% C.I.	(9.2-14.4)	(6.2-9.2)	(5.8-8.2)	(5.2-7.6)

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 1-38. Current Asthma Prevalence among Adults, by Annual Household Income, North Carolina, 2010

	Annual Household Income					
	<$15,000	$15,000-24,999	$25,000-34,999	$35,000-49,999	$50,000-74,999	$75,000+
%	13.2	11.1	7.9	5.4	6.3	5.5
95% C.I.	(11.0-15.7)	(8.8-13.9)	(5.9-10.4)	(4.0-7.3)	(4.8-8.2)	(4.3-7.0)

Source: 2010 Behavioral Risk Factor Surveillance System, National Center for Health Statistics, CDC

Symptoms and Management

Table 2-1. Frequency of Asthma Symptoms during the Past 30 Days among Adults with Current Asthma, North Carolina, 2008

	Frequency				
	None	Less than once a week	Once or twice a week	More than twice a week not every day	Everyday
%	31.4	21.5	19.8	10.0	17.3
95% C.I.	(27.1-36.0)	(18.1-25.3)	(16.6-23.3)	(8.0-12.4)	(14.7-20.4)

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-2. Frequency of Asthma Symptoms Affecting Sleep during the Past 30 Days among Adults with Current Asthma, North Carolina, 2008

	Frequency				
	None	1 to 2 days	3 to 4 days	5 to 10 days	More than 10 days
%	49.3	20.2	12.1	7.7	10.6
95% C.I.	(44.5-54.2)	(16.2-25.0)	(9.5-15.3)	(5.8-10.2)	(7.9-13.9)

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-3. Adults with Current Asthma with Asthma Symptoms Affecting Sleep for One or More Days during the Past 30 Days, by Gender and Race, North Carolina, 2008

	Gender			Race		
	Total	Male	Female	White	African American	Other
%	50.7	56.9	47.2	47.1	65.4	54.6
95% C.I.	(45.9-55.6)	(47.3-66.5)	(42.1-52.3)	(41.4-52.9)	(55.1-75.7)	(39.2-70.0)

Note: Data for Other are based on a numerator of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-4. Asthma Episode/Attack Prevalence among Adults with Current Asthma, by Gender and Race, North Carolina, 2008

	Gender			Race		
	Total	Male	Female	White	African American	Other
%	49.6	45.4	51.8	49.6	42.9	62.5
95% C.I.	(45.3-53.9)	(37.5-53.6)	(47.0-56.6)	(44.9-54.2)	(33.3-53.1)	(47.7-77.4)

Note: Data for Other are based on a numerator of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-5. Severity of Condition among Children with Current Asthma, North Carolina, 2007

		Gender		
		Total	**Boys**	**Girls**
Mild	**%**	70.3	66.8	75.3
	95% C.I.	(59.4-81.2)	(51.9-81.7)	(59.8-90.7)
Moderate	**%**	25.5	26.1	24.6
	95% C.I.	(15.2-35.8)	(12.3-39.9)	(9.1-40.1)

Note: Responses for the "Severe" level were too small to meet standards of reliability or precision, and thus, have been omitted. "Moderate" level responses for total, boys and girls, and "Mild" level responses for girls are based numerators of less than 50, interpret with caution

Source: 2007 National Survey of Children's Health, Maternal and Child Health Bureau, Health Resources and Services Administration

Table 2-6. General Health Status among Adults with and without Current Asthma, North Carolina, 2008

		General Health Status				
		Excellent	**Very Good**	**Good**	**Fair**	**Poor**
With Current Asthma	**%**	7.2	25.5	29.9	21.2	16.1
	95% C.I.	(5.6-9.3)	(21.7-29.7)	(26.2-33.9)	(18.2-24.7)	(13.2-19.5)
Without Current Asthma	**%**	20.8	32.7	30.8	11.7	4.1
	95% C.I.	(19.7-21.9)	(31.5-33.9)	(29.5-32.0)	(10.9-12.5)	(3.7-4.5)

Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never been diagnosed with asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-7. Days with Poor Physical Health during the Past Month among Adults with and without Current Asthma, North Carolina, 2008

		Days				
		None	**1-2 Days**	**3-7 Days**	**8-29 Days**	**30 Days**
With Current Asthma	**%**	38.4	11.6	16.8	17.7	15.5
	95% C.I.	(34.3-42.6)	(9.3-14.5)	(13.5-20.8)	(14.5-21.4)	(13.1-18.3)
Without Current Asthma	**%**	68.2	9.8	9.6	6.4	6.0
	95% C.I.	(67.0-69.4)	(9.1-10.6)	(8.8-10.3)	(5.8-7.0)	(5.6-6.6)

Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never been diagnosed with asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-8. Days with Poor Mental Health during the Past Month among Adults with and without Current Asthma, North Carolina, 2008

		Days				
		None	1-2 Days	3-7 Days	8-29 Days	30 Days
With Current Asthma	%	54.1	8.5	12.9	13.7	10.9
	95% C.I.	(49.7-58.3)	(5.9-12.0)	(10.1-16.3)	(10.9-17.1)	(8.8-13.3)
Without Current Asthma	%	68.6	9.0	9.9	7.6	4.8
	95% C.I.	(67.4-69.8)	(8.3-9.8)	(9.1-10.8)	(7.0-8.2)	(4.3-5.4)

Note: Adults with "no current asthma" include those who had ever been diagnosed with asthma (lifetime asthma) and those who had never been diagnosed with asthma.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-9. Days of Day Care or School Missed by Children with Current Asthma, North Carolina, 2010

	Days			
	No Days	1-4 Days	5-10 Days	≥11 Days
%	50.5	28.6	12.9	7.9
95% C.I.	(41.5-59.6)	(20.8-38.0)	(8.0-20.3)	(3.9-15.5)

Note: Data for 1-4 Days, 5-10 Days, and ≥11 Days groups are based on numerators of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 2-10. Number of Days Unable to Work or Carry Out Usual Activities Due to Asthma among Adults with Current Asthma, by Gender and Race, North Carolina, 2008

		Days			
		None	1-7 Days	8-30 Days	>30 Days
North Carolina	%	73.1	18.1	5.2	3.6
	95% C.I.	(68.9-76.9)	(14.7-22.1)	(3.9-6.9)	(2.4-5.5)
Male	%	73.8	18.1	3.1	5.0
	95% C.I.	(66.5-80.0)	(12.9-24.8)	(1.7-5.7)	(2.6-9.3)
Female	%	72.7	18.1	6.4	2.8
	95% C.I.	(67.5-77.3)	(13.8-23.3)	(4.7-8.7)	(1.6-4.9)
White	%	78.1	12.6	5.8	3.5
	95% C.I.	(74.2-81.6)	(9.9-15.7)	(4.2-8.0)	(2.0-6.0)
African American	%	60.8	30.9	3.8	4.5
	95% C.I.	(49.9-70.8)	(21.8-41.8)	(1.8-7.8)	(2.2-8.8)
Other	%	58.4	35.8	3.7	2.0
	95% C.I.	(38.4-78.5)	(14.6-57.1)	(0.0)-8.0)	(0.0-4.9)

Note: Data for Male 1-7 Days, 8-30 Days, >Days; Female >30 Days; White >30 Days; African American 1-7 Days, 8-30 Days, >30 Days; and Other 1-7 Days, 8-30 Days, >30 Days are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-11. Children with Current Asthma with an Asthma Action Plan, by Gender, North Carolina, 2005-2010

		Gender		
		Total	Boys	Girls
2005	%	56.9	61.7	50.9
	95% C.I.	(50.7-62.9)	(53.5-69.3)	(41.8-60.0)
2006	%	59.6	58.9	60.4
	95% C.I.	(52.3-66.4)	(49.2-68.0)	(49.3-70.5)
2007	%	64.3	68.3	60.3
	95% C.I.	(56.4-71.5)	(57.7-77.2)	(48.6-71.0)
2008	%	65.8	69.3	61.5
	95% C.I.	(58.0-72.8)	(59.8-77.4)	(48.9-72.7)
2009	%	55.4	54.5	56.6
	95% C.I.	(46.3-64.1)	(42.9-65.7)	(42.5-69.7)
2010	%	57.1	55.5	59.0
	95% C.I.	(47.9-65.7)	(42.9-67.5)	(45.9-71.0)

Note: Data for 2009 Girls are based on a numerator of less than 50; interpret with caution.

