

*The Burden
of Asthma in
North Carolina*

2006



N.C. Division of Public Health
N.C. Department of Health
and Human Services

The Burden of Asthma in North Carolina

2006

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Chronic Disease & Injury Section

Division of Public Health

North Carolina Department of Health and Human Services

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Executive Summary



Executive Summary

Prevalence

Adults

- In 2005, 10.1% of adults (age ≥ 18 years) in North Carolina reported ever having been told by a health care provider that they have asthma. Of those adults in North Carolina, 6.5% of reported currently having asthma.⁵²
- Adult females in North Carolina have a 1.45^a greater odds than adult males to have lifetime asthma (ever having been diagnosed with asthma by a health care provider), and have a 1.79^b greater odds than males to have current asthma.⁵²
- North Carolina adults living in households with an income less than \$15,000 are 1.78 times as likely to have lifetime asthma and are 2.14 times as likely to have current asthma than those who live in households that make more than \$15,000 a year.⁵²



Children

- In 2005, 17.8% of children (age ≤ 17 years) in North Carolina reported ever having been told by a health care provider that they have asthma. Of those children, 11.5% report that they still currently have asthma.⁵³
- Male children in North Carolina have a 1.5^c greater odds to have lifetime asthma (ever having been diagnosed with asthma by a health care provider) as female children in N.C.⁵³
- According to the 2004 National Health Interview Survey (NHIS), the national median for lifetime asthma was 12.2% for children. For current asthma, the national median reported in the 2004 NHIS was 8.5% for children. Although 2004 data are not available for North Carolina children, the 2005 data that are available do suggest that North Carolina's childhood lifetime asthma prevalence (17.8%) and current asthma prevalence (11.5%) greatly exceed the national median.^{14,53}

Asthma Management and Quality of Life

- Almost 50% of North Carolina adults with current asthma reported experiencing asthma symptoms a minimum of once a week over the past 30 days. Approximately 20% of those who reported having

^a Odds Ratio (an approximation of the rate ratios with rare diseases), 95% Confidence Interval (CI) 1.3-1.6

^b Odds Ratio, 95% CI 1.6-2.1

^c Odds Ratio, 95% CI 1.3-1.8

symptoms a minimum of once a week, reported experiencing asthma symptoms every day during those 30 days.⁵²

Asthma Attack or Episode

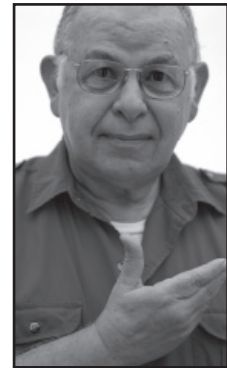
- Approximately 50% of North Carolinian adults with current asthma experienced an asthma attack or episode in the past 12 months.
- High school females in North Carolina have a higher prevalence of asthma attack (39.5%) than North Carolina high school males (22.6%).⁵⁴
- In 2003, half of children (age ≤ 17 years) with current asthma in North Carolina reported having had an asthma attack or episode in the previous 12 months.³⁷

Missed Activity

- Thirty-two percent of adults in North Carolina with asthma were unable to work or carry out normal activity due to their asthma at least one day during the last 12 months.⁵²
- Of children (age ≤ 17 years) with current asthma in North Carolina, almost half (47.5%) missed at least one day of school due to their asthma in the last year. Of that group, 37% of children with asthma missed between one and nine days of school in the past 12 months due to their asthma, and 10% of children with asthma missed 10 or more days due to their asthma.⁵³

Health Care Utilization

- About 45 percent of North Carolina adults with current asthma have not seen a doctor or health professional for a routine checkup for their asthma in the past 12 months.⁵²
- In 2004, females in North Carolina had a significantly higher asthma hospitalization rate (158 per 100,000) than males (92.8 per 100,000).
- In 2004, the highest asthma hospitalization rates in North Carolina occurred in the youngest age group, ages 0-4 years (312.7 per 100,000). The rates then steadily decreased through middle age and then began increasing again in the 65+ age group to a rate of 210.2 per 100,000.
- Almost a quarter (23.6%) of adults with current asthma in North Carolina visited an ER or urgent care center in the past 12 months. Of that 23.6%, two-thirds went three or more times.
- Almost 25% of children with current asthma in North Carolina visited the hospital emergency room or urgent care clinic because of their asthma in the past 12 months. In North Carolina, African American children were more than twice as likely as white children to have



visited the hospital emergency room or urgent care clinic because of their asthma.⁵³

- In 2004, total charges for hospitalizations in North Carolina for a primary diagnosis of asthma exceeded \$88 million dollars. This represented an average charge of \$8,259 per asthma hospitalization stay.

Mortality

- In North Carolina in 2005, females had a significantly higher mortality rate (17.48 per 1,000,000) due to a primary cause of asthma than males (8.24 per 1,000,000). This data is consistent with previous years.
- Over the previous six years, African American's mortality rate due to asthma (30.39 deaths per million) is significantly higher than the mortality rate due to asthma for whites (11.21 deaths per million).
- Native Americans have a mortality rate due to asthma of 27.9 per 1,000,000 from 1999 to 2004 (2005 census data not available at time of publication). This number is similar to the mortality rate for other minorities in North Carolina, and significantly greater than the white mortality rate due to asthma. However, this mortality rate is based on a small number of deaths (13) and therefore should be interpreted with caution.



Introduction



Introduction

What is Asthma?

In the United States, over 20 million adults and 9 million children have been diagnosed with asthma during their lifetime and over 16 million adults are currently living and coping with the disease.^{12,14,57} Asthma is one of the most common chronic diseases. It affects the lungs, causing repeated episodes of wheezing, breathlessness, chest tightness, and nighttime or early morning coughing. While a person may experience asthma attacks only when their lungs are irritated, once they have been diagnosed with asthma, it is with them for the rest of their lives.⁵⁷

An asthma attack or episode is an inflammation of the airways.⁵⁸ Airways are the paths that carry air to the lungs. As the air moves through the lungs, the airways become smaller. During an attack, the sides 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. The attack can include coughing, chest tightness, wheezing, and trouble breathing.⁵⁷ An asthma attack is caused by environmental factors, including allergens, irritants, viral infections, or even adverse weather conditions (e.g. temperature).⁵⁸



Asthma is a Public Health Priority

Asthma is a public health priority for many different reasons. Environmental factors have a significant impact on asthma episodes and attacks. Working to recognize and potentially control some of these factors can lead to better asthma management and improved quality of life. A solid asthma medical infrastructure is also necessary to improve the quality of life for persons with asthma. The North Carolina Asthma program needs to work with physicians and other health care professionals to ensure they provide their patients with asthma management plans and proper asthma education, the number of visits to the emergency room and asthma hospitalizations can be reduced. Finally, asthma is a policy issue. Supporting policies that allow children to carry asthma rescue medications to school and to self-administer them, as well as providing reimbursement to certified asthma educators are just a few of the policies that are being looked at not only on the local level, but also on the national level.

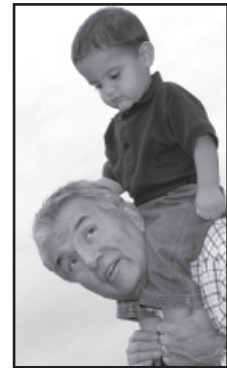
Although effective asthma treatment and management practices do exist, not all persons with asthma have access to them. Socio-economic status, lack of health insurance, not receiving an asthma management plan from their health care provider, and failure to recognize the severity of their disease can all impact a person's access to adequate asthma healthcare. As a result of poor asthma management, there were almost 2 million emergency department visits for asthma nationally in 2002. Also, in the same year, there were 484,000 hospitalizations due to a primary cause of asthma.¹² An economic analysis

commissioned by the American Lung Association estimated the 2004 annual cost for asthma in the United States at \$16.1 billion dollars.⁴²

Asthma in North Carolina

The *Burden of Asthma in North Carolina* is the first comprehensive statewide asthma surveillance report conducted in North Carolina. This report describes asthma in North Carolina in terms of morbidity, management and quality of life, health care utilization, and mortality. To do this, several state and national surveys and databases were utilized to help ascertain a total picture of the disease of asthma and the effects the disease has on persons afflicted with it.

This report will provide the baseline data that will be used to help focus asthma interventions, programs, and policies. A follow-up to this initial report will be issued regularly to review the trends in morbidity, management, health care utilization, and mortality, and new data sources and information will be included as they become available. The *Burden of Asthma in North Carolina* report will be a major factor in tracking and reporting the progress of the North Carolina Asthma Program and our many partners and stakeholders as we work together to reduce the burden of asthma in our state.



Chapter 1:
Asthma Prevalence



Asthma Prevalence

Asthma can be a difficult condition to diagnose. The course of asthma can vary from person to person. This may include weeks to months of symptom-free periods, intermittent or minimal symptoms, or even persistent symptoms at night or during exercise. A diagnosis of asthma usually requires a person to have three or more episodes of wheezing. This can take time and often a diagnosis can be made only after an extended period of observation and testing. The disease may last a lifetime in some people but not in others. Due to these factors, prevalence is a more appropriate measure of asthma than incidence^a.¹ Prevalence is a measure of the number of persons in the population affected by a disease at a certain time. Prevalence can be viewed as a slice through the population at a point in time at which it is determined who has the disease and who does not.²

Determining the prevalence of asthma in a population is very important, and can be obtained most effectively through surveys.¹ In North Carolina, the North Carolina Behavioral Risk Factor Surveillance System (N.C. BRFSS) and the Childhood Health Assessment and Monitoring Program (N.C. CHAMP) are two of the current instruments that are used to determine asthma prevalence. The N.C. BRFSS looks at North Carolina residents 18 years and older, while the N.C. CHAMP concentrates on those 17 years and younger. Persons who have asthma are determined by those who answer yes to the survey questions “*Did a doctor (or other health professional) ever tell you (or any household member) that you (they) had asthma*” or “*Do you (or the other household member) still have asthma*”.³

Because of the nature of asthma, the disease can appear to resolve itself after long periods of being symptom free.¹ Therefore, asthma prevalence is classified in two ways: lifetime and current prevalence. Lifetime asthma prevalence is defined as an affirmative answer to the question “*Have you ever been told by a doctor, nurse, or other health professional that you have asthma?*” Current asthma prevalence is defined as an affirmative response to the lifetime asthma prevalence question, as well as an affirmative response to the subsequent question “*Do you still have asthma?*”⁴

It is important to note that asthma remains an underdiagnosed and undertreated disease. Yeatts et al. (2003) looked at middle school children in North Carolina and determined that 17% of children in this population reported current asthma-like symptoms with no corresponding diagnosis of asthma from health care professional. These children suffered health consequences similar to those who had a diagnosis of asthma, including missed school/activity, sleep disturbances, emergency room visits, and hospitalizations.⁵⁵ The prevalence numbers that will be presented in this document are, therefore, to be considered conservative, with actual prevalence possibly being much higher.



^a Incidence of a disease is defined as the number of new cases of a disease that occur during a specified period of time in a population at risk for developing the disease.²

Adult Asthma Prevalence

The North Carolina adult (≥ 18 years old) prevalence was obtained from the N.C. BRFSS. The N.C. BRFSS is a population-based, annual, random telephone survey of residents aged 18 and older in households with telephones. The BRFSS was initially developed in the 1980s by the Centers for Disease Control and Prevention (CDC) in collaboration with state health departments, and is currently conducted in all 50 states and several U.S. territories. North Carolina has participated in conducting the BRFSS since 1987. Questions related to asthma prevalence have only been included in the N.C. BRFSS since 2000 and the current information includes 6 years of data.⁵

In 2005, the N.C. BRFSS had a response rate of 76.14%, with 17,261 surveys completed. This number of completed surveys was second only to Washington State. The average number of surveys completed for all states/territories was 6,719.

The telephone survey format of the N.C. BRFSS has many advantages, including better quality control over data collection using a computer-assisted telephone interviewing system, relatively low cost, and speed of data collection.⁶ Additional strengths of the N.C. BRFSS include the fact that the answers are representative of adults in North Carolina and that it offers the opportunity to examine trends over time.

While the N.C. BRFSS is the best means of measuring adult asthma prevalence, it does have some limitations. Because it is a telephone survey, those persons who live in a household without a telephone are not included. However, approximately 95% of households in North Carolina have at least one telephone, so the degree of understatement is probably not large. Another limitation is that the data are self-reported by respondents. The validity of self-reported asthma status in the BRFSS is unknown. Finally, the N.C. BRFSS only tracks diagnosed asthma. People who have symptoms of asthma, but have not yet been diagnosed by a health care provider, would answer “no” when asked if a doctor, nurse, or other health professional had ever told them they have asthma.^{6,7,8}

For North Carolina adults, both the lifetime and current asthma prevalence have remained slightly below the national median for the last 6 years, according to the BRFSS. Slight increases in the lifetime and current asthma prevalence for adults in North Carolina have been seen from 2001 through 2004. However, with the release of the 2005 N.C. BRFSS, there is a decrease in the current asthma prevalence among adults in North Carolina, as well as a statistically significant decrease in the lifetime asthma prevalence in adults.

Figure 1. Prevalence of Lifetime and Current Asthma for Adults (≥18 years), United States¹ and North Carolina, 2000-2005

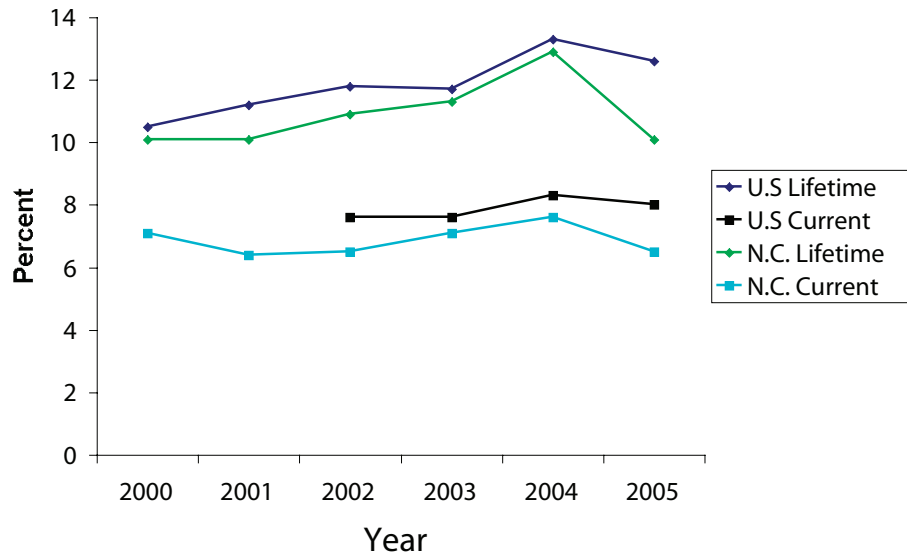


Table 1. Lifetime and Current Asthma Prevalence for the United States and North Carolina, Adults (≥ 18 years old), 2000-2005

	2000	2001	2002	2003	2004	2005
U.S. Lifetime	10.5%	11.2%	11.8%	11.7%	13.3%	12.6%
U.S. Current	*	*	7.6%	7.6%	8.3%	8.0%
N.C. Lifetime (95% CI)	10.1% (9.0, 11.5)	10.1% (8.9, 11.4)	10.9% (9.7, 12.1)	11.3% (10.3, 12.4)	12.9% (12.2, 13.6)	10.1% (9.5, 10.7)
N.C. Current (95% CI)	7.1% (6.1, 8.2)	6.4% (5.5, 7.5)	6.5% (5.6, 7.5)	7.1% (6.3, 7.9)	7.6% (7.0, 8.1)	6.5% (6.0, 7.0)

¹ No confidence intervals (CI) are available as these numbers are the median percentage of the responses from 52 states (# of States includes District of Columbia, Guam, Puerto Rico, and the U.S. Virgin Islands in applicable years)

*No data available

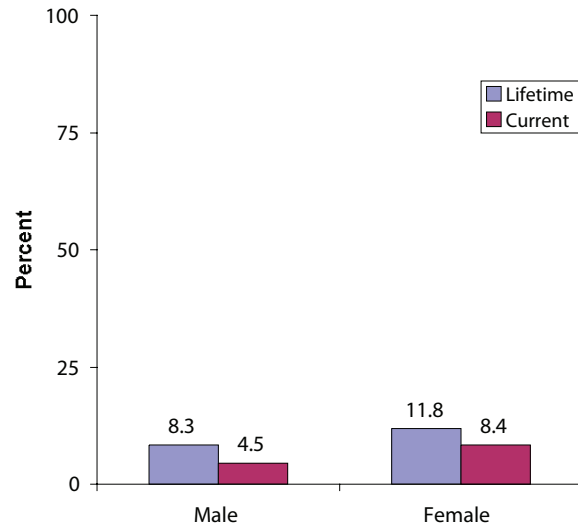
Data Source: BRFSS, United States⁵⁰ and North Carolina, 2000-2004

Summary of Figure 1 and Table 1:

- North Carolina has consistently had a lower current and lifetime asthma prevalence than the national median.

Lifetime and Current Asthma

Figure 2. Prevalence of Lifetime and Current Asthma for Adults (≥ 18 years), by Sex, North Carolina, 2005



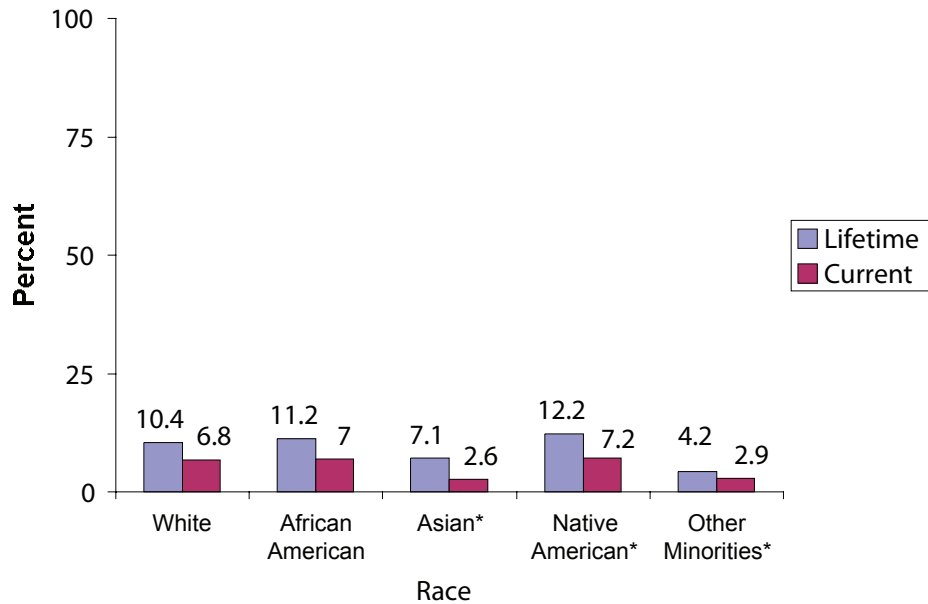
Data Source: BRFSS, North Carolina, 2005

Summary of Figure 2:

- Since the N.C. BRFSS began including asthma questions in 2000, gender differences with asthma have been seen. North Carolina women are more likely than men to report having lifetime or current asthma. This is consistent with the information we have that among the general population; the prevalence of asthma is higher among females than males.⁹
- The prevalence of lifetime asthma has been higher for women than men for the past 6 years. Women's lifetime asthma prevalence was statistically significantly higher than men's in the years 2002, 2004, and 2005.
- The 2005 lifetime asthma prevalence in North Carolina for both men and women is lower than the national median lifetime asthma prevalence (male = 10.4%, female = 14.5%).¹⁰
- The prevalence of current asthma has been higher for women than men in North Carolina for the past 6 years. Women have had a statistically significant higher prevalence of current asthma for 4 of the past 6 years, 2000, 2003, 2004, and 2005.
- The 2005 current asthma prevalence for North Carolina men and women is lower than the national median current asthma prevalence (male = 5.7%, female = 10.3%).¹⁰



Figure 3. Prevalence of Lifetime and Current Asthma for Adults (≥ 18 years), by Race, North Carolina, 2005



* Prevalence based on numerator less than 50, interpret with caution.
Data Source: BRFSS, North Carolina, 2005

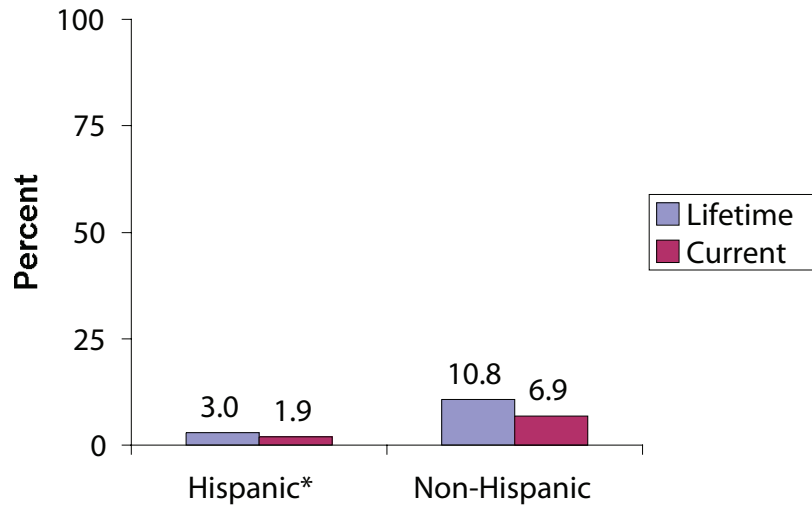
Summary of Figure 3:

- The differences between the racial groups for both lifetime and current asthma were not significant. However, in 2004, Native Americans had a significantly higher prevalence of current asthma than whites.
- White and African American North Carolinians had lifetime and current asthma prevalence lower than the national medians.

North Carolina has one of the largest American Indian populations east of the Mississippi River and among the top ten largest American Indian populations in the nation, according to the 2000 census.¹¹ Native Americans were more likely than whites to report having many chronic diseases, including 25% more likely to have ever been diagnosed with asthma.^{11, 12}



Figure 4. Prevalence of Lifetime and Current Asthma for Adults (≥ 18 years), by Hispanicity, North Carolina, 2005



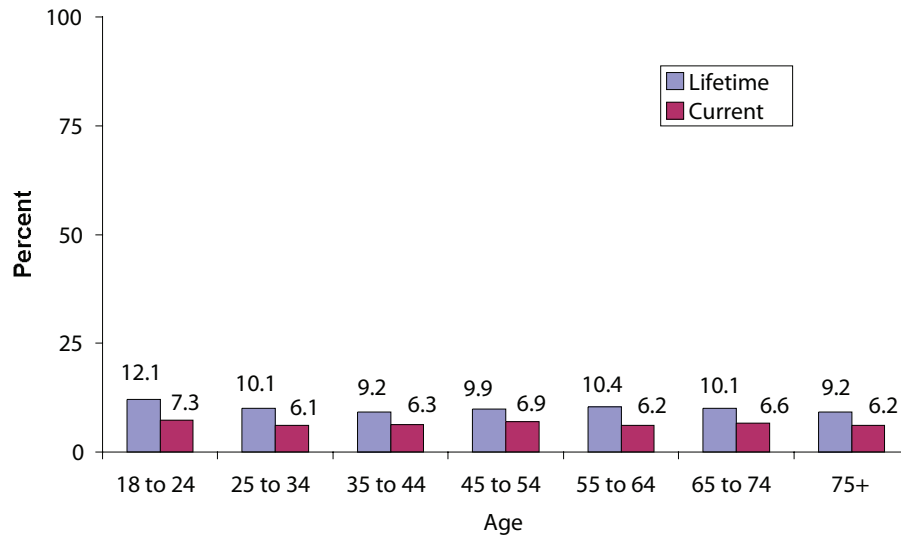
*Prevalence based on numerator less than 50, interpret with caution.
Data Source: BRFSS, North Carolina, 2005

Summary of Figure 4:

Lifetime and current asthma prevalence for North Carolina Hispanics were lower than the national medians, which are 10.3% for lifetime asthma for Hispanics nationally, and 5.9% for current asthma for Hispanics nationally. The N.C. BRFFS showed that Hispanic families who spoke Spanish at home have a lower lifetime asthma prevalence and current asthma prevalence than those Hispanic families who speak English at home. While the number of respondents was too small to draw definitive conclusions, this data implies that 2nd generation Hispanics have a higher asthma prevalence, which could be due to a number of external factors, including environmental factors and acculturation.

Nationally, according to the 2004 National Health Interview Survey (NHIS), Hispanic adults had lower rates of asthma than both white and African American adults.¹³ These results are potentially explained by the possibility of underdiagnosis due to lack of access to care among this group.⁵¹

Figure 5. Prevalence of Lifetime Asthma for Adults (≥ 18 years), by Age, North Carolina, 2005

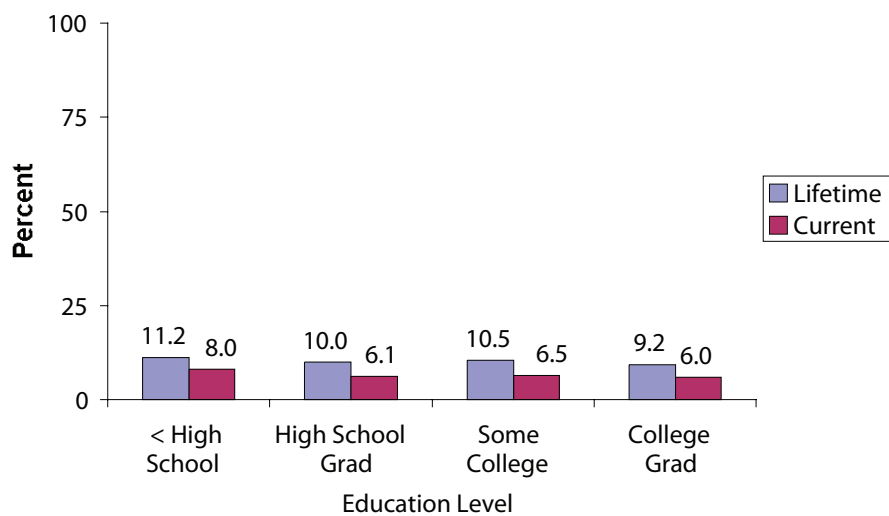


Data Source: BRFSS, North Carolina, 2005

Summary of Figure 5:

- Lifetime and current asthma prevalence were similar across the adult age groups.
- North Carolina lifetime asthma prevalence and current asthma prevalence for all adults in each age group tend to be lower than the national medians.

Figure 6. Prevalence of Lifetime and Current Asthma for Adults (≥ 18 years), by Education Level, North Carolina, 2005

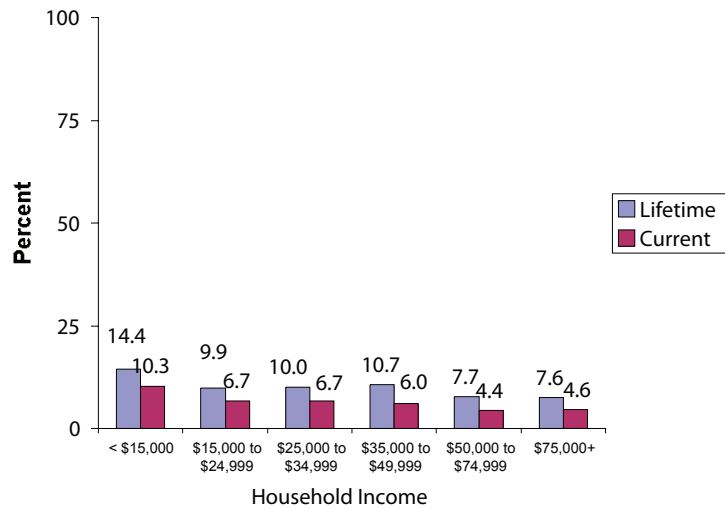


Data Source: BRFSS, North Carolina, 2005

Summary of Figure 6:

- In 2004, survey respondents with less than a high school education were significantly more likely to have lifetime asthma than either high school graduates or college graduates. Respondents with less than a high school education were also significantly more likely to have current asthma than all other education groups.
- In 2005, significant differences were not seen in education level for either lifetime or current asthma prevalence.

Figure 7. Prevalence of Lifetime Asthma for Adults (≥18 years), by Household Income, North Carolina, 2005



Data Source: BRFSS, North Carolina, 2005

Summary of Figure 7:

- North Carolinians from a household with an income less than \$15,000 were significantly more likely to have a higher prevalence of both lifetime and current asthma than all other income groups. This is similar to national trends, which show that adults in poor^b families have higher percentages of asthma than adults in families that were not poor.¹³
- Those from a household with an income greater than \$50,000 had significantly lower lifetime asthma prevalence than North Carolinians living in a household with an income between \$35,000 and \$49,999.
- Households with an income greater than \$50,000 had significantly lower lifetime asthma prevalence than households with incomes less than \$25,000.
- The lifetime asthma prevalence and current asthma prevalence for North Carolinians at all household income levels was below the national medians.

^b Poverty status is based on family income and family size using the U.S. Census Bureau's poverty thresholds for the previous calendar year. "Poor" persons are defined as below the poverty threshold.¹³



Table 2. Lifetime Asthma Prevalence by Sex, Race, Ethnicity, Age Group, Education, and Household Income, North Carolina, 2003-2005

	Lifetime Asthma Prevalence					
	2003		2004		2005	
	Rate (%)	95% CI	Rate (%)	95% CI	Rate (%)	95% CI
Total	11.3	10.3-12.4	12.9	12.2-13.6	10.1	9.5-10.7
Sex						
Male	10.0	8.5-11.8	10.8	9.8-11.9	8.3	7.4-9.2
Female	12.5	11.3-13.8	14.7	13.9-15.7	11.8	11.1-12.6
Race						
White	11.0	9.9-12.2	13.0	12.2-13.9	10.4	9.7-11.2
African American	13.8	11.4-16.5	14.5	12.8-16.2	11.2	9.8-12.9
Asian	0.4*	0.1-3.0	6.6*	2.6-15.9	7.1*	3.4-14.6
Native American	16.7*	7.6-32.8	18.4	13.5-24.5	12.2*	8.5-17.2
Other Minorities	7.6*	4.4-12.7	5.6*	3.7-8.5	4.2*	2.8-6.2
Ethnicity						
Hispanic	7.5*	4.4-12.5	5.7*	3.8-8.3	3.0*	2.1-4.3
Non-Hispanic	11.5	10.5-12.6	13.4	12.7-14.1	10.8	10.1-11.4
English Speaking Hispanic	12.6*	6.1-24.4	10.7*	6.8-16.4	8.0*	5.0-12.4
Spanish Speaking Hispanic	5.8*	2.7-11.8	3.4*	1.7-6.7	1.6*	0.9-2.9
Age						
18 to 24	15.4	11.4-20.6	17.9	14.7-21.7	12.1	9.6-15.1
25 to 34	10.5	8.4-13.0	10.4	8.9-12.1	10.1	8.7-11.6
35 to 44	10.8	8.8-13.0	14.0	12.4-15.7	9.2	8.1-10.4
45 to 54	10.3	8.3-12.6	13.4	11.9-15.1	9.9	8.8-11.2
55 to 64	10.5	8.4-12.9	13.4	11.9-15.1	10.4	9.2-11.7
65 to 74	12.6	10.1-15.6	11.2	9.7-12.9	10.1	8.8-11.6
75+	9.8	7.5-12.8	11.2	9.3-13.4	9.2	7.7-10.9
Education Level						
< High School	11.7	9.7-14.0	15.3	13.5-17.3	11.2	9.5-13.1
High School Grad	12.0	10.1-14.2	11.9	10.8-13.2	10.0	8.9-11.2
Some College	11.4	9.4-13.9	13.4	12.1-14.9	10.5	9.4-11.7
College Grad	10.3	8.8-12.1	11.8	10.7-13.1	9.2	8.3-10.3
Household Income						
< \$15K	16.2	13.1-20.0	18.6	16.4-21.1	14.4	12.5-16.5
\$15K to \$24,999	12.3	9.9-15.1	13.5	11.8-15.4	9.9	8.6-11.3
\$25K to \$34,999	12.9	9.8-16.9	11.0	9.3-12.9	10.0	8.4-11.8
\$35K to \$49,999	10.2	7.7-13.5	12.7	10.9-14.7	10.7	9.3-12.4
\$50K to \$74,999	9.4	7.1-12.2	10.0	8.4-11.9	7.7	6.5-9.2
\$75K +	6.9	5.3-9.0	11.3	9.7-13.2	7.6	6.4-9.0

*Based on numerator less than 50, interpret with caution.
Data Source: BRFSS, North Carolina, 2003, 2004, 2005

Table 3. Current Asthma Prevalence by Sex, Race, Ethnicity, Age Group, Education, and Household Income, North Carolina, 2003-2005

	Current Asthma Prevalence					
	2003		2004		2005	
	Rate (%)	95% CI	Rate (%)	95% CI	Rate (%)	95% CI
Total	7.1	6.3-7.9	7.6	7.0-8.1	6.5	6.0-7.0
Sex						
Male	5.2	4.2-6.5	5.2	4.5-6.0	4.5	3.9-5.3
Female	8.9	7.9-10.0	9.8	9.0-10.6	8.4	7.7-9.1
Race						
White	7.0	6.1-8.0	7.6	7.0-8.3	6.8	6.2-7.4
African American	8.0	6.4-9.9	8.4	7.2-9.8	7.0	5.8-8.3
Asian	0.4*	0.1-3.0	6.1*	2.2-15.5	2.6*	0.8-8.0
Native American	12.2*	4.6-28.7	13.2*	9.3-18.3	7.2*	4.8-10.8
Other Minorities	5.2*	2.8-9.6	3.6*	2.1-6.2	2.9*	1.8-4.8
Ethnicity						
Hispanic	4.3*	2.2-8.4	3.5*	2.1-5.8	1.9*	1.2-3.0
Non-Hispanic	7.2	6.4-8.1	7.9*	7.3-8.4	6.9	6.4-7.5
English Speaking Hispanic	5.0*	2.1-11.4	7.3*	4-13	6.0*	3.4-10.4
Spanish Speaking Hispanic	4.1*	1.7-9.7	1.7*	0.6-4.4	0.8*	0.4-1.5
Age						
18 to 24	7.5*	4.9-11.4	8.4	6.3-11.3	7.3	5.3-9.8
25 to 34	5.7	4.3-7.6	6.2	5.0-7.5	6.1	5.0-7.4
35 to 44	7.1	5.6-9.0	7.1	6.1-8.3	6.3	5.3-7.3
45 to 54	6.5	5.0-8.4	8.0	6.8-9.3	6.9	6.0-8.0
55 to 64	7.0	5.4-9.0	9.3	7.9-10.8	6.2	5.3-7.3
65 to 74	9.1	7.0-11.8	7.4	6.2-8.8	6.6	5.5-7.8
75+	8.0	5.9-10.8	7.1	5.5-9.1	6.2	5.0-7.7
Education Level						
< High School	9.7	8.0-11.9	10.4	9.0-12.1	8.0	6.6-9.6
High School Grad	6.1	4.9-7.6	7.1	6.2-8.1	6.1	5.3-7.1
Some College	6.8	5.3-8.8	7.4	6.4-8.5	6.5	5.6-7.5
College Grad	6.8	5.5-8.4	6.5	5.6-7.4	6.0	5.2-6.9
Household Income						
< \$15K	12.5	10.0-15.5	12.6	10.8-14.7	10.3	8.7-12.2
\$15K to \$24,999	7.4	5.7-9.7	8.4	7.1-9.9	6.7	5.6-8.0
\$25K to \$34,999	8.3	5.7-11.8	6.5	5.2-8.0	6.7	5.3-8.4
\$35K to \$49,999	6.6	4.6-9.5	7.6	6.2-9.3	6.0	4.9-7.2
\$50K to \$74,999	5.8	4.0-8.2	5.1	4.0-6.4	4.4	3.5-5.6
\$75K +	3.4	2.2-5.1	5.7	4.6-7.0	4.6	3.7-5.6

*Based on numerator less than 50, interpret with caution.
Data Source: BRFSS, North Carolina, 2003, 2004, 2005

Child Prevalence (≤ 17 years old)

Asthma is a leading chronic illness among children in the United States. The prevalence of asthma is higher among children than adults.⁹ An estimated 9 million (12.5%) of children younger than 18 years old have been diagnosed with asthma. As age increases, the percentage of children ever diagnosed with asthma increases.¹⁴ Rates of current asthma decreased with age, with children 17 years old or younger having a much higher rate (83 per 1,000) of asthma, than adults 18 years and older with asthma (68 per 1,000).¹²

North Carolina child asthma prevalence data was obtained from two primary sources, the North Carolina Child Health Assessment and Monitoring Program (CHAMP) and the Youth Risk Behavior Survey (YRBS). As with the adults in the N.C. BRFSS, asthma prevalence is estimated with two measures, lifetime asthma and current asthma. In N.C. CHAMP, lifetime asthma is estimated with the question “*Has a doctor ever told you your child has asthma?*” Current asthma is estimated with the question, “*Does your child still have asthma?*”

The N.C. CHAMP survey is a phone survey conducted as a continuation of the N.C. BRFSS. The children who are selected for the N.C. CHAMP are chosen through a child selection module that is conducted during the N.C. BRFSS. The N.C. CHAMP has similar benefits, limitations, and biases of the N.C. BRFSS.