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 2-12. Adults with Current Asthma with an Asthma Action Plan, by Gender and Race, North Carolina, 2008

	Gender			Race		
	Total	Male	Female	White	African American	Other
%	31.7	21.3	37.4	31.4	37.9	23.0
95% C.I.	(28.0-35.7)	(16.2-27.5)	(32.7-42.3)	(27.4-35.7)	(28.0-48.9)	9.9-36.0)

Note: Data for Other are based on a numerator of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-13. Self-Administration of Emergency Medication for Asthma at School, by Gender, North Carolina, 2005-2010

		Gender		
		Total	Boys	Girls
2005	%	61.2	63.0	58.8
	95% C.I.	(54.0-67.9)	(53.1-71.8)	(48.1-68.7)
2006	%	53.7	56.1	50.7
	95% C.I.	(45.2-61.9)	(44.5-67.1)	(38.5-62.8)
2007	%	52.3	48.8	56.1
	95% C.I.	(43.6-60.9)	(37.0-60.8)	(43.5-67.9)
2008	%	52.1	47.5	57.8
	95% C.I.	(44.3-59.9)	(37.4-57.9)	(45.4-69.2)
2009	%	55.7	58.0	52.2
	95% C.I.	(46.2-64.8)	(46.0-69.2)	(37.5-66.6)
2010	%	58.2	63.5	50.9
	95% C.I.	(48.1-67.6)	(49.5-75.6)	(37.2-64.4)

Note: Data for 2006 Girls are based on a numerator of less than 50, interpret with caution.

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 2-14. Self-Administration of Emergency Medication for Asthma at School, by Grade Level, North Carolina, 2010

	Grade Level			
	Total	K-5	6-8	9-12
%	58.2	35.4	75.4	78.5
95% C.I.	(48.1-67.6)	(21.9-51.8)	(57.6-87.3)	(62.1-89.1)

Note: Data for K-5, 6-8, 9-12 grade levels are based on numerators of less than 50, interpret with caution.

Source: 2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Figure 2-15. Asthma-Related Policies and Programs in Secondary Public Schools, North Carolina, 2008

Asthma-related Policies and Programs	North Carolina % (95% C.I.)
Percentage of schools with a fulltime registered nurse who provides health services to students at school.	28.5 (24.5–32.9)
Percentage of schools that implemented a policy permitting students to carry and self administer asthma medications by communicating the policy to students, parents, and families, and by designating an individual responsible for implementing the policy.	52.7 (47.4 – 58.0)
Percentage of schools that had an asthma action plan on file for all students with known asthma*.	70.5 (65.9 – 74.8)
Percentage of schools that identified students with poorly controlled asthma by keeping track of them in at least three different ways.	67.1 (62.0 – 71.8)
Percentage of schools that provided intensive case management** for students with poorly controlled asthma at school.	29.3 (24.9 – 34.2)
Percentage of schools that required all school staff members to receive annual training on recognizing and responding to severe asthma symptoms.	68.4 (63.8 – 72.7)
Percentage of schools that provided parents and families with health information to increase parent and family knowledge of asthma.	19.8 (16.2 – 24.1)

Source: School Health Profiles 2008: Characteristics of Health Programs among Secondary Schools, Atlanta: Centers for Disease Control and Prevention, 2009

* Students with known asthma are those who are identified by the school to have a current diagnosis of asthma as reported on student emergency cards, medication records, health room visit information, emergency care plans, physical exam forms, parent notes, and other forms of health care clinician notification.

** Includes all nine specific services for students with poorly controlled asthma:
1. Provided referrals to primary healthcare clinicians or child health insurance programs.
2. Ensured an appropriate written asthma action plan is obtained.
3. Ensured access to and appropriate use of asthma medications, spacers, and peak flow meters at school.
4. Offered asthma education for the student with asthma and his/her family.
5. Minimized asthma triggers in the school environment.
6. Addressed social and emotional issues related to asthma.
7. Provided additional psychological counseling or support services as needed.
8. Ensured access to safe, enjoyable physical education and activity opportunities.
9. Ensured access to preventive medications before physical activity.

Table 2-16. Number of Students in Grades K-12 with Asthma as Reported by School Nurses, North Carolina, 2004-2011

School Year	Students with Asthma (Number)	All Chronic Health Conditions (Number)	Asthma as Percentage of All Chronic Health Conditions
2004-2005	77,593	197,051	39.4
2005-2006	80,886	209,718	38.6
2006-2007	83,440	227,940	36.6
2007-2008	86,437	237,940	36.4
2008-2009	75,576	240,528	31.4
2009-2010	92,838	265,215	35.0
2010-2011	101,599	292,288	34.8

Source: 2004-2011 North Carolina Annual School Health Services Reports, North Carolina Healthy Schools

Table 2-17. Percentage of Selected Chronic Diseases among Adults with and without Current Asthma, North Carolina, 2007, 2009, 2010

		Asthma Status	
		With Current Asthma	**Without Current Asthma**
Arthritis	**% (95% C.I.)**	44.7 (39.6-49.9)	26.1 (24.9-27.3)
Hypertension	**% (95% C.I.)**	36.9 (32.1-41.9)	31.1 (29.8-32.5)
Depression	**% (95% C.I.)**	33.8 (27.4-40.8)	14.6 (13.4-16.0)
COPD	**% (95% C.I.)**	28.6 (24.0-33.6)	3.6 (3.1-4.2)
History of Any CVD	**% (95% C.I.)**	16.4 (13.4-19.9)	8.3 (7.7-9.0)
Diabetes	**% (95% C.I.)**	15.6 (12.8-18.8)	9.3 (8.7-10.0)

Note: Year questions were asked: arthritis – 2009; hypertension – 2009; depression – 2007; COPD – 2009; history of any CVD – 2010; diabetes - 2010

Source: 2007, 2009, 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-18. Smoking Status of Adults with and without Current Asthma, North Carolina, 2010

		Asthma Status	
		With Current Asthma	**Without Current Asthma**
Smoke everyday	**% (95% C.I.)**	15.2 (11.7-19.5)	14.2 (13.0-15.5)
Smoke some days	**% (95% C.I.)**	7.9 (5.8-10.7)	5.3 (4.5-6.1)
Former smoker	**% (95% C.I.)**	28.6 (24.3-33.4)	24.1 (22.9-25.3)
Never smoked	**% (95% C.I.)**	48.2 (43.1-53.4)	56.5 (54.9-58.0)