Figure 8. Lifetime and Current Asthma Prevalence among Children (≤ 17 years), United States and North Carolina, 2001 – 2005

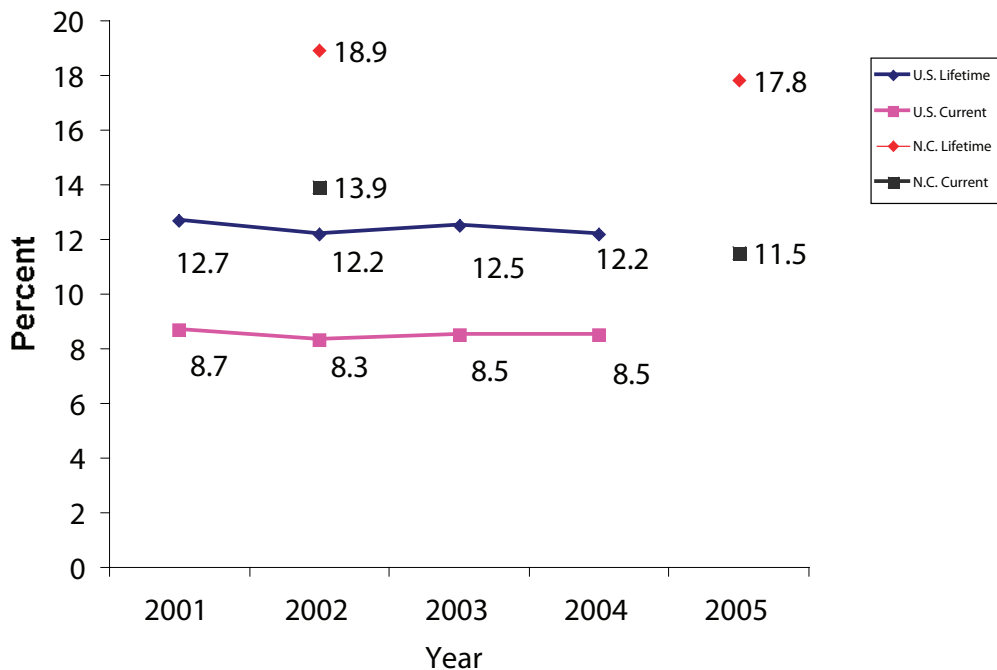


Table 4. Lifetime and Current Asthma Prevalence for the United States and North Carolina^{1,2,3}, Children (≤17 years old), 2001-2005

Year	U.S. Lifetime Asthma ¹	N.C. Lifetime Asthma	U.S. Current Asthma ¹	N.C. Current Asthma
2001	12.7	*	8.7	*
2002	12.2	18.9 ²	8.3	13.9 ²
2003	12.5	*	8.5	*
2004	12.2	*	8.5	*
2005	*	17.8 ³	*	11.5 ³

* Data not available

¹ U.S. estimates are taken from the NHIS which asks "Has a doctor or other health professional ever told you that (your child) had asthma?" as a measure for lifetime asthma. For current asthma, the NHIS asked "Does (your child) still have asthma?"

² The 2002 N.C. BRFSS asked, "How many of the children (in your household) have ever been diagnosed with asthma?" as the measure for lifetime asthma, and "How many of these children still have asthma?" as the measure for current asthma.

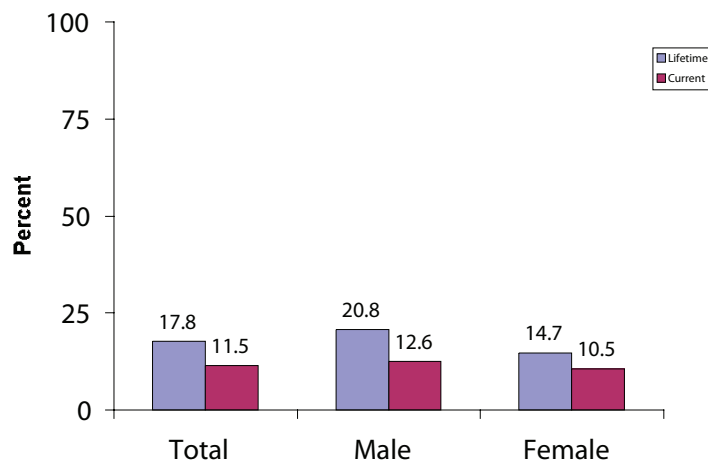
³ The 2005 N.C. CHAMP asked "Has a doctor ever told you that (your child) has asthma?" for the lifetime asthma and "Does (your child) still have asthma?" for current asthma.

Data Source: National Health Interview Survey, 2001-2004, BRFSS, North Carolina, 2002, CHAMP, North Carolina 2005

Lifetime and Current Asthma

North Carolina Children

Figure 9. Prevalence of Lifetime and Current Among Children¹ (≤ 17 years), Total and by Sex, North Carolina, 2005



¹ Question regarding children who currently have asthma asked only of respondents who reported children with asthma living in the same household.
Data Source: CHAMP, North Carolina, 2005

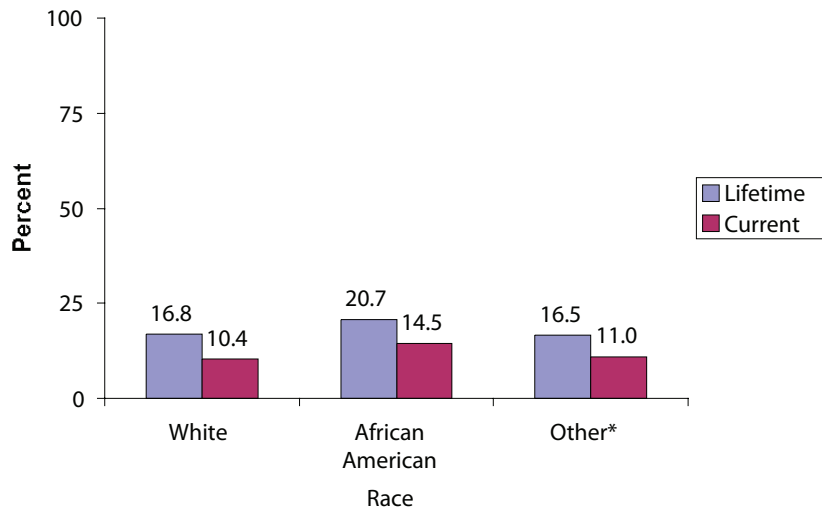


Summary of Figure 9:

- Among North Carolina children, males are significantly more likely to have a greater lifetime asthma prevalence (20.8%) than females (14.7%).
- Among North Carolina children, males tend to have a higher prevalence of asthma than females, which is a reversal of the pattern for adults, where females have the higher prevalence of asthma.^{9,12}
- No significant gender difference was seen in North Carolina’s 2005 child current asthma prevalence.

Both lifetime and current asthma prevalence for North Carolina’s children are higher than the national lifetime and current asthma prevalence.¹⁴

Figure 10. Prevalence of Lifetime and Current Asthma Among Children (≤ 17 years), by Race, North Carolina, 2005



*Based on numerator less than 50, interpret with caution
Data Source: CHAMP, North Carolina, 2005

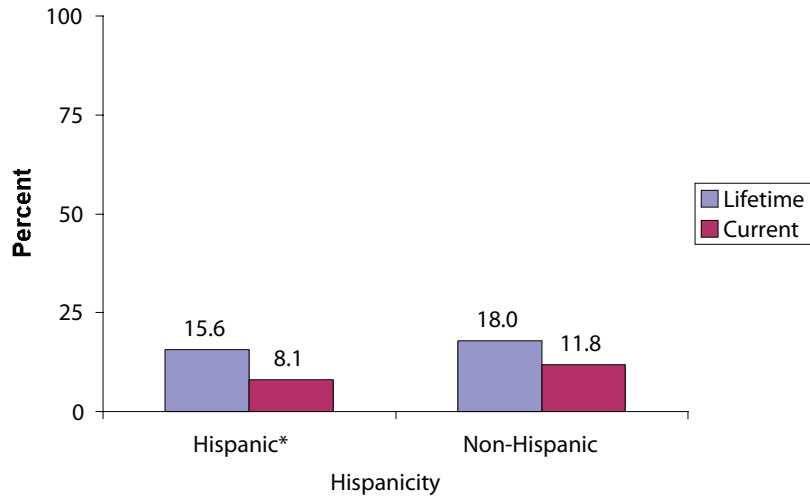
Summary of Figure 10:

- Although data suggest that African American children in North Carolina have a higher prevalence of lifetime asthma (20.7%) and current asthma (14.5%) than white children (lifetime asthma = 16.8%, current asthma = 10.4%), the difference is not significant.



White, African American, and children of other races in North Carolina have a higher prevalence of lifetime and current asthma than the national prevalence.¹⁴

Figure 11. Prevalence of Lifetime and Current Asthma Among Children (≤ 17 years), by Hispanicity, North Carolina, 2005



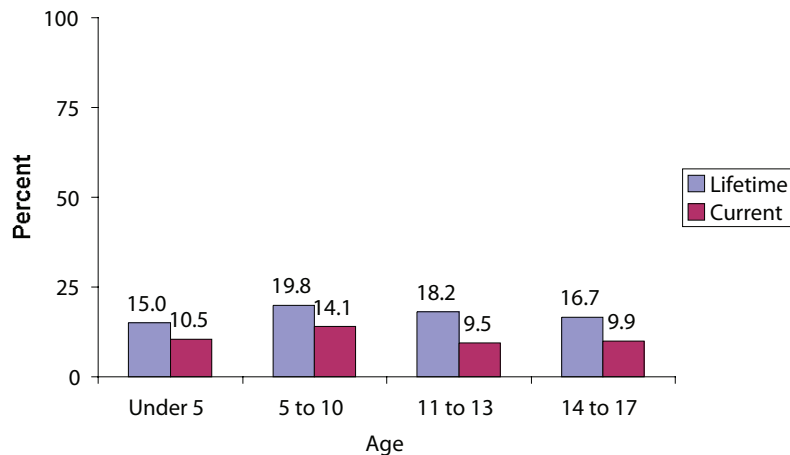
*Based on numerator less than 50, interpret with caution.
Data Source: CHAMP, North Carolina, 2005

Summary of Figure 11:

- There are no significant differences in lifetime asthma prevalence and current asthma prevalence for Hispanic children as compared to Non-Hispanic children in North Carolina.

Lifetime asthma prevalence and current asthma prevalence for both Hispanic and Non-Hispanic children in North Carolina are higher than national lifetime and current asthma prevalence rates.¹⁴

Figure 12. Prevalence of Lifetime and Current Asthma Among Children (≤ 17 years), by Age, North Carolina, 2005

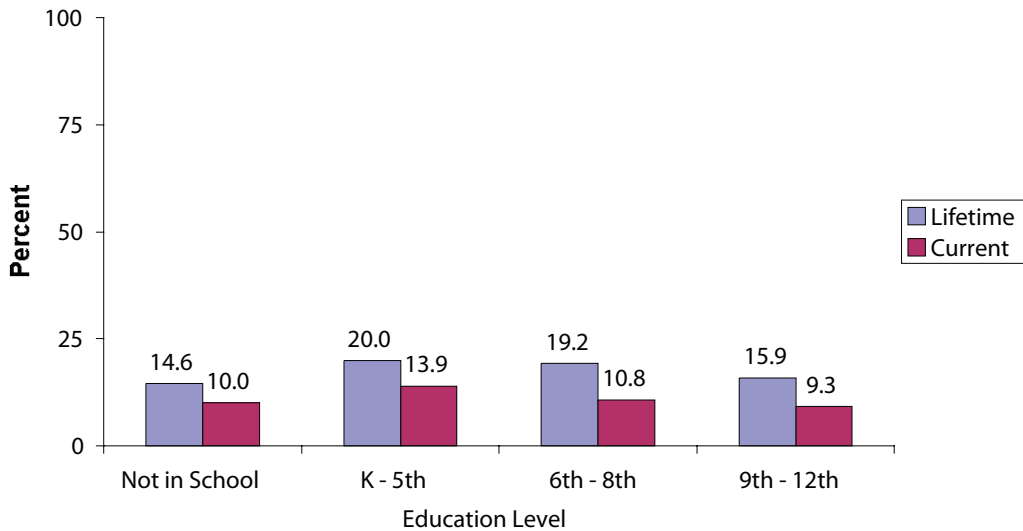


Data Source: CHAMP, North Carolina, 2005

Summary of Figure 12:

- Prevalence of lifetime asthma between the age groups shown here ranged from 15.0% to 19.8%. Current asthma prevalence ranged from 10.5% to 14.1%. However, no significant difference was seen in either lifetime or current asthma prevalence between the specified age groups among North Carolina children.

Figure 13. Prevalence of Lifetime and Current Asthma Among Children (≤ 17 years), by Education Level, North Carolina, 2005

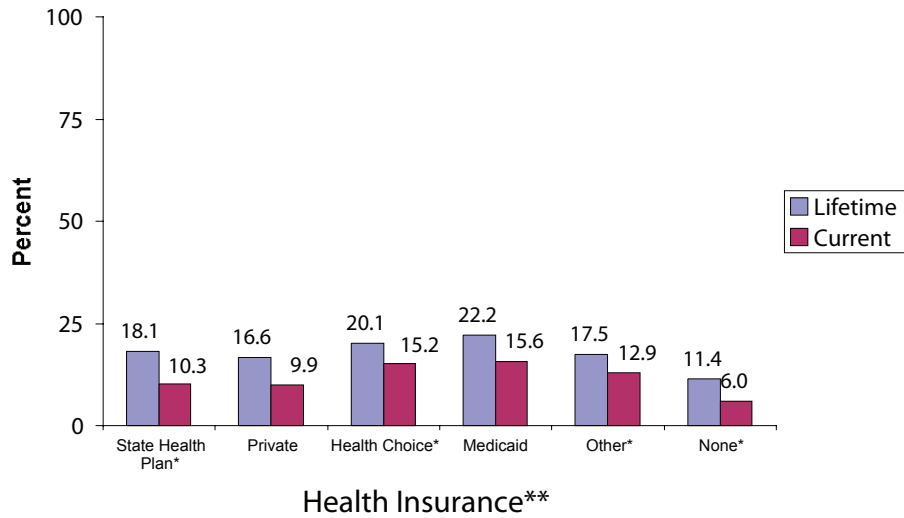


Data Source: CHAMP, North Carolina, 2005

Summary of Figure 13:

- While lifetime asthma prevalence ranged from 14.6% to 20.0% across all school grades (including those children not in school), no significant difference was seen between the grade levels.
- Current asthma prevalence across the grades ranged from 10.0% for those not in school to 13.9% for those in kindergarten through fifth grade; however, no significant difference was seen.

Figure 14. Prevalence of Lifetime and Current Asthma Among Children (≤ 17 years), by Health Insurance, North Carolina, 2005



*Based on numerator less than 50, interpret with caution.

**For and explanation on the different public insurance programs in North Carolina, please see Appendix H.

Data Source: CHAMP, North Carolina, 2005

Summary of Figure 14:

- Although not significant, the data is suggestive that lifetime asthma prevalence is higher among North Carolina children who are on Medicaid (22.2%), as compared to those who have private health insurance (16.6%).
- Children on Medicaid have a statistically significantly higher prevalence of current asthma (15.6%) than do North Carolina children who have private medical insurance (9.9%).