Source: 2010 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 2-19. Smoking Rules in Homes of Adults with and without Current Asthma, North Carolina, 2008

		Asthma Status	
		With Current Asthma	**Without Current Asthma**
Not allowed anywhere inside home	**% (95% C.I.)**	74.4 (70.8-77.7)	77.3 (76.2-78.3)
Allowed in some places/some times	**% (95% C.I.)**	8.4 (6.5-10.8)	6.9 (6.3-7.6)
Allowed anywhere inside home	**% (95% C.I.)**	3.8 (2.5-5.9)	2.3 (1.9-2.7)
No rules about smoking inside home	**% (95% C.I.)**	13.3 (11.0-16.1)	13.5 (12.7-14.4)

Note: Data for "Allowed anywhere inside home" With Current Asthma group are based on a numerator of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Healthcare Utilization and Cost of Asthma

Table 3-1. Frequency of Routine Checkup for Asthma during the Past 12 Months among Adults with Current Asthma, by Gender, North Carolina, 2008

		None	Once	Twice	Three or more times
Total	**%**	45.9	28.9	11.4	13.8
	95% C.I.	(41.6-50.3)	(24.9-33.1)	(9.3-14.0)	(11.6-16.4)
Male	**%**	48.5	28.2	10.0	13.3
	95% C.I.	(40.1-56.9)	(21.0-36.7)	(6.6-14.8)	(9.4-18.7)
Female	**%**	44.5	29.2	12.1	14.1
	95% C.I.	(39.6-49.4)	(24.8-34.1)	(9.6-15.4)	(11.5-17.1)

Note: Data for "Male, Twice" are based on a numerator of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-2. Frequency of Routine Checkup for Asthma during the Past 12 Months among Adults with Current Asthma, by Race, North Carolina, 2008

		None	Once	Twice	Three or more times
Total	**%**	45.9	28.9	11.4	13.8
	95% C.I.	(41.6-50.3)	(24.9-33.1)	(9.3-14.0)	(11.6-16.4)
White	**%**	46.0	29.0	11.4	13.6
	95% C.I.	(41.3-50.8)	(24.8-33.6)	(9.0-14.4)	(11.1-16.5)
African American	**%**	46.1	28.2	12.7	13.0
	95% C.I.	(35.7-56.8)	(18.5-40.3)	(7.8-20.2)	(8.5-19.5)
Other	**%**	44.2	29..4	9.3	17.1
	95% C.I.	(24.2-64.2)	(11.8-46.9)	(1.3-17.4)	(5.6-28.5)

Note: Data for "African American, Twice, Three or more times," and "Other, None, Once, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-3. Frequency of Visits to a Healthcare Provider for Urgent Treatment of Asthma during the Past 12 Months among Adults with Current Asthma, by Gender, North Carolina, 2008

		None	Once	Twice	Three or more times
Total	**%**	54.4	17.7	12.1	15.8
	95% C.I.	(48.6-60.0)	(13.8-22.4)	(9.2-15.8)	(11.8-20.8)
Male	**%**	46.1	24.4	8.1	21.5
	95% C.I.	(36.0-56.5)	(16.0-35.3)	(4.3-14.6)	(13.2-33.0)
Female	**%**	58.4	14.5	14.1	13.1
	95% C.I.	(51.8-64.7)	(10.8-19.1)	(10.3-18.8)	(9.3-18.1)

Note: Data for "Male, Once, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-4. Frequency of Visits to a Healthcare Provider for Urgent Treatment of Asthma during the Past 12 Months among Adults with Current Asthma, by Race, North Carolina, 2008

		None	Once	Twice	Three or more times
Total	**%**	54.4	17.7	12.1	15.8
	95% C.I.	(48.6-60.0)	(13.8-22.4)	(9.2-15.8)	(11.8-20.8)
White	**%**	57.2	17.2	10.9	14.6
	95% C.I.	(51.1-63.1)	(13.2-22.1)	(7.9-15.0)	(10.3-20.3)
African American	**%**	41.2	19.4	16.0	23.5
	95% C.I.	(29.6-53.8)	(11.4-30.9)	(9.3-26.2)	(12.6-39.5)
Other	**%**	54.3	17.8	15.2	12.6
	95% C.I.	(28.1)	(0.0-38.1)	(0.9-29.6)	(0.0-25.6)

Note: Data for "African American, None, Once, Twice, Three or more times," and "Other, None, Once, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-5. Emergency Department or Urgent Care Visits during the Past 12 Months among Children with Current Asthma, by Gender, North Carolina, 2005-2010

	Total	Male	Female
%	25.8	26.2	25.4
95% C.I.	(23.1-28.6)	(22.4-30.0)	(21.3-29.4)

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 3-6. Emergency Department or Urgent Care Visits during the Past 12 Months among Children with Current Asthma, by Race, North Carolina, 2005-2010

	Total	White	African American	Other Minorities
%	25.8	18.0	37.3	29.2
95% C.I.	(23.1-28.6)	(14.9-21.2)	(31.7-42.9)	(19.5-39.0)

Note: Data for "Other Minorities" are based on a numerator of less than 50, interpret with caution.

Source: 2005-2010 N.C. Child Health Assessment and Monitoring Program, N.C. State Center for Health Statistics

Table 3-7. Frequency of Emergency Department or Urgent Care Visits during the Past 12 Months among Adults with Current Asthma, by Gender, North Carolina, 2008

		None	Once	Twice	Three or more times
Total	**%**	67.0	14.7	11.0	7.3
	95% C.I.	(60.8-72.6)	(10.1-20.9)	(8.1-14.9)	(4.6-11.4)
Male	**%**	60.8	13.6	13.5	12.1
	95% C.I.	(49.9-70.7)	(7.8-22.4)	(7.7-22.7)	(6.1-22.6)
Female	**%**	70.0	15.3	9.8	5.0
	95% C.I.	(62.3-76.6)	(9.4-23.8)	(6.8-13.9)	(2.7-9.0)

Note: Data for "Total, Three or more times," "Male, Once, Twice, Three or more times," and "Female, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-8. Frequency of Emergency Department/Urgent Care Visits during the Past 12 Months among Adults with Current Asthma, by Race, North Carolina, 2008

		None	Once	Twice	Three or more times
Total	**%**	67.0	14.7	11.0	7.3
	95% C.I.	(60.8-72.6)	(10.1-20.9)	(8.1-14.9)	(4.6-11.4)
White	**%**	74.6	10.5	9.2	5.6
	95% C.I.	(68.5-79.9)	(7.3-14.9)	(6.2-13.6)	(2.8-11.0)
African American	**%**	39.7	22.8	19.0	18.5
	95% C.I.	(28.2-52.34)	(14.2-34.4)	(10.5-31.9)	(9.9-31.9)
Other	**%**	59.2	29.0	8.9	2.9
	95% C.I.	(30.3-88.1)	(0.0-60.7)	(0.0-18.1)	(0.0-8.3)

Note: Data for "Total, Three or more times," "White, Twice, Three or more times," and "African American, None, Once, Twice, Three or more times," and "Other, None, Once, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-9. Hospitalizations* with a Primary Diagnosis of Asthma**, All Ages, United States and North Carolina, 2003-2010

	2003	2004	2005	2006	2007	2008	2009	2010
North Carolina	14.3	12.6	12.8	11.8	11.6	11.5	11.7	11.0
United States	19.8	17.0	16.6	14.9	15.2	14.9	15.7	NA

* Rate per 10,000 population

** ICD-9CM Code 493

Sources: N.C.: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2010
U.S.: Centers for Disease Control and Prevention, National Hospital Discharge Survey, 2003-2009

Table 3-10. Hospitalizations* with a Primary Diagnosis of Asthma**, All Ages, North Carolina, 2003-2010

Year	Total – All Ages	
	Number	Rate
2003	12,051	14.3
2004	10,753	12.6
2005	11,158	12.8
2006	10,500	11.8
2007	10,535	11.6
2008	10,644	11.5
2009	10,986	11.7
2010	10,471	11.0

* Rate per 10,000 population

** ICD-9CM Code 493

Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2010

Table 3-11. Hospitalizations* with a Primary Diagnosis of Asthma**, by Gender, All Ages, North Carolina, 2003-2010

	2003	2004	2005	2006	2007	2008	2009	2010
Male	10.4	9.6	9.6	9.7	9.0	8.4	9.1	8.4
Female	18.1	15.4	15.8	15.3	14.0	14.1	14.3	13.4

* Rate per 10,000 population

** ICD-9CM Code 493

Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2010

Table 3-12. Hospitalizations* with a Primary Diagnosis of Asthma**, by Age, North Carolina, 2003-2010

	2003	2004	2005	2006	2007	2008	2009	2010
0 to 4	38.1	31.3	26.9	29.8	26.3	25.2	26.0	26.4
5 to 14	12.6	11.4	11.3	12.2	11.8	10.0	12.2	11.7
15 to 34	5.9	4.5	4.8	4.8	4.1	3.9	4.4	3.7
35 to 64	14.1	13.1	13.3	12.8	11.6	11.7	12.0	11.1
65+	23.4	21.1	24.2	21.9	20.6	21.9	18.5	17.3

* Rate per 10,000 population

** ICD-9CM Code 493

Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2003-2008

Table 3-13. Hospitalizations* with a Primary Diagnosis of Asthma**, by Race, North Carolina, 2010

	Total	White	African American	Other
Number	10,471	4,918	4,299	482
Rate	11.0	7.5	21.0	5.4
Percent	100.0	47.0	41.0	88.6

* Rate per 10,000 population

** ICD-9CM Code 493

Note: "Other" includes American Indian, Asian, and other races; numbers, rates and percentages do not include 381 cases that declined to provide race information or where race was unavailable.

Source: N.C. State Center for Health Statistics, North Carolina Hospital Discharge Data, 2010

Table 3-14. Frequency of Visits to a Health Professional for Routine Care among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008

		None	Once	Twice	Three or more times
No Insurance	**%**	50.1	30.8	11.7	7.3
	95% C.I.	(39.1-61.2)	(20.5-43.4)	(6.8-19.6)	(3.4-15.3)
Medicaid	**%**	58.0	11.5	11.3	19.2
	95% C.I.	(40.5-73.7)	(5.8-21.3)	(5.3-22.6)	(10.9-31.6)
All Other Insurance	**%**	43.7	30.5	11.4	14.4
	95% C.I.	(39.0-48.5)	(26.2-35.2)	(9.0-14.4)	(11.9-17.4)

Note: Data for "No Insurance, Once, Twice, Three or more times" and "Medicaid, None, Once, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-15. Frequency of Visits to a Health Professional for Urgent Treatment of Asthma among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008

		None	Once	Twice	Three or more times
No Insurance	**%**	52.7	18.9	12.6	15.8
	95% C.I.	(37.8-67.1)	(8.6-36.7)	(6.0-24.6)	(6.3-34.4)
Medicaid	**%**	67.1	15.6	8.7	8.6
	95% C.I.	(44.0-84.1)	(6.0-35.0)	(3.5-20.1)	(3.4-20.0)
All Other Insurance	**%**	53.1	17.7	12.4	16.8
	95% C.I.	(47.1-58.9)	(13.7-22.5)	(9.1-16.7)	(12.4-22.4)

Note: Data for "No Insurance, Once, Twice, Three or more times" and "Medicaid, None, Once, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-16. Frequency of Visits to an Emergency Department Due to Asthma among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008

		None	Once	Twice	Three or more times
No Insurance	**%**	65.7	15.4	9.4	9.5
	95% C.I.	(50.5-78.3)	(7.5-28.8)	(4.6-18.4)	(2.7-27.9)
Medicaid	**%**	35.5	42.9	10.7	10.9
	95% C.I.	(17.3-59.2)	(17.2-73.1)	(3.9-26.1)	(3.8-27.3)
All Other Insurance	**%**	71.5	10.8	11.5	6.2
	95% C.I.	(65.7-76.7)	(7.8-14.6)	(8.0-16.3)	(3.6-10.6)

Note: Data for "No Insurance, Once, Twice, Three or more times," "Medicaid, None, Once, Twice, Three or more times," and "All Other Insurance, Twice, Three or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-17. Frequency of Taking Medication to Prevent an Asthma Attack during the Past 30 Days among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008

		Never	1-14 days	15-24 days	25-30 days
No Insurance	**%**	58.2	15.3	3.3	23.2
	95% C.I.	(47.3-68.3)	(9.9-22.8)	(1.6-6.7)	(15.6-33.1)
Medicaid	**%**	38.7	29.2	4.4	27.7
	95% C.I.	(20.6-60.5)	(16.1-47.1)	(1.7-11.0)	(16.7-42.2)
All Other Insurance	**%**	40.4	20.8	3.6	35.2
	95% C.I.	(35.7-45.2)	(16.9-25.4)	(2.4-5.5)	(31.1-39.4)

Note: Data for "No Insurance, 1-14 days, 15-24 days, 25-30 days," "Medicaid, Never, 1-14 days, 15-24 days, 25-30 days," and "All Other Insurance, 15-24 days" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Table 3-18. Frequency of Asthma Inhaler Usage during the Past 30 Days among Adults with Current Asthma, by Health Insurance Coverage, North Carolina, 2008

		Never	1-4 times	5-14 times	15 or more times
No Insurance	**%**	51.6	21.1	15.4	11.9
	95% C.I.	(40.6-62.5)	(14.0-30.4)	(9.2-24.7)	(40.6-62.5)
Medicaid	**%**	56.5	21.7	9.6	12.1
	95% C.I.	(39.2-72.5)	(12.2-35.6)	(4.5-19.1)	(6.6-21.4)
All Other Insurance	**%**	53.0	28.3	7.1	11.5
	95% C.I.	(48.3-57.7)	(24.5-32.5)	(5.4-9.5)	(9.3-14.1)

Note: Data for "No Insurance, 1-4 times, 5-14 times, 15 or more times" and "Medicaid, Never, 1-4 times, 5-14 times, 15 or more times" are based on numerators of less than 50, interpret with caution.