According to the 2004 National Health Interview Survey, children in poor families were more likely to have ever been diagnosed with asthma (14.0%) than children in families that were not poor (12.0%).¹⁴



Table 5. Lifetime and Current Asthma Prevalence Among Children (≤ 17 years), by Sex, Race, Ethnicity, Age Group, Education Level, and Health Insurance, North Carolina, 2005

Lifetime Asthma			Current Asthma		
	2005			2005	
	Rate (%)	95% CI		Rate (%)	95% CI
Total	17.8	16.4-19.4	Total	11.5	10.3-12.9
Sex			Sex		
Male	20.8	18.6-23.2	Male	12.6	10.8-14.6
Female	14.7	12.8-16.9	Female	10.5	8.8-12.4
Race			Race		
White	16.8	15.1-18.7	White	10.4	9.0-11.9
African American	20.7	17.4-24.4	African American	14.5	11.7-17.9
Other Minorities	16.5	12.4-21.5	Other Minorities	11.0*	7.7-15.4
Ethnicity			Ethnicity		
Hispanic	15.6*	10.9-21.8	Hispanic	8.1*	4.7-13.7
Non-Hispanic	18.0	16.4-19.6	Non-Hispanic	11.8	10.5-13.2
Age			Age		
Under 5	15.0	11.8-18.7	Under 5	10.5	7.9-13.9
5 to 10	19.8	17.2-22.6	5 to 10	14.1	11.8-16.7
11 to 13	18.2	15.0-21.9	11 to 13	9.5	7.2-12.5
14 to 17	16.7	14.1-19.7	14 to 17	9.9	7.8-12.4
Education Level			Education Level		
Not in School	14.6	11.6-18.2	Not in School	10.0	7.5-13.2
K – 5th	20.0	17.4-22.7	K – 5th	13.9	11.7-16.4
6th – 8th	19.2	15.9-23.0	6th – 8th	10.8	8.3-13.9
9th – 12th	15.9	13.2-18.9	9th – 12th	9.3	7.2-12.0
Health Insurance			Health Insurance		
State Health Plan	18.1*	12.9-24.9	State Health Plan	10.3*	6.3-16.2
Private	16.6	14.5-18.8	Private	9.9	8.3-11.8
Health Choice	20.1*	14.2-27.6	Health Choice	15.2*	10.0-22.5
Medicaid	22.2	18.7-26.2	Medicaid	15.6	12.6-19.2
Other	17.5	13.3-22.7	Other	12.9*	9.2-17.8
None	11.4*	7.8-16.3	None	6.0*	3.4-10.2

*Based on numerator less than 50, interpret with caution.
Data Source: CHAMP, North Carolina, 2005

Youth Risk Behavior Survey

H i g h S c h o o l

The Youth Risk Behavior Surveillance System (YRBS) monitors six categories of priority health-risk behaviors among youth and young adults. The YRBS includes a national school-based survey conducted by CDC as well as state and local school-based surveys conducted by state and local education and health agencies. The YRBS data are used to: 1) measure progress toward achieving 15 national health objectives for Healthy People 2010 and three of the 10 leading health indicators, 2) to assess trends in priority health-risk behaviors among high school students, and 3) to evaluate the impact of broad school and community interventions at the national, state, and local levels.¹⁵

In the spring of every odd-numbered year, N.C. Healthy Schools implements a statewide Youth Risk Behavior Survey. The N.C. YRBS helps assess behaviors in youth that impact their health now and in the future. Below are the results from the 2005 North Carolina YRBS (note: the data on middle school students can be found in Appendix F). In 2005, the high school YRBS collected a total of 3,874 surveys, a 64% completion rate. The 2005 middle school YRBS had a completion rate of 58%, for a total of 3,659 surveys.

The YRBS, like the N.C. BRFSS and CHAMP, includes the measures of lifetime and current asthma. Lifetime asthma is estimated with a question *“Have you have been told by a doctor or nurse that you have asthma.”* Current asthma is estimated with a question that is slightly different than the questions asked by the BRFSS and CHAMP. The YRBS asks *“Have you ever been told by a doctor or nurse that you have asthma and have asthma but have not had an episode of asthma or an asthma attack during the past 12 months or have had an asthma episode or an asthma attack during the past 12 months?”*

Table 7. Lifetime Asthma Prevalence among High School Students by Age, Grade, Race, and Sex, North Carolina and United States, YRBS¹, 2005

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
North Carolina	20.1% (17.9-22.2)	21.8% (19.0- 24.5)	18.4% (15.9- 21.0)
United States	17.1% (± 0.9)	17.3% (± 1.4)	17.0% (± 1.3)
AGE - N.C. only			
Age ≤ 15	20.3% (16.9- 23.8)	24.5% (18.7- 30.2)	16.5% (13.6- 19.5)
Age 16 or 17	20.3% (18.3- 22.2)	21.4% (18.7- 34.2)	19.2% (15.9- 22.4)
Age ≥ 18	18.4% (10.0- 26.9)	15.2% (9.0- 21.5)	22.0% (9.0- 34.9)
GRADE			
9th Grade - N.C.	20.7% (18.2- 23.3)	24.1% (18.9- 29.3)	17.2% (13.0- 21.5)
U.S.	18.5% (± 2.1)	18.3% (± 3.1)	18.7% (± 2.2)
10th Grade - N.C.	20.2% (15.7- 24.6)	24.7% (19.4- 30.0)	15.6% (11.7- 19.6)
U.S.	17.6% (± 1.9)	17.7% (± 2.3)	17.5% (± 2.7)
11th Grade - N.C.	18.9% (15.0- 22.8)	20.4% (16.8- 24.0)	17.5% (11.9- 23.2)
U.S.	16.4% (± 1.7)	18.2% (± 2.5)	14.6% (± 2.0)
12th Grade - N.C.	19.5% (13.1- 25.8)	14.6% (10.7- 18.5)	24.2% (13.3- 35.1)
U.S.	15.4% (± 1.7)	14.1% (± 2.5)	16.8% (± 2.4)
RACE/ETHNICITY			
African American - N.C.	28.1% (22.0- 34.2)	31.5% (23.0- 40.1)	25.3% (18.2- 32.4)
U.S.	18.8% (± 1.6)	20.1% (± 2.7)	17.6% (± 2.5)
Hispanic/Latino - N.C.	16.3% (11.1- 21.5)	22.3% (15.1- 29.5)	9.3% (3.9- 14.7)
U.S.	16.9% (± 2.5)	17.8% (± 3.2)	16.0% (± 3.2)
White - N.C.	16.2% (14.3- 18.0)	17.2% (14.8- 19.5)	15.1% (12.6- 17.7)
U.S.	16.4% (± 1.2)	16.1% (± 1.9)	16.8% (± 1.9)
All Other Races - N.C.	21.2% (15.0- 27.3)	*	*
Multiple Races - N.C.	25.9% (15.5- 36.2)	*	*

¹Data is weighted

*Fewer than 100 cases

Data Source: YRBS United States and North Carolina, 2005

Summary of Table 7:

- The lifetime asthma prevalence for high school males in North Carolina is significantly larger (21.8%) than the lifetime asthma prevalence for high school males nationally (17.3%).
- The lifetime asthma prevalence for high school males in grades nine and 10 was statistically significantly greater (24.1% and 24.7%) than the lifetime asthma prevalence for males in grade 12 (14.6%).
- African American high school students in North Carolina had a significantly higher lifetime asthma prevalence (28.1%) than African American high school students nationally (18.8%).
- African American students in North Carolina had a significantly higher prevalence of lifetime asthma (28.1%) than Hispanic (16.3%) or white (16.2%) high school students.
- In North Carolina, white male high school students had significantly lower lifetime asthma prevalence (17.2%) than African American males (31.5%).
- White and Hispanic female high school students in North Carolina had a significantly lower prevalence of lifetime asthma (15.1% and 9.3%) than African American females in North Carolina (25.3%).
- Hispanic female students had significantly lower lifetime asthma prevalence (9.3%) than Hispanic males (22.3%) in North Carolina.



Table 8. Current Asthma Prevalence among High School Students by Age, Grade, Race, and Sex, North Carolina and United States, YRBS¹, 2005

	Total Percent (Count)	Males Percent (Count)	Females Percent (Count)
North Carolina	16.4% (14.8- 18.0)	16.3% (13.8- 18.9)	16.6% (14.3- 18.9)
United States	14.5% (± 0.8)	14.3% (± 1.3)	14.7% (± 1.1)
AGE - N.C. only			
Age ≤ 15	17.1% 14.3- 20.0)	18.8% (14.0- 23.6)	15.7% (12.7- 18.8)
Age 16 or 17	16.2% (14.1- 18.3)	15.7% (13.4- 18.1)	16.7% (13.0- 20.4)
Age ≥ 18	14.9% (9.1- 20.7)	11.4% (6.6- 16.2)	18.7% (9.3- 28.2)
RACE/ETHNICITY			
African American – N.C.	23.2% (18.4- 27.9)	23% (14.9- 31.1)	23.4% (17.6- 29.2)
U.S.	15.3% (± 1.7)	15.6% (± 2.8)	15.0% (± 2.3)
Hispanic/Latino – N.C.	9.6% (4.5- 14.8)	13.1% (6.1- 20.2)	5.4% (0.9- 10.0)
U.S.	14.2% (± 2.2)	14.4% (± 2.8)	14.1% (± 2.8)
White – N.C.	13.8% (12- 15.5)	13.7% (11.1- 16.2)	13.8% (11.5- 16.1)
U.S.	14.2% (± 1.1)	13.7% (± 1.9)	14.8% (± 1.5)
All Other Races – N.C.	12% (5.0- 19.1)	*	*
Multiple Races - N.C.	18.4% (10.3,-26.5)	*	*

¹ Data is weighted

*Fewer than 100 cases

Data Source: YRBS United States and North Carolina, 2005



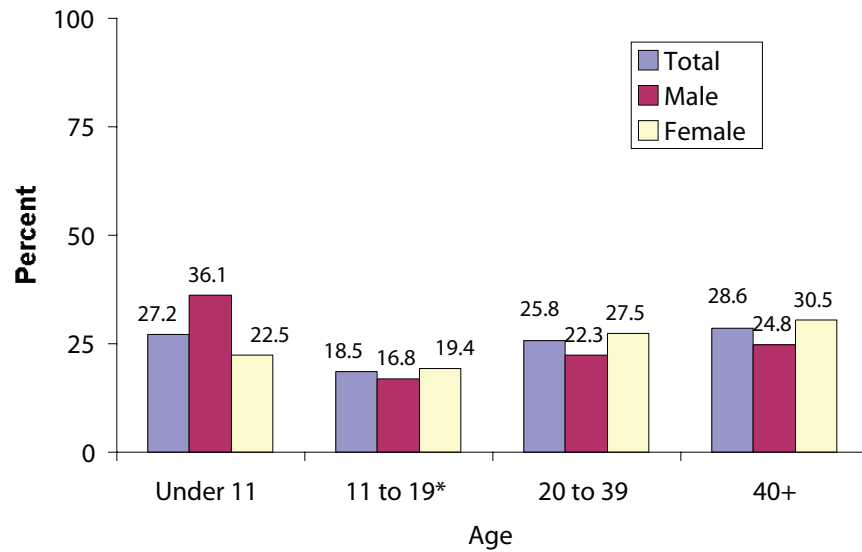
Summary of Table 8:

- African American high school students in North Carolina had a higher prevalence of current asthma (23.2%) than African American high school students nationally (15.3%).
- White and Hispanic high school students in North Carolina had a significantly lower current asthma prevalence (13.8% and 9.6%) than African American high school students (23.2%).
- African American female students in North Carolina had a higher current asthma prevalence (23.4%) than female African American students nationally (15%).
- Hispanic female students had significantly lower current asthma prevalence (5.4%) than both white (13.8%) and African American female students (23.4%); white female students had significantly lower current asthma prevalence than African American females.
- Grade breakdowns for current asthma prevalence among high school students showed no differences among the groups and therefore were omitted from this table.

Age At Diagnosis of Asthma

While many people are diagnosed with asthma in childhood, it can develop and manifest at anytime in the life of a person. Individuals who develop asthma as adults are said to have adult onset asthma, which can occur in a variety of situations. It is currently unknown what causes asthma, including adult onset asthma. Allergens may play an important role, as well as heredity. In women, hormonal fluctuations and changes may play a role. Data from Harvard's ongoing Nurses Health Study found that postmenopausal women who took estrogen as hormone replacement for 10 years or longer were more likely to develop asthma than were women who never used estrogen. Occupational exposure to workplace material can cause airway inflammation and clinical signs of asthma.^{16,17}

Figure 15. Age at First Asthma Diagnosis¹, Adults (≥ 18 years), North Carolina, 2005



¹Response to the question "How old were you when you were first told by a doctor, nurse, or other health professional that you had asthma?" Question was asked only of those who reported having asthma currently.

Table 9. Age at First Asthma Diagnosis¹, Adults (≥ 18 years), North Carolina, 2005

2005	Under 11	11 to 19	20 to 39	40+
Total	27.2%	18.5%	25.8%	28.6%
(95% CI)	(23.5, 31.2)	(15.0, 22.6)	(22.4, 29.4)	(25.5, 31.9)
Male	36.1%	16.8%*	22.3%	24.8%
(95% CI)	(28.4, 44.5)	(10.6, 25.6)	(16.2, 30.0)	(19.4, 31.1)
Female	22.5%	19.4%	27.5%	30.5%
(95% CI)	(18.9, 26.7)	(15.5, 24.0)	(23.8, 31.6)	(27.0, 34.3)

*Based on numerator less than 50, interpret with caution.
Data Source: BRFSS, North Carolina, 2005

Summary of Figure 15 and Table 9:

- Overall, North Carolinians were significantly more likely to be diagnosed under age 11 (27.2%) than between the ages of 11 and 19 (18.5%). North Carolinians age 40 and older were also significantly more likely to be diagnosed with asthma (28.5%) than those between the ages of 11 and 19.
- For adults diagnosed age 40 and older, there is a significant increase in the percentage diagnosed with asthma in 2005 (28.6%) as compared with 2002 (19.8%).
- Males were significantly more likely to be diagnosed with asthma under the age of 11 (36.1%) than females (22.5%).
- The data suggest that males are more likely to be diagnosed before 11 than at any other age, with the results being significantly less for males age 11 to 19 (16.8%).
- Conversely, females were significantly more likely to be diagnosed with asthma at age 40 and older (30.5%) than at age 19 and younger (age 11 to 19 = 19.4%, under 11 = 22.5%)



Key Findings From This Chapter

Adults

- In 2005, 10.1% of adults (age ≥ 18 years) in North Carolina reported ever having been told by a health care provider that they have asthma. Of those adults in North Carolina, 6.5% of reported currently having asthma.⁵²
- Adult females in North Carolina have a 1.45^c greater odds than adult males to have lifetime asthma (ever having been diagnosed with asthma by a health care provider), and have a 1.79^d greater odds than males to have current asthma.⁵²
- North Carolina adults living in households with an income less than \$15,000 are 1.78 times as likely to have lifetime asthma and are 2.14 times as likely to have current asthma than those who live in households that make more than \$15,000 a year.⁵²

Children

- In 2005, 17.8% of children (age ≤ 17 years) in North Carolina reported ever having been told by a health care provider that they have asthma. Of those children, 11.5% report that they still currently have asthma.⁵³
- Male children in North Carolina have a 1.5^e greater odds of having lifetime asthma (ever having been diagnosed with asthma by a health care provider) as female children in N.C.⁵³
- According to the 2004 National Health Interview Survey (NHIS), the national median for lifetime asthma was 12.2% for children. For current asthma, the national median reported in the 2004 NHIS was 8.5% for children. Although 2004 data are not available for North Carolina children, the 2005 data that are available do suggest that North Carolina's childhood lifetime asthma prevalence (17.8%) and current asthma prevalence (11.5%) greatly exceed the national median.^{14,53}



^cOdds Ratio (an approximation of the rate ratios with rare diseases), 95% Confidence Interval (CI) 1.3-1.6

^dOdds Ratio, 95% CI 1.6-2.1

^eOdds Ratio, 95% CI 1.3-1.8

Chapter 2:
*Asthma Management
and Quality of Life*



Asthma Management and Quality of Life

The goal of effective management of asthma is to allow children and adults with asthma to function with minimal restrictions and enjoy a good quality of life throughout their lives. There are several ways to monitor and support management and self-management of asthma. These include: determining the frequency of episodes of the asthma over time, staging the condition according to daytime and nighttime symptoms and lung function, reporting about quality of health, life and activity limitations from persons and their families, use of school and child care action plans to assist children and students with asthma management, and partnering to reduce environmental triggers in the home, child care, school, work and other settings.⁵⁹

Data for the Asthma Management and Quality of Life sections were obtained from several sources, including the N.C. BRFSS, the N.C. YRBS, the N.C. CHAMP, the N.C. School Health Education Profile: Principal's Survey, and the National Survey on Children's Health. (For more detailed information about these and other data sources used in this document, please see Appendix A.)