Source: 2008 N.C. Behavioral Risk Factor Surveillance System, N.C. State Center for Health Statistics

Mortality

Table 4-1. Age-Adjusted Asthma Mortality Rates Per Million, North Carolina and United States, 2000-2010

Year	North Carolina Rate (Number)	United States Rate (Number)
2000	16.00 (125)	16.10 (4,487)
2001	17.39 (138)	15.00 (4,269)
2002	13.53 (110)	14.78 (4,261)
2003	14.65 (122)	13.94 (4,099)
2004	13.50 (113)	12.77 (3,816)
2005	13.57 (116)	12.70 (3,884)
2006	14.09 (123)	11.70 (3,613)
2007	15.01 (138)	11.00 (3,447)
2008	12.32 (117)	10.60 (3,397)
2009	9.70 (94)	10.50 (3,388)
2010	10.30 (102)	10.00 (3,355)

Note: Direct age-adjustment using the Standard 2000 U.S. population; asthma listed as the underlying cause of death (ICD-10 codes J45- J46); all ages included

Source: N.C.: North Carolina State Center for Health Statistics, 2000-2010;
U.S.: CDC WONDER, National Center for Health Statistics, CDC, 2001-2009; National Vital Statistics Reports, Vol. 60, No. 4, 2010

Table 4-2. Age-Specific Asthma Mortality Rates Per Million, North Carolina, 2000-2010

	Age (Years)				
	0 to 4	5 to 14	15 to 34	35 to 64	65+
Rate	1.6	2.9	4.4	13.5	51.9
Number	11	37	118	516	616

Note: Asthma listed as the underlying cause of death (ICD-10 codes J45-J46); rate for the 0-4 year group is based on the number of deaths less than 20, interpret with caution.

Source: North Carolina State Center for Health Statistics, 2000-2010

Table 4-3. Age-Adjusted Asthma Mortality Rates Per Million, by Gender, North Carolina, 2000-2010

Year	Gender	
	Male Rate (Number)	Female Rate (Number)
2000	13.7 (46)	17.6 (79)
2001	11.6 (39)	22.2 (99)
2002	10.3 (37)	15.8 (73)
2003	12.4 (44)	16.8 (78)
2004	9.6 (38)	15.7 (75)
2005	8.2 (32)	17.5 (84)
2006	11.5 (44)	16.3 (79)
2007	9.5 (40)	18.9 (98)
2008	11.0 (46)	13.2 (71)
2009	8.4 (38)	10.3 (56)
2010	8.4 (35)	12.2 (67)

Note: Asthma listed as the underlying cause of death (ICD-10 codes J45-J46).

Source: North Carolina State Center for Health Statistics, 2000-2010

Table 4-4. Asthma Mortality Rates Per Million, by Age and Gender, North Carolina, 2000-2010

	Age (Years)				
	0 to 4 Rate (Number)	5 to 14 Rate (Number)	15 to 34 Rate (Number)	35 to 64 Rate (Number)	65+ Rate (Number)
Male	1.2 (4)	3.5 (23)	3.9 (53)	10.0 (185)	35.7 (174)
Female	2.1 (7)	2.2 (14)	5.0 (65)	16.9 (330)	63.3 (442)

Note: Asthma listed as the underlying cause of death (ICD-10 codes J45-J46); rates for the 0-4 year, male and female, and 5-14 year, female groups are based on the number of deaths less than 20, interpret with caution.

Source: North Carolina State Center for Health Statistics, 2000-2010

Table 4-5. Age-Adjusted Asthma Mortality Rates Per Million, by Race, North Carolina, 2000-2010

Year	Race		
	White Rate (Number)	African American Rate (Number)	Other Minorities* Rate (Number)
2000	12.1 (76)	30.8 (46)	25.8 (3)
2001	13.6 (86)	30.2 (48)	20.3 (4)
2002	10.7 (69)	25.0 (38)	27.4 (3)
2003	10.1 (67)	32.4 (51)	30.7 (4)
2004	10.3 (69)	27.0 (43)	40.3 (1)
2005	9.3 (64)	29.9 (51)	11.4 (1)
2006	10.3 (71)	28.9 (51)	9.1 (1)
2007	11.9 (87)	28.4 (51)	0.0 (0)
2008	9.1 (69)	25.4 (47)	5.2 (1)
2009	6.8 (54)	18.0 (36)	11.8 (4)
2010	8.0 (63)	16.5 (34)	26.9 (5)

* Other Minorities include Asian, and American Indian and Alaskan Native.

Note: Direct age-adjustment using the Standard 2000 U.S. population; asthma listed as the underlying cause of death (ICD-10 codes J45-J46); rates for the Other Minorities group are based on the number of deaths less than 20, interpret with caution.

Source: North Carolina State Center for Health Statistics, 2000-2010

Table 4-6. Age-Adjusted Asthma Mortality Rates Per Million, by Race and Gender, North Carolina, 2000-2010

Year	Race		
	White Rate (Number)	African American Rate (Number)	Other Minorities* Rate (Number)
Male	7.0 (227)	23.2 (196)	17.8 (16)
Female	12.6 (548)	28.0 (299)	11.1 (11)

* Other Minorities include Asian, and American Indian and Alaskan Native.

Note: Direct age-adjustment using the Standard 2000 U.S. population; asthma listed as the underlying cause of death (ICD-10 codes J45-J46); rates for the Other Minorities, male and female groups are based on the number of deaths less than 20, interpret with caution.

Source: North Carolina State Center for Health Statistics, 2000-2010

Appendix E. Asthma Medication Possession and Self-Administration Law

115C 375.2. Possession and self administration of asthma medication by students with asthma or students subject to anaphylactic reactions, or both.

(a) Local boards of education shall adopt a policy authorizing a student with asthma or a student subject to anaphylactic reactions, or both, to possess and self administer asthma medication on school property during the school day, at school sponsored activities, or while in transit to or from school or school sponsored events. As used in this section, "asthma medication" means a medicine prescribed for the treatment of asthma or anaphylactic reactions and includes a prescribed asthma inhaler or epinephrine auto injector. The policy shall include a requirement that the student's parent or guardian provide to the school:

(1) Written authorization from the student's parent or guardian for the student to possess and self administer asthma medication.

(2) A written statement from the student's health care practitioner verifying that the student has asthma or an allergy that could result in an anaphylactic reaction, or both, and that the health care practitioner prescribed medication for use on school property during the school day, at school sponsored activities, or while in transit to or from school or school sponsored events.

(3) A written statement from the student's health care practitioner who prescribed the asthma medication that the student understands, has been instructed in self administration of the asthma medication, and has demonstrated the skill level necessary to use the asthma medication and any device that is necessary to administer the asthma medication.

(4) A written treatment plan and written emergency protocol formulated by the health care practitioner who prescribed the medicine for managing the student's asthma or anaphylaxis episodes and for medication use by the student.

(5) A statement provided by the school and signed by the student's parent or guardian acknowledging that the local school administrative unit and its employees and agents are not liable for an injury arising from a student's possession and self administration of asthma medication.

(6) Other requirements necessary to comply with State and federal laws.

(b) The student must demonstrate to the school nurse, or the nurse's designee, the skill level necessary to use the asthma medication and any device that is necessary to administer the medication.

(c) The student's parent or guardian shall provide to the school backup asthma medication that shall be kept at the student's school in a location to which the student has immediate access in the event of an asthma or anaphylaxis emergency.

(d) Information provided to the school by the student's parent or guardian shall be kept on file at the student's school in a location easily accessible in the event of an asthma or anaphylaxis emergency.

(e) If a student uses asthma medication prescribed for the student in a manner other than as prescribed, a school may impose on the student disciplinary action according to the school's disciplinary policy. A school may not impose disciplinary action that limits or restricts the student's immediate access to the asthma medication.

(f) The requirement that permission granted for a student to possess and self administer asthma medication shall be effective only for the same school and for 365 calendar days and must be renewed annually.

(g) No local board of education, nor its members, employees, designees, agents, or volunteers, shall be liable in civil damages to any party for any act authorized by this subsection [section], or for any omission relating to that act, unless that act or omission amounts to gross negligence, wanton conduct, or intentional wrongdoing. (2005 22, s. 1.)

Obtained from the North Carolina General Assembly, general statues website: http://www.ncga.state.nc.us/gascripts/Statutes/Statutes.asp

Appendix F: County-Specific Data

Table F-1. Emergency Department Visits with a Primary Diagnosis of Asthma: Number and Age-adjusted Rate per 10,000, All Ages, by County, North Carolina, 2009

County	Number*	Rate	95% C.I.
North Carolina	**47,102**	**53.0**	**52.9 - 53.1**
Alamance	755	52.7	52.6 - 52.8
Alexander	148	41.4	41.3 - 41.4
Alleghany	54	59.3	59.2 - 59.4
Anson	288	119.0	118.9 - 119.1
Ashe	63	27.1	27.1 - 27.2
Avery	63	37.0	36.9 - 37.0
Beaufort	183	41.5	41.4 - 41.6
Bertie	120	63.4	63.4 - 63.5
Bladen	180	56.5	56.4 - 56.6
Brunswick	414	48.1	48.0 . 48.2
Buncombe	2,207	103.8	103.7 - 103.9
Burke	539	63.9	63.8 - 64.0
Cabarrus	911	52.5	52.4 - 52.6
Caldwell	455	61.7	61.6 - 61.8
Camden	64	74.6	74.5 - 74.7
Carteret	88	17.0	17.0 - 17.1
Caswell	95	45.4	45.3 - 45.5
Catawba	660	43.0	42.9 - 43.0
Chatham	147	25.8	25.7 - 25.8
Cherokee	107	51.1	51.0 - 51.2
Chowan	83	63.3	63.2 - 63.4
Clay	21	25.4	25.3 - 25.5
Cleveland	976	104.9	104.8 - 105.1
Columbus	198	36.4	36.3 - 36.5
Craven	973	99.2	99.1 - 99.3
Cumberland	3,081	90.7	90.6 - 90.8

County	Number*	Rate	95% C.I.
Currituck	65	31.8	31.8 - 31.9
Dare	76	25.6	25.5 - 25.7
Davidson	638	40.9	40.8 - 40.9
Davie	81	20.6	20.5 - 20.6
Duplin	71	13.0	13.0 - 13.0
Durham	1,174	43.6	43.5 - 43.7
Edgecombe	356	73.2	73.1 - 73.3
Forsyth	1,849	53.3	53.2 - 53.4
Franklin	228	39.6	39.5 - 39.7
Gaston	951	48.2	48.1 - 48.3
Gates	38	35.9	35.8 - 36.0
Graham	43	59.8	59.7 - 59.9
Granville	189	34.0	33.9 - 34.0
Greene	53	25.6	25.5 - 25.7
Guilford	2,916	62.6	62.5 - 62.7
Halifax	599	115.1	115.0 - 115.2
Harnett	394	34.9	34.8 - 35.0
Haywood	291	54.3	54.2 - 54.4
Henderson	395	44.1	44.1 - 44.2
Hertford	97	44.5	44.4 - 44.5
Hoke	304	60.5	60.4 - 60.5
Hyde	32	54.9	54.8 - 55.0
Iredell	784	50.9	50.8 - 51.0
Jackson	187	53.8	53.7 - 53.7
Johnston	402	24.1	24.0 - 24.1
Jones	118	131.5	131.4 - 131.6
Lee	421	72.7	72.6 - 72.8
Lenoir	203	38.1	38.0 - 38.2
Lincoln	122	16.8	16.8 - 16.9
Macon	148	50.9	50.8 - 51.0
Madison	164	86.8	86.7 - 89.9
Martin	114	50.5	50.4 - 50.6
McDowell	199	47.2	47.2 - 47.3
Mecklenburg	4,270	47.6	47.5 - 47.6

County	Number*	Rate	95% C.I.
Mitchell	42	30.4	30.4 - 30.5
Montgomery	141	53.2	53.1 - 53.3
Moore	414	56.7	56.6 - 56.8
Nash	355	39.0	38.9 - 39.0
New Hanover	798	43.5	43.4 - 43.6
Northampton	183	96.9	96.8 - 97.1
Onslow	670	39.8	39.7 - 39.9
Orange	326	27.6	27.5 - 27.7
Pamlico	84	78.1	78.0 - 78.2
Pasquotank	506	134.9	134.8 - 135.1
Pender	135	28.3	28.3 - 28.4
Perquimans	99	97.5	97.4 - 97.6
Person	221	61.6	61.5 - 61.7
Pitt	520	33.4	33.3 - 33.4
Polk	34	21.5	21.4 - 21.5
Randolph	268	19.4	19.3 - 19.4
Richmond	328	72.0	71.9 - 72.1
Robeson	1,262	94.0	93.9 - 94.1
Rockingham	408	47.3	47.2 - 47.4
Rowan	872	64.6	64.5 - 64.7
Rutherford	534	85.6	85.4 - 85.7
Sampson	165	25.6	25.5 - 25.6
Scotland	138	39.5	39.4 - 39.6
Stanly	282	49.9	49.8 - 49.9
Stokes	153	35.5	35.4 - 35.6
Surry	57	8.3	8.3 - 8.4
Swain	106	81.4	81.2 - 81.5
Transylvania	47	17.5	17.4 - 17.5
Tyrrell	11	29.1	29.1 - 29.2
Union	515	26.2	26.1 - 26.2
Vance	77	17.8	17.7 - 17.8
Wake	4,749	53.5	53.4 - 53.6
Warren	23	12.5	12.5 - 12.6
Washington	14	11.1	11.1 - 11.2

County	Number*	Rate	95% C.I.
Watauga	91	21.2	21.2 - 21.3
Wayne	271	23.6	23.6 - 23.7
Wilkes	220	33.6	33.6 - 33.7
Wilson	1,009	130.0	129.9 - 130.2
Yadkin	66	19.0	18.9 - 19.0
Yancey	63	40.8	40.8 - 40.9

* 1449 observations excluded due to missing age or county data

Note: When rates are based on numerators less than 50, interpret with caution.