Symptoms and Severity Of Asthma

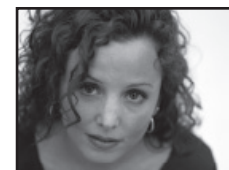
The severity of asthma can vary in individuals greatly. The National Heart, Lung, and Blood Institute released the National Asthma Education and Prevention Program Guidelines for the Diagnosis and Management of Asthma in 1997, with an update in 2002 (table 10). These guidelines provide a stepwise approach for managing asthma based on frequency of symptoms and lung function. By determining the severity of a person's asthma and using the stepwise approach for management, the ultimate goal of asthma control will be achieved. Asthma control includes: minimal or no chronic symptoms day or night/ minimal or no exacerbations; no limitations on activities (no school/work missed); maintenance of (near) normal pulmonary function; minimal use of short-acting inhaled beta₂-agonist; and minimal or no adverse effects from medications. Below is the stepwise approach for managing asthma for adults and children older than 5 years of age.¹⁸

Table 10. Stepwise Approach for Managing Asthma in Adults and Children Older Than 5 Years of Age¹⁶

Classify Severity: Clinical Features Before Treatment or Adequate Control			Medications Required to Maintain Long-Term Control
	Symptoms Day/ Symptoms Night	PEF or FEV ₁ PEF Variability	Daily Medications
Step 4 Severe Persistent	Continual/ Frequent	≤ 60% > 30%	Preferred Treatment: High-dose inhaled corticosteroids and long-acting inhaled beta ₂ -agonist
Step 3 Moderate Persistent	Daily / > 1 night/week	> 60%- < 80% > 30%	Preferred Treatment: Low-to-medium dose inhaled corticosteroid and long acting inhaled beta ₂ -agonist
Step 2 Mild Persistent	> 2/week but < 1x/day / > 2 nights/month	≥ 80% 20-30%	Preferred Treatment: Low-dose inhaled corticosteroids
Step 1 Mild Intermittent	≤ 2 days/week/ ≤ 2 nights/month	≥ 80% < 20%	No daily medications needed

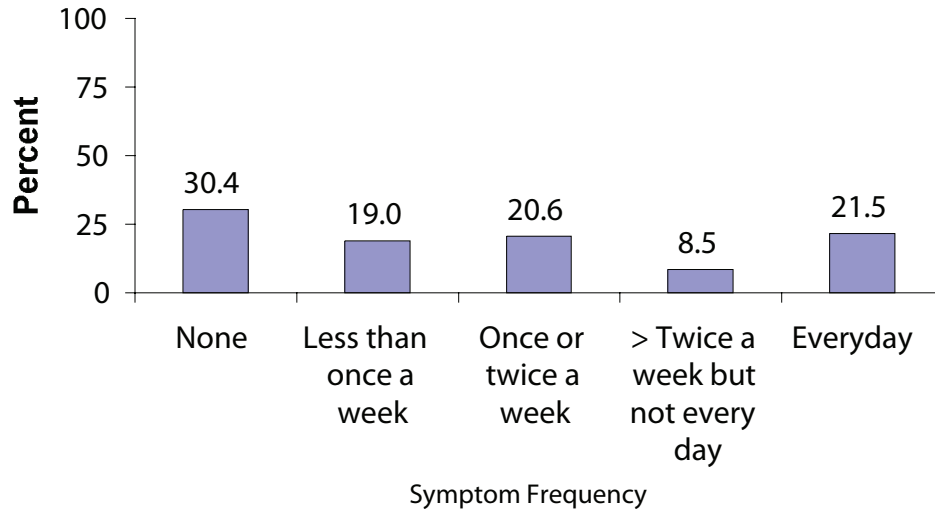
Adults

The N.C. BRFSS looks at self reported frequency of symptoms for adults with current asthma, which allows for an estimation of the severity of asthma among North Carolina adults.



Daytime Symptoms

Figure 16. How Often During the Past 30 Days Have Persons with Asthma Reported having Symptoms¹ of Asthma², Adults (≥ 18 years), North Carolina, 2005



¹Symptoms of asthma include cough, wheezing, shortness of breath, chest tightness and phlegm production when you don't have a cold or respiratory infections.

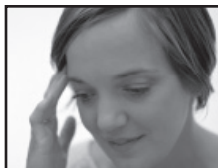
²Responses to the question "Symptoms of asthma include cough, wheezing, shortness of breath, chest tightness and phlegm production when you don't have a cold or respiratory infection. During the past 30 days, how often did you have any symptoms of asthma?" Question was asked only of those who reported having asthma currently.

	None	Less than once a week	Once or twice a week	> Twice a week but not every day	Everyday
2005 %	30.4%	19.0%	20.6%	8.5%	21.5%
(95% CI)	(26.9, 34.0)	(16.1, 22.2)	(17.3, 24.2)	(6.8, 10.7)	(18.1, 25.4)

Data Source: BRFSS, North Carolina, 2005

Summary of Figure 16:

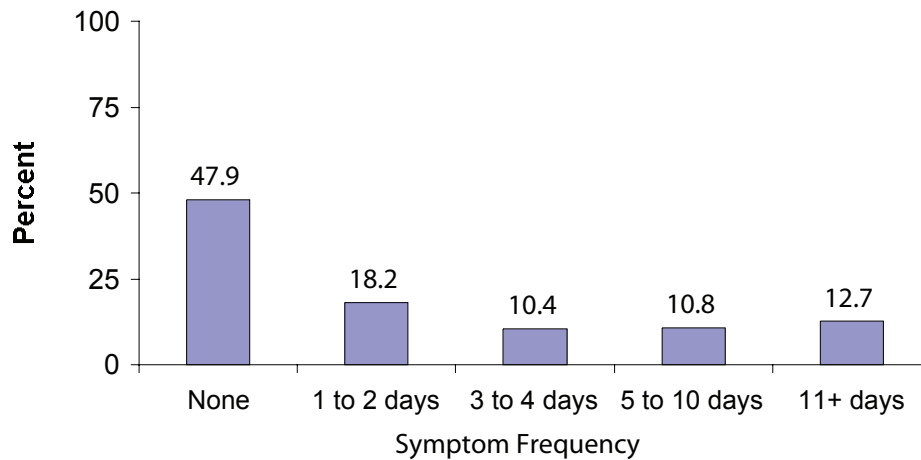
- Almost 70% of adults with current asthma reported having any symptoms of asthma in the past 30 days.
- Almost 50% of North Carolina adults with current asthma report experienced asthma symptoms at least once a week over the past 30 days.
- No significant gender or race differences were seen in the frequency of asthma symptoms over the past 30 days.



Nighttime Symptoms

When looking at the quality of life of persons with asthma, one dimension for measurement is if that person has any disturbances in sleep due to asthma. Patients with asthma have more problems initiating and maintaining sleep than healthy people do.¹⁹ Impaired quality of sleep, with disturbed sleep during the night, early morning awakenings and daytime sleepiness, are common among patients with bronchial asthma.²⁰ Sleep disturbance (nocturnal awakening) due to asthma is an indicator of both the severity of asthma, and the fact that asthma is not being properly controlled.¹⁶

Figure 17. How Many Times in the Past 30 Days Have Persons with Asthma Had Difficulty Staying Asleep Due to Their Symptoms of Asthma¹, Adults (≥ 18 years), North Carolina, 2005



¹Responses to the question "During the past 30 days, how many days did symptoms of asthma make it difficult for you to stay asleep?" Question was asked only of those who reported having asthma currently.

	None	1 to 2 days	3 to 4 days	5 to 10 days	11+ days
2005 %	47.9%	18.2%	10.4%	10.8%	12.7%
(95% CI)	(42.9, 52.8)	(14.6, 22.3)	(7.9, 13.6)	(7.9, 14.8)	(10.0, 16.1)

Data Source: BRFSS, North Carolina, 2005

Summary of Figure 17:

- Of North Carolina adults with current asthma, over half experienced symptoms of asthma which made it difficult for them to stay asleep at least one night out of the past 30 days.
- Thirty-three percent of adults with current asthma reported that asthma symptoms made it difficult for them to stay asleep more than two nights in the past month.

Asthma Attack or Episode

Asthma attack prevalence, the number of people who had at least one asthma attack 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.¹² There are triggers in the

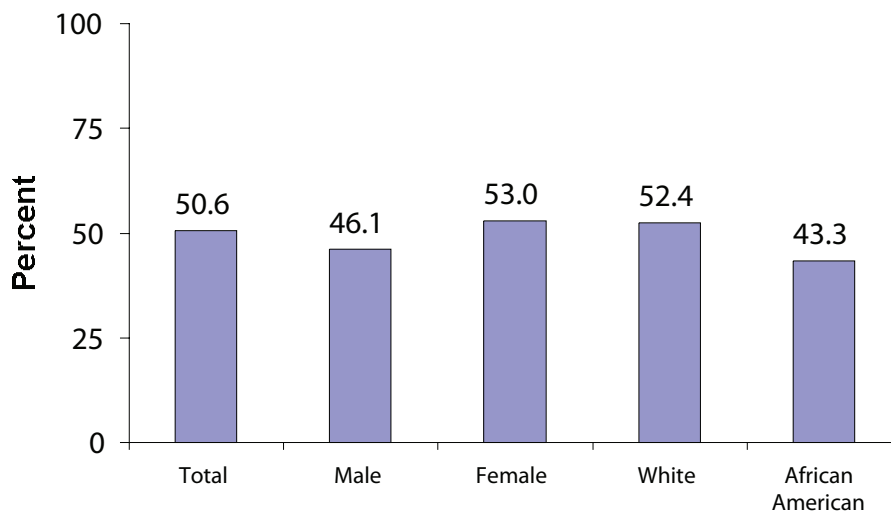
environment that can lead to asthma attacks. These triggers include allergens and irritants, which may be able to be reduced and controlled in some situations. These will be discussed later in this chapter.

Three surveys were analyzed to determine the asthma attack prevalence for North Carolinians: the N.C. BRFSS, the N.C. YRBS, and the National Survey of Children’s Health.

Adults

For adults (≥ 18 years old), the N.C. BRFSS was used. The N.C. BRFSS asked “During the past 12 months, have you had an episode or an asthma attack?” This question was only asked of those who have current asthma.

Figure 18. Persons With Asthma Who Have Had an Asthma Episode or Asthma Attack in the Past 12 Months¹, by Sex and Race, Adults (≥ 18 years), North Carolina, 2005



¹Response to the question “During the past 12 months, have you had an episode of asthma or an asthma attack?” Question was asked only of those who reported having asthma currently.

2005	Asthma Attack or Episode	
	Percent (%)	95% CI
Total	50.6	46.4-54.8
Male	46.1	37.9-54.7
Female	53.0	48.4-57.5
White	52.4	47.6-57.1
African American	43.3	33.9-53.2

Data Source: North Carolina BRFSS, 2005

Summary of Figure 18:

- Approximately half of North Carolina adults with current asthma experienced an asthma attack or episode in the past twelve months.
- There were not any significant gender or racial differences seen in the prevalence of asthma attacks.

High School Students (grades nine through 12)

The N.C. YRBS looked only at students in the grades nine through 12 and asked the question, *"Among students with current asthma, the percentage who had an episode of asthma or an asthma attack during the past 12 months."*



Table 11. High School Students With Current Asthma Who Have Had an Episode of Asthma or an Asthma Attack During the Past 12 Months, Age, Grade, Race, and Sex, North Carolina and United States, YRBS¹, 2005

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
North Carolina	31.3% (27.1-35.4)	22.6% (17.2- 28)	39.5% (32.2-46.8)
United States	37.9% (± 2.9)	30.4% (± 4.1)	45.7% (± 4.3)
AGE - N.C. only			
Age ≤ 15	31.4% (24.4-38.3)	24.4% (15.7-33)	39.5% (31.4- 47.5)
Age 16 or 17	30% (23.6-36.3)	24.1% (16.6- 31.7)	35.3% (24.1- 46.6)
Age ≥ 18	*	*	*
GRADE			
9th Grade - N.C.	28.6% (17.7- 39.6)	*	39.3% (26.9-51.7)
U.S.	38.6% (± 3.6)	32.3% (± 7.3)	44.7% (± 6.5)
10th Grade - N.C.	32.8% (25.2- 40.5)	*	*
U.S.	40.7% (± 6.5)	32.2% (± 6.4)	48.8% (± 9.3)
11th Grade - N.C.	33.5% (25.0- 41.9)	*	*
U.S.	37.4% (± 5.4)	30.7% (± 7.5)	45.6% (± 8.6)
12th Grade - N.C.	*	*	*
U.S.	34.3% (± 6.7)	23.2% (± 8.0)	43.4% (± 8.5)
RACE/ETHNICITY			
African American - N.C.	28.8% (21.3- 36.4)	*	*
U.S.	33.0% (± 5.1)	23.8% (± 8.0)	42.2% (± 7.2)
Hispanic/Latino - N.C.	*	*	*
U.S.	35.2% (± 6.5)	32.7% (± 10.0)	37.8% (± 11.3)
White - N.C.	34.2% (29.8- 38.7)	25% (16.2- 33.7)	43.7% (36-51.4)
U.S.	40.5% (± 3.8)	31.6% (± 5.3)	48.9% (± 5.9)



¹Data is weighted
 *Fewer than 100 cases
 Data Source: YRBS, North Carolina, 2005

Summary of Table 11:

- High School females with asthma in North Carolina have a significantly higher prevalence of asthma attacks (39.5%) than males (22.6%).
- While the national data points to females having a higher prevalence of asthma attacks than males in all grades, only females in grades 10 and 12 were shown to be statistically significant.
- In North Carolina, white high school females had a significantly higher prevalence of asthma attacks (43.7%) than white high school males (25%). The national data showed similar significant results between genders for white high school students, as well as African American females having a significantly higher prevalence of asthma attacks than males.

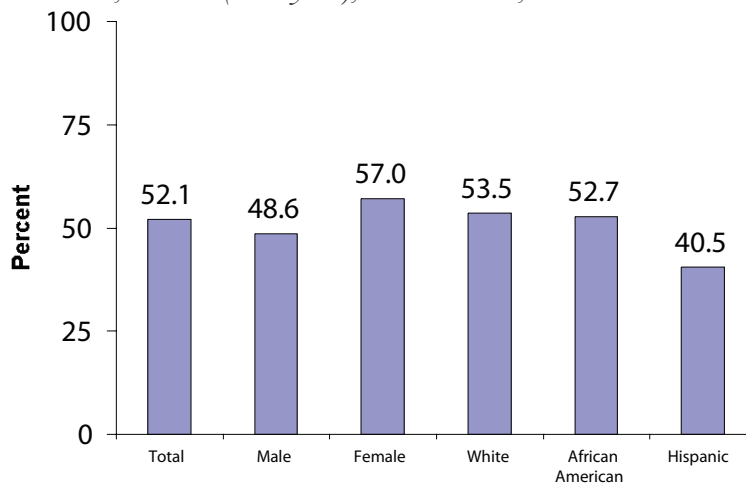
Additional data for the N.C. YRBS is available in Appendix F.

Children

The 2004 National Health Interview Survey reported that almost 4 million children in the U.S. had an asthma attack in the past 12 months. African American children were more likely than Hispanic children to have had an attack in the past 12 months. Children in fair or poor health were more than seven times as likely to have had an asthma attack in the past 12 months (29.0%) as children in excellent or very good health (4.0%).¹⁴

The National Survey of Children’s Health focused on children (≤ 17 years old). A survey was conducted throughout the United States, including North Carolina, and asked, “How many children/youth reported as ever having asthma, had an asthma attack in the last 12 months.”

Figure 19. Children With Asthma Who Have Had an Asthma Episode or Asthma Attack in the Past 12 Months¹, by Sex and Race, Children (≤ 17 years), North Carolina, 2003.



¹Response to the question “During the past 12 months, has your child had an episode of asthma or an asthma attack?” Question was asked only of those who reported having asthma currently.

Data Source: National Survey of Children’s Health, 2003

Table 12. Percent of Children (≤ 17 years) who have had an Asthma Episode or Asthma Attack in the Past 12 Months, by Sex and Race, United States and North Carolina, 2003

	Asthma Attack or Episode in the Past 12 Months	
	Percent (%)	95% CI
United States	46.4	44.8-47.9
North Carolina	52.1	44.5-59.7
Sex		
Male	48.6	38.8-58.5
Female	57.0	45.1-68.6
Race/Ethnicity		
White	53.5	43.5-63.5
African American	52.7*	38.7-66.8
Hispanic	40.5	18.7-62.4

*Use caution in interpreting cell sizes less than 50.
Data Source: National Survey of Children’s Health, 2003

Summary of Figure 19 and Table 12:

- Fifty-two percent of North Carolina children with asthma had an asthma attack in the past 12 months. This is higher than the national data.
- No significant gender or racial differences were found in this data.

Health Related Quality Of Life

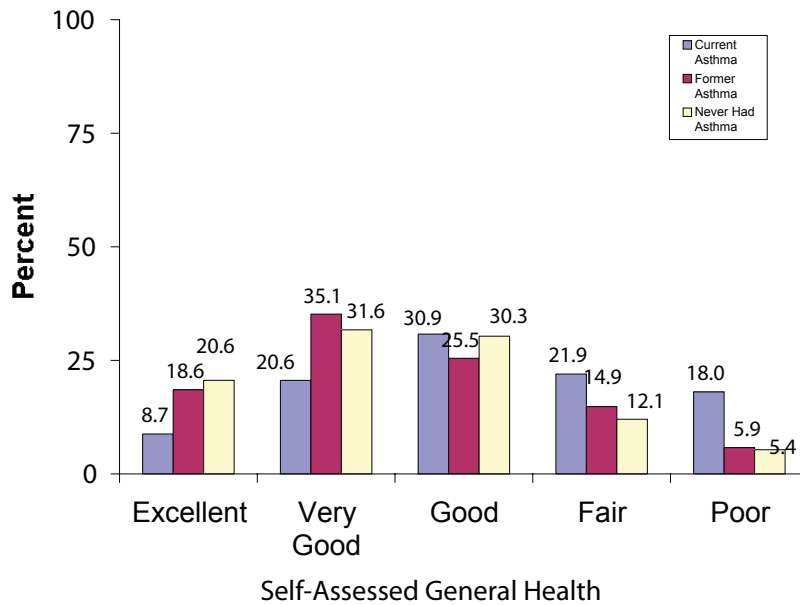
Quality of life measures are increasingly being used to supplement the more traditional measures of morbidity and mortality. Today, health status is being viewed by the public health community as a multidimensional construct. As medical and public health advances have led to better treatment and delayed mortality, it seems logical that health outcome measures would need to assess not only the saving of lives, but also the quality of lives. Quality of life conveys an overall sense of well-being, including the ability to attempt to assess aspects of happiness and satisfaction with life as a whole. Health related quality of life and its determinants have evolved to encompass those aspects of overall quality of life that can be clearly shown to affect health – both physical and mental.²¹

In the study *Self-Reported Asthma and Health Related Quality of Life* by Ford et al, the authors concluded that asthma had a major negative impact on the health related quality of life in the community and that its impact was similar to that of other chronic health conditions. It was found that persons with asthma have worse health-related quality of life than respondents who previously had asthma or those who never had asthma.²²

Adults

Health-related quality of life questions are included in the N.C. BRFSS. Participants are asked “What would you say your general health is: *Excellent, Very Good, Good, Fair, Poor?*” Figure 20 looks at the responses from adults in North Carolina with current asthma, as well as those living without it.