Source: NC Disease Event Tracking and Epidemiologic Collection Tool, 2009

Table F-2. Hospital Discharges with a Primary Diagnosis of Asthma: Number and Rate per 10,000, All Ages and Ages 0-14 Years, by County, North Carolina, 2010

County	Number All Ages	Rate All Ages	Number Ages 0-14	Rate Ages 0-14
North Carolina	**10,470**	**11.0**	**3,152**	**16.6**
Alamance	144	9.5	37	12.6
Alexander	44	11.8	9	13.0
Alleghany	8	7.2	0	0.0
Anson	34	12.6	10	20.8
Ashe	16	5.9	8	18.1
Avery	10	5.6	0	0.0
Beaufort	52	10.9	15	17.2
Bertie	46	21.6	8	22.4
Bladen	35	10.0	13	19.6
Brunswick	74	6.9	30	17.9
Buncombe	203	8.5	24	6.0
Burke	50	5.5	13	8.0
Cabarrus	185	10.4	37	9.1
Caldwell	52	6.3	15	9.8
Camden	9	9.0	3	14.4
Carteret	60	9.0	22	21.6
Caswell	14	5.9	5	12.7
Catawba	96	6.2	37	12.2
Chatham	29	4.6	11	9.4
Cherokee	25	9.1	9	20.9
Chowan	29	19.6	2	7.4
Clay	4	3.8	0	0.0
Cleveland	95	9.7	15	8.0
Columbus	82	14.1	36	32.3
Craven	119	11.5	16	7.8
Cumberland	402	12.6	124	17.2
Currituck	13	5.5	2	4.4
Dare	6	1.8	1	1.8
Davidson	115	7.1	27	8.4

County	Number All Ages	Rate All Ages	Number Ages 0-14	Rate Ages 0-14
Davie	19	4.6	4	5.0
Duplin	36	6.2	10	8.0
Durham	285	10.7	91	17.7
Edgecombe	142	25.1	50	44.4
Forsyth	365	10.4	58	8.2
Franklin	107	17.7	21	17.0
Gaston	226	11.0	91	22.4
Gates	8	6.6	0	0.0
Graham	11	12.4	3	18.8
Granville	81	13.5	21	19.4
Greene	25	11.7	5	12.1
Guilford	481	9.9	120	12.7
Halifax	90	16.5	30	29.5
Harnett	140	12.2	36	13.4
Haywood	31	5.3	5	5.3
Henderson	107	10.0	18	9.8
Hertford	13	5.3	1	2.4
Hoke	45	9.6	20	16.3
Hyde	8	13.8	0	0.0
Iredell	274	17.2	70	21.0
Jackson	18	4.5	10	16.8
Johnston	169	10.0	56	14.1
Jones	17	16.7	4	22.2
Lee	63	10.9	10	8.1
Lenoir	131	22.0	42	36.1
Lincoln	86	11.0	26	17.2
McDowell	23	5.1	5	6.2
Macon	25	7.4	7	13.1
Madison	17	8.2	1	3.0
Martin	75	30.6	11	24.9
Mecklenburg	1,120	12.2	456	23.2
Mitchell	23	14.8	10	40.5
Montgomery	30	10.8	12	21.8

County	Number All Ages	Rate All Ages	Number Ages 0-14	Rate Ages 0-14
Moore	82	9.3	25	15.8
Nash	123	12.8	41	21.9
New Hanover	166	8.2	91	27.0
Northampton	17	7.7	2	5.4
Onslow	174	9.8	56	14.3
Orange	84	6.3	25	10.9
Pamlico	13	9.9	1	5.2
Pasquotank	38	9.4	13	17.0
Pender	27	5.2	13	13.4
Perquimans	14	10.4	6	26.6
Person	65	16.5	9	12.0
Pitt	249	14.8	47	14.8
Polk	14	6.8	2	6.3
Randolph	68	4.8	28	9.7
Richmond	146	31.3	34	36.2
Robeson	361	26.9	156	52.3
Rockingham	175	18.7	37	21.9
Rowan	154	11.1	32	11.7
Rutherford	78	11.5	5	4.0
Sampson	66	10.4	14	10.4
Scotland	82	22.7	32	43.2
Stanly	36	5.9	12	10.7
Stokes	33	7.0	1	1.2
Surry	59	8.0	9	6.4
Swain	32	22.9	11	40.7
Transylvania	26	7.9	2	4.2
Tyrrell	5	11.4	1	15.2
Union	189	9.4	77	15.1
Vance	122	26.9	17	18.0
Wake	913	10.1	395	20.0
Warren	28	13.4	4	11.7
Washington	18	13.6	8	31.9
Watauga	29	5.7	6	10.4

County	Number All Ages	Rate All Ages	Number Ages 0-14	Rate Ages 0-14
Wayne	190	15.5	61	24.0
Wilkes	87	12.6	7	5.5
Wilson	109	13.4	30	18.1
Yadkin	32	8.3	1	1.4
Yancey	24	13.5	8	27.6

Notes: Data as of June 1, 2012; data include only NC residents served in NC hospitals – numbers and rates shown here may be smaller than the actual hospital use for counties that border other states; when rates are based on numerators less than 50, interpret with caution.

Source: NC State Center for Health Statistics, North Carolina Hospital Discharge Data, 2010

Table F-3. Hospital Discharges with a Primary Diagnosis of Asthma: Number and Rate per 10,000, Ages 0-14 Years and 15+ Years, by County, 2010

County	Number All Ages	Rate All Ages	Number 0-14 Years	Rate 0-14 Years	Number 15+ Years	Rate Ages 0-14
North Carolina	**10,471**	**11.0**	**3,152**	**16.6**	**7,319**	**9.6**
Alamance	144	9.5	37	12.6	107	8.8
Alexander	44	11.8	9	13.0	35	11.6
Alleghany	8	7.2	0	0.0	8	8.6
Anson	34	12.6	10	20.8	24	10.9
Ashe	16	5.9	8	18.1	8	3.5
Avery	10	5.6	0	0.0	10	6.5
Beaufort	52	10.9	15	17.2	37	9.5
Bertie	46	21.6	8	22.4	38	21.5
Bladen	35	10.0	13	19.6	22	7.7
Brunswick	74	6.9	30	17.9	44	4.9
Buncombe	203	8.5	24	6.0	179	9.0
Burke	50	5.5	13	8.0	37	5.0
Cabarrus	185	10.4	37	9.1	148	10.8
Caldwell	52	6.3	15	9.8	37	5.5
Camden	9	9.0	3	14.4	6	7.6
Carteret	60	9.0	22	21.6	38	6.8
Caswell	14	5.9	5	12.7	9	4.6
Catawba	96	6.2	37	12.2	59	4.8
Chatham	29	4.6	11	9.4	18	3.5
Cherokee	25	9.1	9	20.9	16	6.9
Chowan	29	19.6	2	7.4	27	22.4
Clay	4	3.8	0	0.0	4	4.5
Cleveland	95	9.7	15	8.0	80	10.1
Columbus	82	14.1	36	32.3	46	9.8
Craven	119	11.5	16	7.8	103	12.4
Cumberland	402	12.6	124	17.2	278	11.2
Currituck	13	5.5	2	4.4	11	5.8
Dare	6	1.8	1	1.8	5	1.8
Davidson	115	7.1	27	8.4	88	6.7