Figure 20. Adults (≥ 18 years) With Current Asthma and Reporting of General Health Status, North Carolina, 2004



Data Source: SCHS, BRFSS, North Carolina, 2004

Summary of Figure 20:

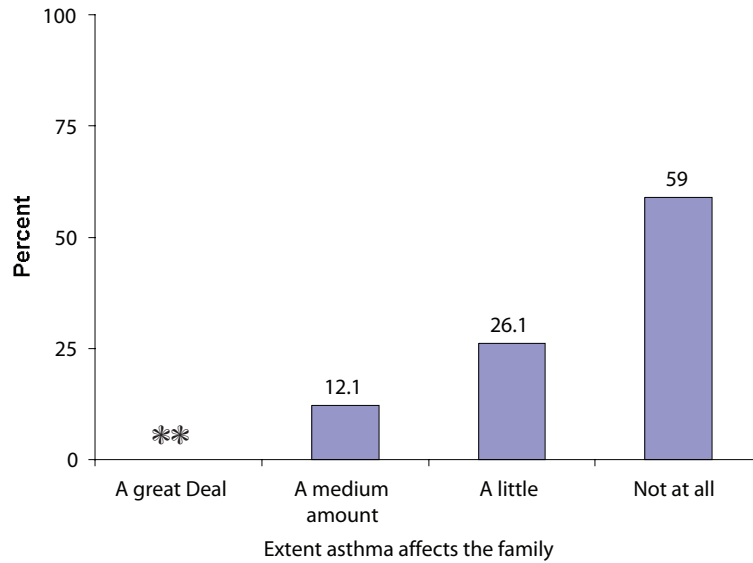
- Adults in North Carolina with current asthma reported having a worse general health status than those without current asthma.

Researchers have shown that patients with asthma have impaired quality of life.²² This is an area that North Carolina should continue to monitor and work to improve.



Children

Figure 21. Extent to Which Child's Asthma Affects the Family, North Carolina, 2003¹



¹Responses to the question "Overall, would you say your child's asthma puts a burden on your family a great deal, a medium amount, a little, or not at all?" Question was asked only of those who reported having asthma currently.

Data Source: National Survey of Children's Health, 2003

	A Great Deal	A Medium Amount	A Little	Not At All
%	**	12.1%*	26.1%*	59.0%
(95% CI)		(5.2, 19.1)	(18.4, 33.8)	(50.0, 68.0)
Count		16	49	94

*Use caution in interpreting cell sizes less than 50.

**Estimates based on sample sizes too small to meet standards for reliability or precision.

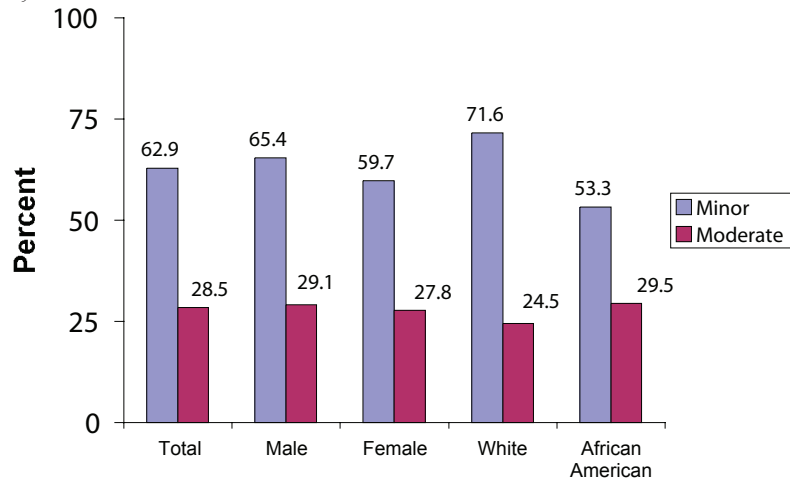
Data Source: National Survey of Children's Health, 2003

Summary of Figure 21:

- According to the National Survey of Children's Health in 2003, of the children with current asthma in North Carolina, 14.9% have asthma that presents a great or medium amount of burden on the family.³⁷



Figure 22. Level of Health Difficulties Caused by Asthma Among Children/Youth (≤ 17 years), North Carolina, 2003^{1,2}



¹Response to the question “Would you describe the health difficulties caused by your child’s asthma as minor, moderate, or severe?” Question was asked only of those who reported having asthma currently.

²Responses for the level severe were too small to meet standards of reliability or precision and thus have been omitted.

	All NC Children	Male	Female	White	African American
Minor					
%	62.9%	65.4%	59.7%*	71.6%	53.3%*
(95% CI)	(53.9, 71.8)	(54.1, 76.7)	(45.6, 73.8)	(60.3, 82.9)	(37.3, 69.3)
Count	105	60	45	64	28
Moderate					
%	28.5%	29.1%*	27.8%*	24.5%*	29.5%*
(95% CI)	(20.5, 36.5)	(18.4, 39.9)	(15.9, 39.7)	(13.9, 35.1)	(15.6, 43.4)
Count	51	28	23	22	18

* Use caution interpreting, cell size smaller than 50
 Data Source: National Survey of Children’s Health, 2003

Summary of Figure 22:

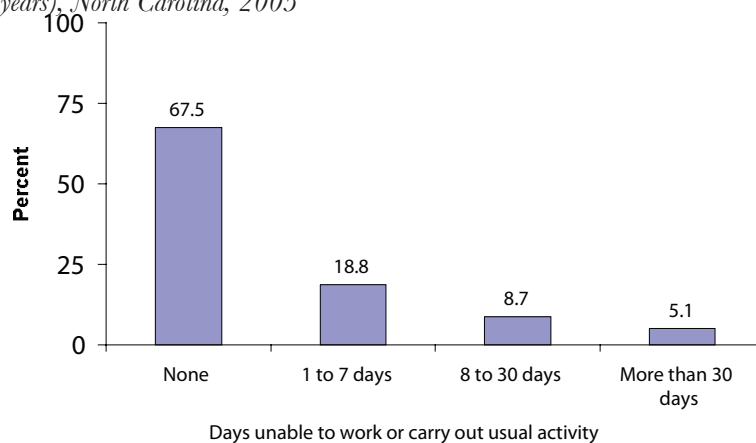
- Over one-half of parents of children with current asthma in North Carolina would describe the difficulties caused by their child’s asthma as moderate.

Missed Activity

Quality of life of persons with asthma can also be measured by looking at activity restriction and missed activity (including missed school or work days) due to asthma. Asthma interferes with daily activities, including attending school and going to work. According to the 2002 National Health Interview Survey, conducted by the National Center for Health Statistics at the CDC, adults 18 years of age and over who were currently employed missed 11.8 million work days due to asthma. Children five to 17 years of age missed 14.7 million school days due to asthma.¹²

Adults

Figure 23. Number of Days Unable to Work or Carry Out Usual Activities Because of Asthma¹, Adults (≥ 18 years), North Carolina, 2005



¹Responses 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?" Question was asked only of those who reported having asthma currently.

	None	1 to 7 days	8 to 30 days	More than 30 days
2005 %	67.5%	18.8%	8.7%	5.1%
(95% CI)	(63.5, 71.3)	(15.4, 22.7)	(6.8, 11.0)	(3.8, 6.6)

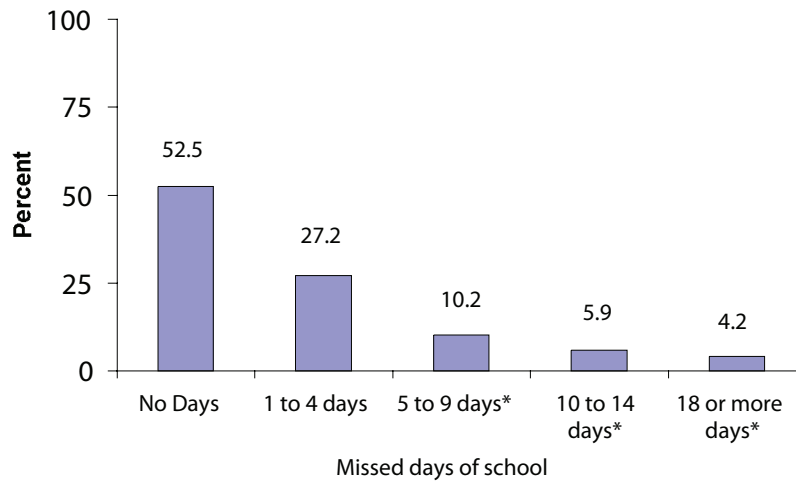
Data Source: BRFSS, North Carolina, 2005

Summary of Figure 23:

- Thirty-two percent of adults with asthma were unable to work or carry out normal activity due to their asthma at least one day during the last 12 months. Five percent were unable to work or carry out normal activities for more than 30 days.
- There were no gender or racial differences in the number of days unable to work or carry out usual activity due to asthma.

Children

Figure 24. Number of Days of Daycare or School That Children Missed Due to Asthma¹, Children (≤ 17 years), North Carolina, 2005



¹Responses to the question "During the past 12 months, how many days of daycare or school did your child miss due to asthma?" Question was asked only of those who reported having asthma currently.

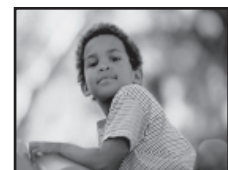
	No days	1 to 4 days	5 to 9 days	10 to 14 days	15 or more days
%	52.5	27.2	10.2*	5.9*	4.2*
95% CI	46.3-58.7	22.2-32.9	6.9-14.8	3.5-9.7	2.1-8.0

*Based on numerator less than 50, interpret with caution.
Data Source: CHAMP North Carolina, 2005

Summary of Figure 24:

- Of children with current asthma in North Carolina, 47.5% missed at least one day of school due to their asthma in the last year. Thirty-seven percent of children with asthma missed between one and nine days of school in the past 12 months due to their asthma, and 10% of children with asthma missed 10 or more days due to their asthma.
- No significant gender differences were seen in missed days of daycare or school due to asthma.

Children with asthma are 37 times as likely to miss school as children without asthma symptoms.²³

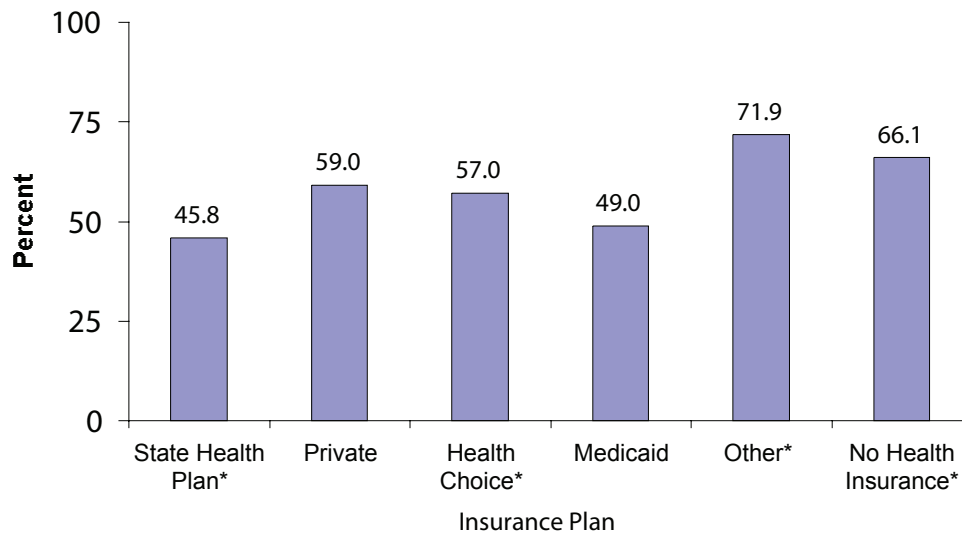


Asthma Management Activities

Asthma is a chronic disease that requires effective control and management. Each child, youth or adult with asthma will have specific medical and social needs and concerns that are important to his or her ongoing successful treatment and management. An asthma management or action plan should be developed jointly with the patient, health care provider and also with the family.²⁴ An asthma management plan guides the child and adult living with asthma to self-manage or co-manage his or her condition by using tools like medication and spirometry at home, child care, school, and work.

This plan should be used as part of an overall effort to educate children and adults in self-management.¹⁸ 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 health care 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 emergency plan will also include contact information for the health care provider and even for a local hospital. An asthma management plan helps the child, adult, and family with his or her health care provider to establish a course of action for managing asthma. Asthma Management plans are needed for use in schools and child and adult care facilities. These plans should be provided to and used by patients, families, school staff, and other providers who care for the child or adult.²⁵

Figure 25. Children (≤ 17 years) With Current Asthma Who Have Been Given an Asthma Management Plan From Their Doctor or Other Health Professional, by Health Insurance¹, North Carolina, 2005



¹Responses to the question "Has a doctor or other health professional ever given you an asthma management plan for your child?" Question was asked only of those who reported having asthma currently.



	Total	State Health Plan	Private	Health Choice	Medicaid	Other	No Health Insurance
%	56.9%	45.8%*	59.0%	57.0%*	49.0%	71.9%*	66.1%*
95% CI	50.7-62.9	24.3-68.9	49.4-67.9	35.6-76.1	37.8-60.4	54.8-84.4	40.6-84.8

*Based on numerator less than 50, interpret with caution.
Data Source: CHAMP North Carolina, 2005

Summary of Figure 25:

- Almost 57.0% of parents (or caregivers) of children with current asthma reported that they have not received an asthma management plan from their child’s doctor or other health professional. This means that 43.0% of parents (or caregivers) have not received an asthma management plan for their child with current asthma.
- There were no differences between health insurances and children receiving asthma management plans. However, it is important to note that between 28.1% and 54.2% of children in each of these plans did not receive an asthma management plan from their doctor or other health professional.

Children in grades six through eight were significantly more likely to receive an asthma management plan from a doctor or health professional (69.4%) than children who were not in school^f (36.6%). There were no gender or racial differences in who receives an asthma management plan.

Asthma Management in Schools

In 2005, North Carolina passed the “self medication” law (statute 115C-375.2). This law states that students with asthma can carry and self-administer their asthma medication at school. (Box 1 contains portion of the law that discusses asthma medication. The full text of the law can be found in Appendix B.)

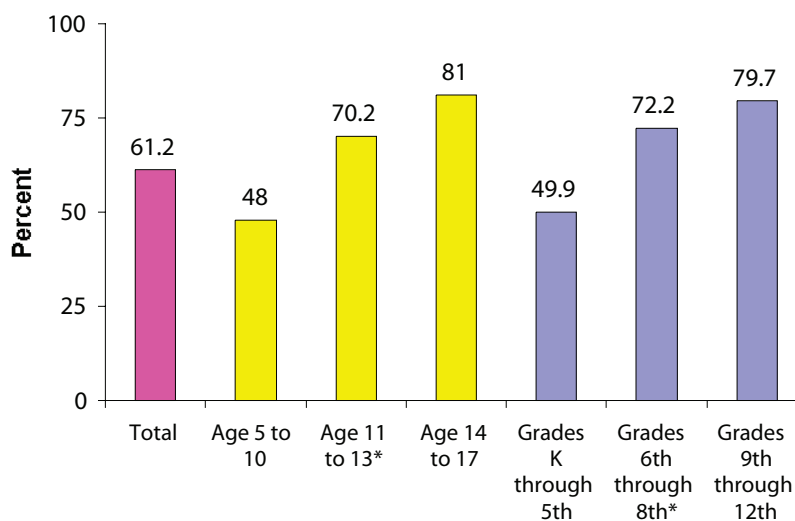
^fThe group of children “not in school” in the CHAMP survey can consist of children age 17 and younger who are drop-outs, or have already graduated. However, this group is primarily made up of children who are too young to have started school.

§ 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 events....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.

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?”

Figure 26. Percentage of Children With Current Asthma Allowed to Self-Administer Emergency Medication for Asthma at School, North Carolina, 2005



2005	Ability to Self Administer Emergency Asthma Medication	
	Percent	95% CI
Total	61.2%	54.0-46.0
Age 5 to 10	48.0%	37.8-58.3
Age 11 to 13	70.2%*	54.9-82.0
Age 14 to 17	81.0%	69.0-89.1
Grades K through 5th	49.9%	39.9-60.0
Grades 6th through 8th	72.2%*	58.3-82.8
Grades 9th through 12th	79.7%	66.2-88.7

*Based on numerator less than 50, interpret with caution.
Data Source: North Carolina CHAMP, 2005

Summary of Figure 26:

- Sixty-one percent of respondents reported that their children with current asthma had the ability to self-administer emergency asthma medication at school.
- The data suggests that older children with current asthma have more freedom to self-administer emergency asthma medication than younger children.

Asthma is the leading cause of school absenteeism. Approximately three students in a classroom of 30 will have asthma. Uncontrolled asthma can result in reduced performance for the child with asthma and disruptions for the entire classroom.³⁵ Therefore, it is important that school staff understand the issues involved with asthma and asthma management in schools. A healthy student is a student ready to learn. In the document “*Strategies for Addressing Asthma Within a Coordinated School Health Program*”, the Centers for Disease Control and Prevention outlines six strategies for schools to consider when addressing asthma:

1. Establish management and support systems for asthma-friendly schools.
2. Provide appropriate school health and mental services for student with asthma.
3. Provide asthma education and awareness programs for students and school staff.
4. Provide a safe and health school environment to reduce asthma triggers.
5. Provide safe, enjoyable physical education and activity opportunities for students with asthma.
6. Coordinate school, family, and community efforts to better manage asthma symptoms and reduce school absences among students with asthma.³⁵



While the CDC recognizes that every school will not be able to implement each strategy, schools should determine which strategies have the highest priority on the basis of the needs of the school and available resources.²⁶

North Carolina has been collecting and assessing some of the asthma-related resources and needs in the schools. The North Carolina School Health Education Profile: Principal's Survey examined 402 randomly selected middle and high schools in the state in 2002 and 2004. Of those that were sent the survey, 281 principals completed the survey, representing 158 middle schools, 111 high schools, and 12 junior/senior combined schools. This survey was designed to monitor the status of school health and physical education at the middle and high school levels.

Table 13. Asthma Management in North Carolina Secondary Public Schools, North Carolina, 2002 and 2004

	Middle School		High School		National Median *
	2002	2004	2002	2004	2004
Percent of schools that have a full-time registered nurse	12.0%	10.0%	19.0%	9.0%	36.1%
Percent of schools that identify and track all students with asthma	82.0%	90.0%	68.0%	79.0%	85.8%
Percent of schools that obtain and use an asthma action plan or individualized health plan for all students with asthma	66.0%	80.0%	53.0%	70.0%	62.2%
Percent of schools that assure immediate access to medication as prescribed by a physician and approved by parents	96.0%	95.0%	97.0%	94.0%	92.9%
Percent of schools that provide intensive case management for students with asthma who are absent 10 days or more per year	43.0%	49.0%	39.0%	38.0%	35.4%
Percent of schools that educate staff about asthma	64.0%	76.0%	46.0%	60.0%	53.7%
Percent of schools that educate students with asthma about asthma management	56.0%	75.0%	52.0%	45.0%	52.4%
Percent of schools that educate all students about asthma awareness in at least one grade	23.0%	41.0%	19.0%	28.0%	25.8%

*For all secondary schools
 Data Source: 2002/2004 North Carolina School Health Education Profile Principal's Survey, Department of Public Instruction, Grunbaum (Department of Health and Human Services School Health Profiles)⁴³

Summary of Table 13:

- From 2002 to 2004 there was a decrease in the number of full-time registered nurses in both middle and high schools. Both of these numbers fall well below the national median.
- An increase has been seen in the amount of both middle and high schools that identify and track all students with asthma.
- North Carolina middle and high schools are above the national median for percent of schools that obtain and use an asthma action plans (or individualized health plans) for all students with asthma.
- Less than half of North Carolina public schools provide intensive case management for students with asthma who are absent 10 days or more per year.
- Three-fourths of North Carolina middle schools educate both their staff and students with asthma about asthma and asthma management; however, only 60.0% of high schools educate staff, and only 45.0% educate students with asthma.

Asthma and School Physical Education Classes

Asthma is one of the top three reasons, behind physical disabilities (65.7%) and religious reasons (42.2%), for students to be exempt from physical education.²⁷ Physical fitness is important for all students, yet students with asthma often restrict their physical activities. Much of this restriction is unnecessary; children with asthma can be physically active. Today's treatments can successfully control asthma so that students can participate fully in physical activities most of the time. The National Heart, Lung and Blood Institute (NHLBI) of the National Institutes of Health (NIH), produced a manual: *Asthma and Physical Activity in the School: Making a Difference*, which denotes the steps for helping students control their asthma and still participate in school physical education classes.²⁸ For physical education students to control their asthma, they need to recognize their asthma triggers, avoid or control their triggers, and follow their asthma management plan. Physical education teachers can assist students with asthma by ensuring that the students with asthma have convenient access to their medications, and modifying physical activities to match the child's current asthma action plan as indicated by the health care team.²⁸

Table 14. Asthma Management in North Carolina Secondary Public Schools, North Carolina, 2002 and 2004

	Middle School		High School		National Median*
	2002	2004	2002	2004	2004
Percent of schools that encourage full participation in physical education and physical activity when students with asthma are doing well	94.0%	95.0%	99.0%	92.0%	96.4%
Percent of schools that provide modified physical education and physical activities as indicated by the student's asthma action plan.	87.0%	93.0%	83.0%	83.0%	84.9%

Data Source: 2002/2004 North Carolina School Health Education Profile Principal's Survey, Department of Public Instruction, Grunbaum (Department of Health and Human Services School Health Profiles)⁴³

Environmental Triggers

Asthma triggers are factors that can cause an asthma episode, or make asthma worse. Avoiding or controlling these triggers is necessary to successfully controlling a person's asthma.²⁸ Environmental asthma triggers occur in both indoor and outdoor settings.

Outdoor environmental triggers include outdoor air pollution like exhaust from cars and factories, smoke and road dust. The Air Quality Index (AQI) is a tool that offers information about whether the air quality could affect one's health. Colors are used to show how much pollution is in the air. Green and yellow indicate that air pollution levels are low, while orange, red, and purple indicate that air pollution are at points that may make asthma worse.²⁹ Other outdoor asthma triggers include cold weather and allergens, which include pollen from trees, plants, and grasses.²⁸

Indoor allergens and irritants often play a significant role in triggering asthma episodes and attacks. Indoor asthma triggers include secondhand smoke, dust mites, mold, cockroaches and other pests, household pets, and nitrogen dioxide, which is a by-product of fuel burning appliances. Each of these environmental triggers can be controlled if not completely removed from the living area of the person living with asthma.

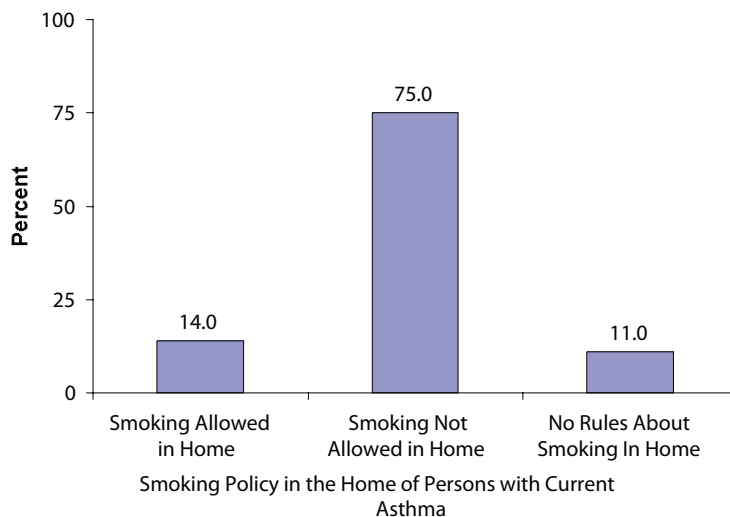
Secondhand smoke is one of the most preventable indoor environmental asthma triggers. According to the North Carolina Youth Tobacco Survey (YTS), 40.5% of middle schoolers and 42.6% of high schoolers live in homes where others smoke.^{38,39}

Secondhand smoke is exhaled smoke from smokers and the side stream smoke from the burning end of cigarettes, cigars, or pipes. Secondhand smoke is a known human carcinogen (cancer-causing agent). More than 50 compounds in secondhand smoke have been identified as known or reasonably anticipated human carcinogens. Secondhand smoke contains at least 250 chemicals that are known to be toxic or carcinogenic.⁶⁰ Secondhand smoke can trigger asthma episodes and increase the severity of attacks. This smoke is a factor related to new cases of asthma in children who have not already exhibited asthma symptoms.³²

According to the 2006 Surgeon General’s report on the Health Consequences of Involuntary Exposure to Tobacco Smoke, secondhand smoke (also referred to as environmental tobacco smoke) exposure places children at increased risk for sudden infant death syndrome, acute respiratory infections, ear problems, and more severe asthma. Smoking by parents causes respiratory symptoms and slows lung growth in their children. The Surgeon General’s report concludes that sufficient evidence exists to infer a clear causal relationship between secondhand smoke exposure from parental smoking and the onset of wheeze illnesses in early childhood. The report also states the evidence is suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure from parental smoking and the onset of childhood asthma. The Surgeon General’s report also looked at adult asthma. The evidence found was suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure and adult-onset asthma; and the evidence was suggestive but not sufficient to infer a causal relationship between secondhand smoke exposure and a worsening of asthma control.³³

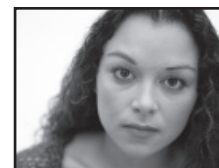
The report went on to state that there is no risk-free or minimally acceptable level of exposure to secondhand smoke. Millions of American children and adults are exposed to secondhand smoke in their homes and workplaces. Eliminating smoking in indoor spaces fully protects nonsmokers from exposure to secondhand smoke.³³

Figure 27. Secondhand Smoke Policies in the Home of Adults (≥ 18 years) with Current Asthma, North Carolina, 2004



Smoking in the Home	Persons with Current Asthma Percent (95% CI)
Smoking Allowed in Home	14.0% (11.5-16.5)
Smoking Not Allowed in Home	75.0% (71.7-78.3)
No Rules About Smoking in Home	11.0% (8.5-13.4)

Confidence Intervals rounded to nearest tenth
 Data Source: SCHS, BRFSS, North Carolina, 2005



Summary of Figure 27:

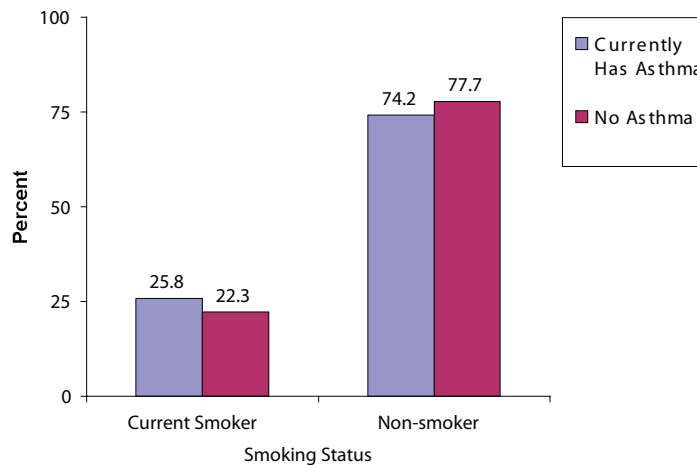
- Fourteen percent of adults with current asthma in North Carolina live in a home where smoking is explicitly allowed.

Smoking

Smoking injures almost all bodily organs, and tragically these injuries often lead to incurable diseases and death.³⁴ Nationally, nearly 21.0% of adults (44.5 million people) are current cigarette smokers.³⁶ According to the 2005 N.C. BRFSS, 22.6% of North Carolinians age 18 and older are current smokers.⁵ According to the 2004 Surgeon General’s report *The Health Consequences of Smoking*, while the evidence is inadequate to infer the presence or absence of a causal relationship between active smoking and asthma in adults, there is sufficient evidence to infer a causal relationship between active smoking and poor asthma control.³⁴

The 2005 N.C. BRFSS shows that adults with asthma in North Carolina are as likely to report that they are current smokers as adults without asthma.

Figure 28. Asthma Status of North Carolina Adults (≥ 18 years) Who Smoke, North Carolina, 2005



Asthma Status	Smoking Status	Percent (95% CI)
Current Asthma	Current Smoker	25.8% (22.2- 29.3)
	Non-Smoker	74.2% (70.7- 77.8)
Does Not Have Current Asthma	Current Smoker	22.3% (21.4- 23.2)
	Non-Smoker	77.7% (76.8- 78.6)

Confidence intervals rounded to nearest tenth
 Data Source: SCHS, BRFSS, North Carolina, 2005

While children aged 17 and younger comprise a smaller percentage of current smokers than adults, smoking is still an issue in this age group. According to the 2005 YTS, 5.8% of middle school students and 20.3% of high school students are current smokers.^{38,39} In the N.C. School Asthma Survey conducted in 1999-2000, approximately 16% of the 7th and 8th graders surveyed reported smoking regularly (or current smokers) (at least one cigarette a day for the last 30 days). Children who smoked were more likely to have asthma and wheezing than those who did not smoke.¹³

Key Findings From This Chapter

- Almost 50% of North Carolina adults with current asthma reported experiencing asthma symptoms a minimum of once a week over the past 30 days. Approximately 20% of those who reported having symptoms a minimum of once a week, reported experiencing asthma symptoms every day during those 30 days.⁵²

Asthma Attack or Episode

- Approximately 50% of North Carolinian adults with current asthma experienced an asthma attack or episode in the past 12 months.
- High school females in North Carolina have a higher prevalence of asthma attacks or episodes (39.5%) than North Carolina high school males (22.6%).⁵⁴
- In 2003, half of children (age ≤ 17 years) with current asthma in North Carolina reported having had an asthma attack or episode in the previous 12 months.³⁷

Missed Activity

- Thirty-two percent of adults in North Carolina with asthma were unable to work or carry out normal activity due to their asthma at least one day during the last 12 months.⁵²
- Of children (age ≤ 17 years) with current asthma in North Carolina, almost half (47.5%) missed at least one day of school due to their asthma in the last year. Of that group, 37% of children with asthma missed between one and nine days of school in the past 12 months due to their asthma, and 10% of children with asthma missed 10 or more days due to their asthma.⁵³

Chapter 3:
Health Care Utilization

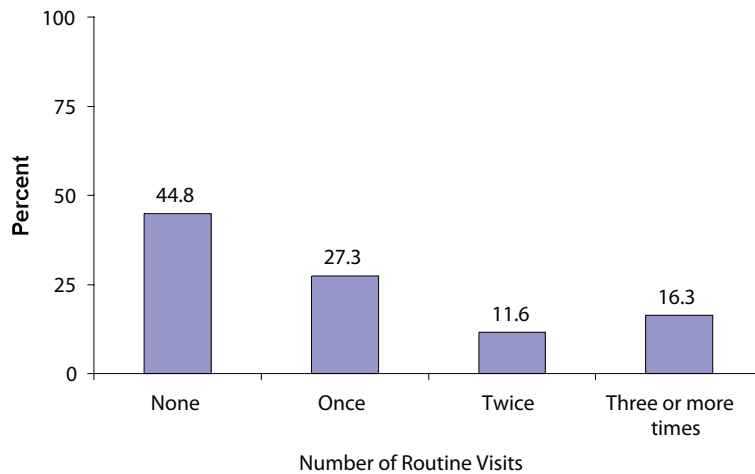


Asthma Office Visits

Routine checkups within a personal medical home with a primary health care provider are essential for effective asthma management and control. According to the National Heart, Lung, and Blood Institute’s National Asthma Education and Prevention Program Clinical Practice Guidelines, regular follow-up visits (at one to six month intervals depending on the needs of each patient over time) are essential. During each visit, clinicians need to assess whether control of asthma has been maintained, if medication needs to be changed, monitor and review action plans, and promote and support self management behaviors according to the needs of each patient.¹⁶

The 2005 N.C. BRFSS asked adults with current asthma “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 responses are detailed below.

Figure 29. How Many Times in the Past 12 Months have Persons With Asthma Seen a Health Professional for a Routine Checkup For Their Asthma¹, Adults (≥ 18 years), North Carolina, 2005



¹Responses 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?” Question was asked only of those who reported having asthma currently.

Table 15. Number of Routine Checkups for Asthma, Total and by Race, 2005

	None	Once	Twice	Three or more times
Total %	44.8%	27.3%	11.6%	16.3%
(95% CI)	(40.9, 48.8)	(23.9, 31.1)	(9.0, 14.7)	(13.8, 19.2)

Confidence intervals rounded to the nearest tenth
Data Source: BRFSS, North Carolina, 2005



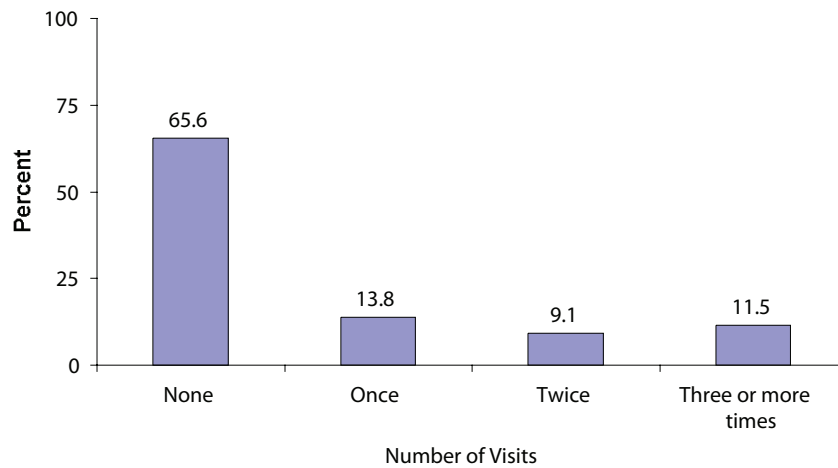
Summary of Figure 29 and Table 15:

- About 45% of North Carolina adults with current asthma have not seen a doctor or health professional for a routine checkup for their asthma in the past 12 months.

There are no significant gender differences regarding with how many times a person with asthma sees a doctor or other health professional for a routine check up of their asthma in the past 12 months.

North Carolinians with current asthma were also asked in the N.C. BRFSS whether or not they had ever visited a health professional for urgent treatment of worsening asthma symptoms.

Figure 30. How Many Times in the Past 12 Month have Persons With Asthma Visited a Health Professional (Other Than ER) For Urgent Treatment of Worsening Asthma Symptoms¹, Adults (≥ 18 years), North Carolina, 2005



¹Responses to the question "(Besides those emergency room visits) During the past 12 months, how many times did you see a doctor, nurse or other health professional for urgent treatment of worsening asthma symptoms?" Question was asked only of those who reported having asthma currently.

Table 16. Urgent Treatment for Worsening Asthma, Total and by Race, 2005

	None	Once	Twice	Three or more times
Total %	65.6%	13.8%	9.1%	11.5%
(95% CI)	(61.6, 69.4)	(11.0, 17.3)	(6.8, 11.9)	(9.3, 14.0)

Confidence intervals rounded to the nearest tenth
Data Source: BRFSS, North Carolina, 2005

Summary of Figure 30 and Table 16:

- About 35% of North Carolinians with asthma saw a doctor or other health professional at least once in the last 12 months for urgent treatment for worsening asthma symptoms.