County	Number All Ages	Rate All Ages	Number 0-14 Years	Rate 0-14 Years	Number 15+ Years	Rate Ages 0-14
Davie	19	4.6	4	5.0	15	4.5
Duplin	36	6.2	10	8.0	26	5.7
Durham	285	10.7	91	17.7	194	9.0
Edgecombe	142	25.1	50	44.4	92	20.3
Forsyth	365	10.4	58	8.2	307	11.0
Franklin	107	17.7	21	17.0	86	17.8
Gaston	226	11.0	91	22.4	135	8.2
Gates	8	6.6	0	0.0	8	8.1
Graham	11	12.4	3	18.8	8	11.0
Granville	81	13.5	21	19.4	60	12.2
Greene	25	11.7	5	12.1	20	11.6
Guilford	482	9.9	120	12.7	362	9.2
Halifax	90	16.5	30	29.5	60	13.5
Harnett	140	12.2	36	13.4	104	11.9
Haywood	31	5.3	5	5.3	26	5.2
Henderson	107	10.0	18	9.8	89	10.1
Hertford	13	5.3	1	2.4	12	5.9
Hoke	45	9.6	20	16.3	25	7.2
Hyde	8	13.8	0	0.0	8	16.3
Iredell	274	17.2	70	21.0	204	16.2
Jackson	18	4.5	10	16.8	8	2.3
Johnston	169	10.0	56	14.1	113	8.7
Jones	17	16.7	4	22.2	13	15.6
Lee	63	10.9	10	8.1	53	11.7
Lenoir	131	22.0	42	36.1	89	18.6
Lincoln	86	11.0	26	17.2	60	9.5
McDowell	23	5.1	5	6.2	18	4.9
Macon	25	7.4	7	13.1	18	6.3
Madison	17	8.2	1	3.0	16	9.2
Martin	75	30.6	11	24.9	64	31.9
Mecklenburg	1,120	12.2	456	23.2	664	9.2
Mitchell	23	14.8	10	40.5	13	9.9

County	Number All Ages	Rate All Ages	Number 0-14 Years	Rate 0-14 Years	Number 15+ Years	Rate Ages 0-14
Montgomery	30	10.8	12	21.8	18	8.1
Moore	82	9.3	25	15.8	57	7.9
Nash	123	12.8	41	21.9	82	10.6
New Hanover	166	8.2	91	27.0	75	4.4
Northampton	17	7.7	2	5.4	15	8.2
Onslow	174	9.8	56	14.3	118	8.5
Orange	84	6.3	25	10.9	59	5.3
Pamlico	13	9.9	1	5.2	12	10.7
Pasquotank	38	9.4	13	17.0	25	7.6
Pender	27	5.2	13	13.4	14	3.3
Perquimans	14	10.4	6	26.6	8	7.2
Person	65	16.5	9	12.0	56	17.5
Pitt	249	14.8	47	14.8	202	14.8
Polk	14	6.8	2	6.3	12	6.9
Randolph	68	4.8	28	9.7	40	3.5
Richmond	146	31.3	34	36.2	112	30.1
Robeson	361	26.9	156	52.3	205	19.7
Rockingham	175	18.7	37	21.9	138	18.0
Rowan	154	11.1	32	11.7	122	11.0
Rutherford	78	11.5	5	4.0	73	13.2
Sampson	66	10.4	14	10.4	52	10.4
Scotland	82	22.7	32	43.2	50	17.4
Stanly	36	5.9	12	10.7	24	4.9
Stokes	33	7.0	1	1.2	32	8.2
Surry	59	8.0	9	6.4	50	8.4
Swain	32	22.9	11	40.7	21	18.6
Transylvania	26	7.9	2	4.2	24	8.5
Tyrrell	5	11.4	1	15.2	4	10.7
Union	189	9.4	77	15.1	112	7.5
Vance	122	26.9	17	18.0	105	29.2
Wake	913	10.1	395	20.0	518	7.4
Warren	28	13.4	4	11.7	24	13.7

County	Number All Ages	Rate All Ages	Number 0-14 Years	Rate 0-14 Years	Number 15+ Years	Rate Ages 0-14
Washington	18	13.6	8	31.9	10	9.3
Watauga	29	5.7	6	10.4	23	5.1
Wayne	190	15.5	61	24.0	129	13.3
Wilkes	87	12.6	7	5.5	80	14.2
Wilson	109	13.4	30	18.1	79	12.2
Yadkin	32	8.3	1	1.4	31	10.0
Yancey	24	13.5	8	27.6	16	10.7

Notes: When rates are based on numerators less than 50, interpret with caution.

Source: NC State Center for Health Statistics, North Carolina Hospital Discharge Data, 2010

Table F-4. Hospital Discharges with a Primary Diagnosis of Asthma: Number and Age-adjusted Rate per 10,000, All Ages, by County, 2006-2010

County	Number	Age-adjusted Rate	County	Number	Age-adjusted Rate
North Carolina	**53,259**	**11.4**	***North Carolina***	**53,259**	**11.4**
Alamance	697	9.3	Johnston	1,007	12.9
Alexander	201	10.4	Jones	97	17.1
Alleghany	36	5.6	Lee	320	10.5
Anson	275	19.9	Lenoir	693	23.7
Ashe	121	9.3	Lincoln	421	11.1
Avery	112	11.5	McDowell	120	5.3
Beaufort	315	12.1	Macon	122	6.8
Bertie	196	17.6	Madison	92	7.8
Bladen	189	11.4	Martin	436	31.4
Brunswick	466	9.4	Mecklenburg	5,464	12.9
Buncombe	974	7.7	Mitchell	97	12.4
Burke	357	7.6	Montgomery	128	9.1
Cabarrus	942	11.3	Moore	428	9.0
Caldwell	328	8.2	Nash	784	16.2
Camden	47	9.9	New Hanover	793	8.8
Carteret	375	11.7	Northampton	131	12.1
Caswell	62	5.2	Onslow	841	12.7
Catawba	534	6.6	Orange	384	6.7
Chatham	165	5.1	Pamlico	106	14.8
Cherokee	105	7.2	Pasquotank	288	14.1
Chowan	91	12.3	Pender	177	6.8
Clay	26	4.2	Perquimans	97	13.8
Cleveland	551	11.0	Person	286	14.0
Columbus	473	17.1	Pitt	852	12.0
Craven	753	14.5	Polk	56	4.8
Cumberland	2,096	14.1	Randolph	427	5.9
Currituck	75	6.6	Richmond	779	33.0
Dare	63	3.6	Robeson	1,872	28.6
Davidson	756	9.0	Rockingham	1,019	20.4

County	Number	Age-adjusted Rate	County	Number	Age-adjusted Rate
Davie	120	5.6	Rowan	672	9.4
Duplin	293	10.5	Rutherford	403	11.3
Durham	1,290	10.3	Sampson	438	13.4
Edgecombe	673	25.0	Scotland	494	26.8
Forsyth	1,551	8.7	Stanly	230	7.7
Franklin	437	14.8	Stokes	148	5.7
Gaston	1,094	10.5	Surry	377	9.8
Gates	38	5.6	Swain	124	17.3
Graham	42	10.9	Transylvania	120	6.7
Granville	354	12.2	Tyrrell	17	7.9
Greene	128	12.2	Union	932	9.9
Guilford	2,345	9.9	Vance	569	24.8
Halifax	589	20.6	Wake	4,057	9.9
Harnett	692	13.0	Warren	149	13.5
Haywood	288	9.3	Washington	80	11.2
Henderson	508	8.4	Watauga	179	9.5
Hertford	106	8.7	Wayne	1,002	17.0
Hoke	212	9.6	Wilkes	461	12.4
Hyde	48	14.1	Wilson	604	15.2
Iredell	1,307	16.6	Yadkin	168	8.5
Jackson	146	8.6	Yancey	76	7.9

Notes: When rates are based on numerators less than 50, interpret with caution.

Source: NC State Center for Health Statistics, North Carolina Hospital Discharge Data, 2006-2010

State of North Carolina
Department of Health and Human Services
Division of Public Health
North Carolina Asthma Program
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6/13