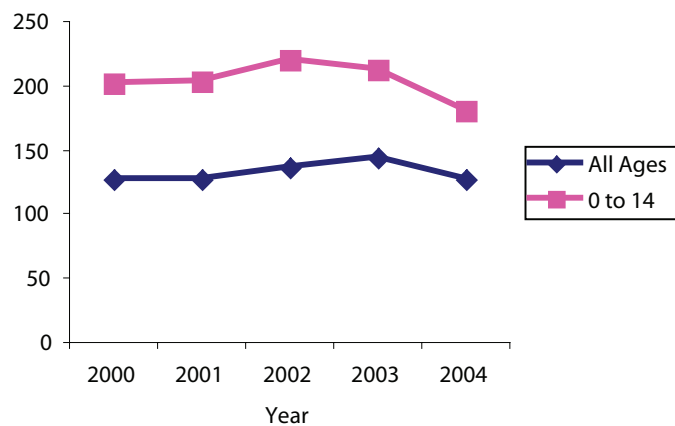
Hospitalizations

Hospitalizations due to asthma are often preventable results from uncontrolled asthma. These serious episodes of asthma are generally preventable with proper treatment and management of the disease. Therefore, hospitalizations due to asthma can be avoided with good asthma management techniques, ongoing education, and support for patients.

Inpatient hospital services represent the single largest direct medical expenditure for asthma.⁴⁰ Costs for hospitalizations due to asthma in North Carolina in 2004 exceeded \$88.5 million, according to the State Center for Health Statistics. Health policy efforts to improve the effectiveness of primary care interventions for asthma within the personal medical home may reduce costs.⁴⁰

The North Carolina Asthma Program receives hospitalization data from the State Center for Health Statistics, which receives the data from a private data processor. 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 company, Solucient, 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. 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.

Figure 31. Hospitalization^{1,2} With a Primary Cause of Asthma per 100,000 Population, All Ages and Ages 0-14, North Carolina, 2000-2004³



¹Only includes primary diagnoses of Asthma for North Carolina residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 Data are provisional.

YEAR	Total - All Ages Rate (Count)	Ages 0-14 Rate (Count)
2000	125.9 (10,180)	201.3 (3,364)
2001	127.0 (10,398)	203.0 (3,415)
2002	135.5 (11,281)	220.0 (3,755)
2003	143.2 (12,051)	211.5 (3633)
2004	125.9 (10,753)	180.2 (3121)

Data Source: North Carolina State Center for Health Statistics, 2000-2004

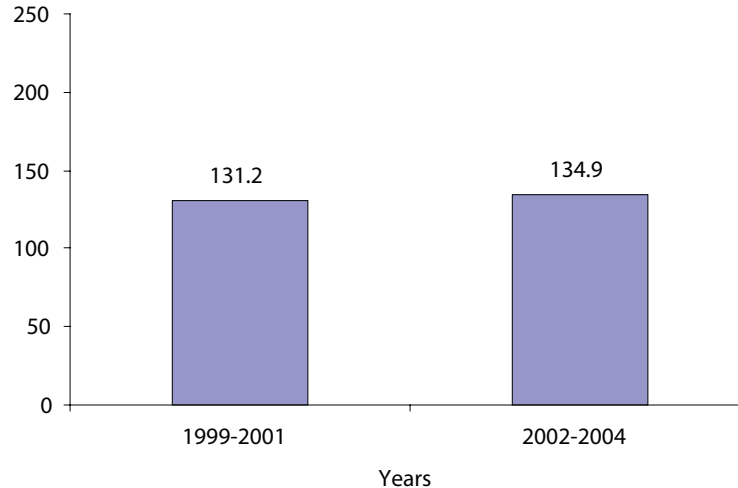
Summary of Figure 31:

- Hospitalization rates in North Carolina have remained relatively stable over the past five years.

In 2002, CDC's National Hospital Discharge Survey reported that, nationally, asthma hospitalizations (for all age groups) were at a rate 170 per 100,000.¹² North Carolina for the same year had an asthma hospitalization rate for all age groups of 135.5 per 100,000.

*Aggregate Hospitalization Rates:
1999-2001 and 2002-2004*

Figure 32. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, All Ages, North Carolina, 1999-2001 and 2002-2004³



¹Only includes primary diagnoses of Asthma for North Carolina residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 Data are provisional.

Data Source: North Carolina State Center for Health Statistics, 1999-2004



Summary of Figure 32:

- There was a statistically significant increase in the rate of asthma hospitalizations from 1999-2001 (131.2 per 100,000) to 2002-2004 (134.9 per 100,000).
- See Table 17 for additional information.

Figure 33. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by Sex, All Ages, North Carolina, 1999-2001 and 2002-2004³



¹Only includes primary diagnoses of Asthma for North Carolina residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 Data are provisional.

Data Source: North Carolina State Center for Health Statistics, 1999-2004

Summary of Figure 33:

- Females are significantly more likely to be hospitalized due to asthma than males for these periods of time.
- A significant increase is seen in the rate of asthma hospitalizations for females between 1999-2001 (161.6 per 100,000) and 2002-2004 (168.7 per 100,000).
- See Table 17 for additional information.



Figure 34a. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by Age Group, North Carolina, 1999-2001

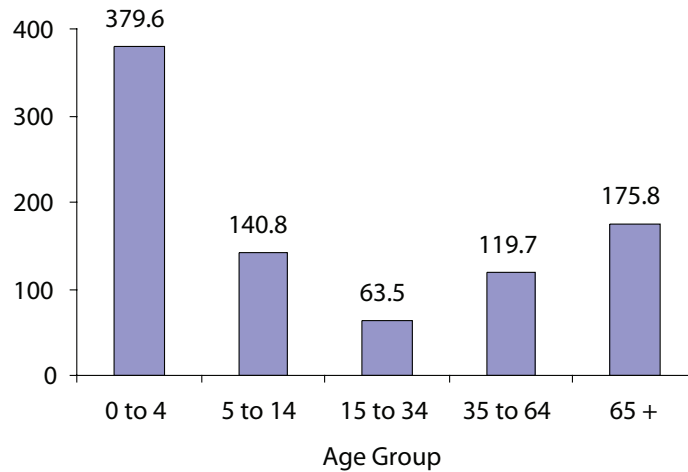
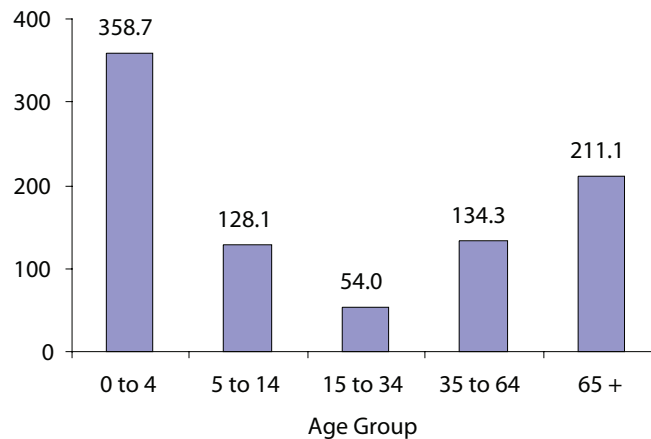


Figure 34b. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by Age Group, North Carolina, 2002-2004³



¹Only includes primary diagnoses of Asthma for North Carolina residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 Data are provisional.

Data Source: North Carolina State Center for Health Statistics, 1999-2004

Summary for Figures 34a and 34b:

- Children up to age four were significantly more likely than any other age group to be hospitalized due to a primary cause of asthma. They are followed by adults age 65 and older, who were significantly more likely than the remaining age groups to be hospitalized due to asthma.
- In the three year period of 2002-2004, significant decreases in hospitalization rates were seen in the age groups of 0-4 years, 5-14 years, and 15-34 years, over the three year period of 1999-2001. However, the opposite was noted for the age groups 35- 64 and 65 years and older. In these two age groups, the asthma hospitalization rates significantly increased in 2002-2004 over the rates in 1999-2001.

- See Table 17 for additional information.

Table 17. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by Sex and Age Group, North Carolina, 1999-2001 and 2002-2004³

	1999-2001	2002-2004
Total Rate	131.2	134.9
95% CI	(129.8-132.7)	(133.5- 136.4)
Count	31,793	34,115
Sex		
Male Rate	99.5	100.0
95% CI	(97.7-101.3)	(98.2-101.8)
Count	11,771	12,433
Female Rate	161.6	168.7
95% CI	(159.3- 163.8)	(166.5- 171.0)
Count	20,020	21,682
Age Group		
0 to 4 Rate	379.6	358.7
95% CI	(370.2-388.9)	(349.8-367.7)
Count	6,313	6,181
5 to 14 Rate	140.8	128.1
95% CI	(136.8- 144.9)	(124.4-131.9)
Count	4,683	4,400
15 to 34 Rate	63.5	54.0
95% CI	(61.6-65.3)	(52.3-55.7)
Count	4,404	3,903
35 to 64 Rate	119.7	134.3
95% CI	(117.5-122)	(132-136.6)
Count	11,170	13,270
65+ Rate	175.8	211.1
95% CI	(171-180.5)	(205.9-216.3)
Count	5,223	6,361

Confidence intervals rounded to the nearest tenth

¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals.

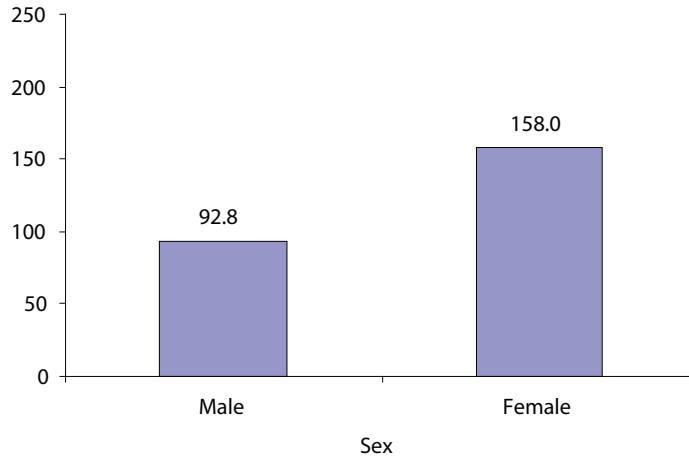
²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 data are provisional.

Data Source: North Carolina State Center for Health Statistics, 1999-2004

2004 Hospitalization Rates

Figure 35. Hospitalizations^{1,2} with a Primary Cause of Asthma per 100,000 Population, by Sex, North Carolina, 2004³



¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

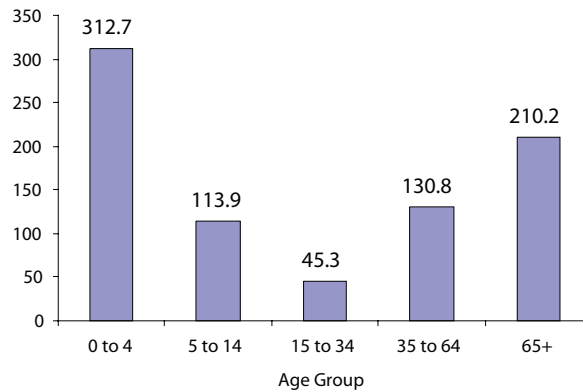
³2004 data are provisional.

Data Source: North Carolina State Center for Health Statistic, 2004

Summary of Figure 35:

- Females have higher hospitalization rates for asthma (158 per 100,000) than males (92.8 per 100,000).
- Asthma hospitalization rates for both male and females in North Carolina in 2004 fall below the 2002 national numbers from the National Hospital Discharge Survey (male-140 per 100,000, female-190 per 100,000).¹²

Figure 36. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by Age, North Carolina, 2004³



¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 data are provisional.

Data Source: North Carolina State Center for Health Statistics, 2004



Summary of Figure 36:

- The highest asthma hospitalization rates occurred in the youngest age group, 0-4 years. The rates then steadily decreased until middle age, when they began increasing again.

Table 18. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by Sex and Age Group, North Carolina, 2003-2004³

	2003	2004
Sex		
Male Rate	104.2	92.8
95% CI	(101.1- 107.3)	(89.9- 95.7)
Count	6849	3904
Female Rate	180.9	158
95% CI	(176.9-184.9)	(154.2- 161.7)
Count	7738	4313
Age Group		
0 to 4 Rate	380.7	312.7
95% CI	(364.8- 396.6)	(298.3- 327.1)
Count	2191	1807
5 to 14 Rate	126.2	113.9
95% CI	(119.6- 132.7)	(107.7- 120)
Count	1442	1314
15 to 34 Rate	58.9	45.3
95% CI	(55.8- 62)	(42.6- 48)
Count	1419	1103
35 to 64 Rate	141.4	130.8
95% CI	(137.3- 145.5)	(126.9- 134.7)
Count	4650	4392
65+ Rate	234.4	210.2
95% CI	(224.9- 243.9)	(201.2- 219.1)
Count	2349	2137

Confidence intervals rounded to the nearest tenth

¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 data are provisional.

Data Source: North Carolina State Center for Health Statistics, 2003-2004



Summary of Table 18:

- The rate of hospitalizations for both males and females decreased significantly from 2003 to 2004.
- Significant decreases in 2004 asthma hospitalization rates were seen in most age groups over the 2003 rates.

Race and Ethnicity

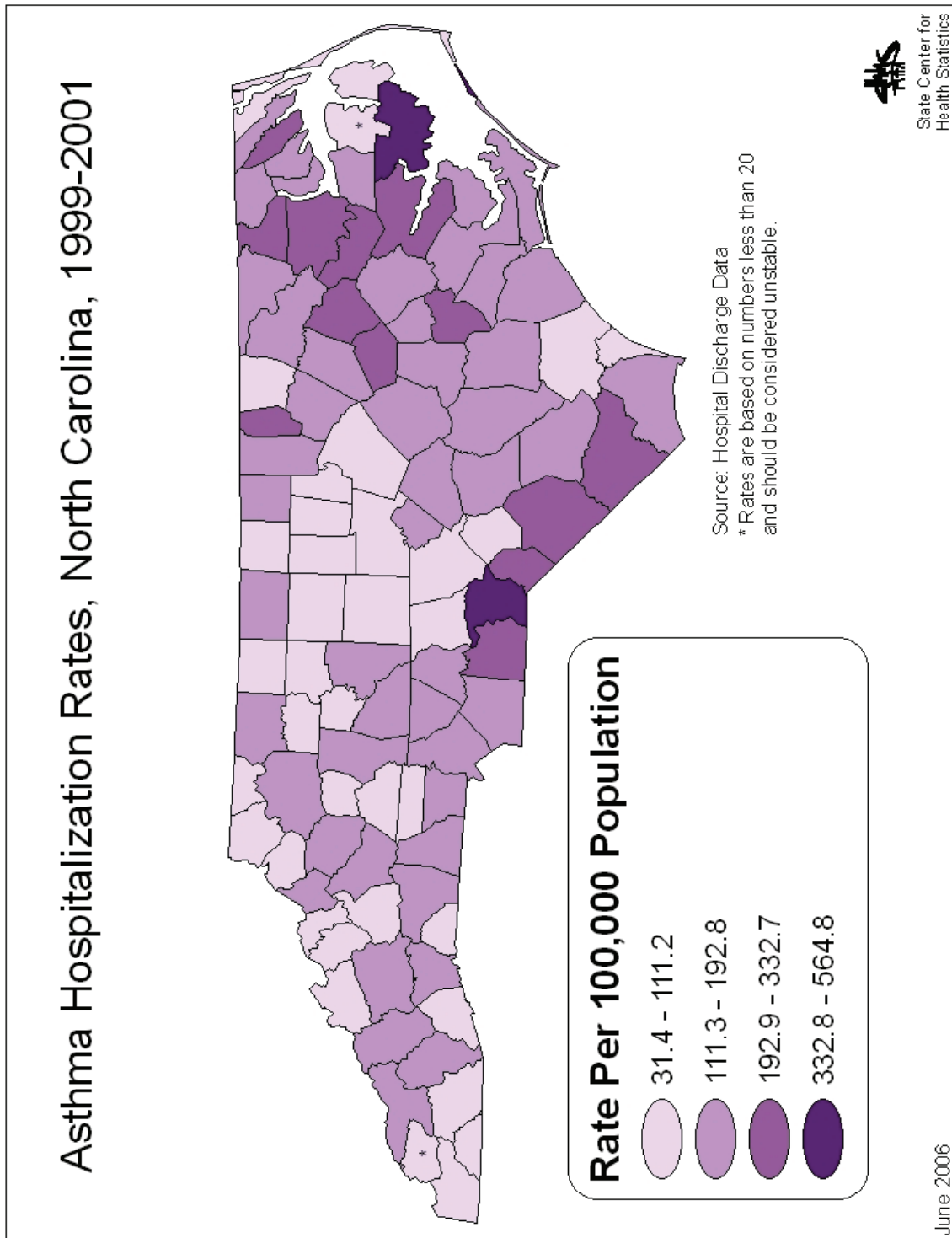
Since the reporting of race is not required for submission of the hospital discharge data to the data processor, values for race have frequently been missing. Patterns for missing race information do not seem to be random, therefore the North Carolina Hospital Discharge data are not cross tabulated by race. Additionally, the Hospital Discharge data do not have variables that reflect ethnicity, with the result that the reporting of data by ethnic origin is impossible. However, National Hospital Discharge data is available and shows large racial and ethnic disparities. Between 1980 and 1999, national asthma hospitalization rates increased significantly more among black children than among white children. In 1998-1999, the asthma hospitalization rate among black children (569 per 100,000) was 3.6 times the rate for white children (155 per 100,000).⁴¹ According to the National Hospital Discharge Survey, in 2002, the asthma hospitalization rate for all African Americans (360 per 100,000) was 225% higher than the asthma hospitalization rate for all whites (110 per 100,000).¹²

County Specific Asthma Hospitalization Data

Hospitalization data by county provides interesting and valuable information concerning the burden of asthma in different counties across North Carolina. This information can be found in Appendix D, Tables 2, 3, and 4.

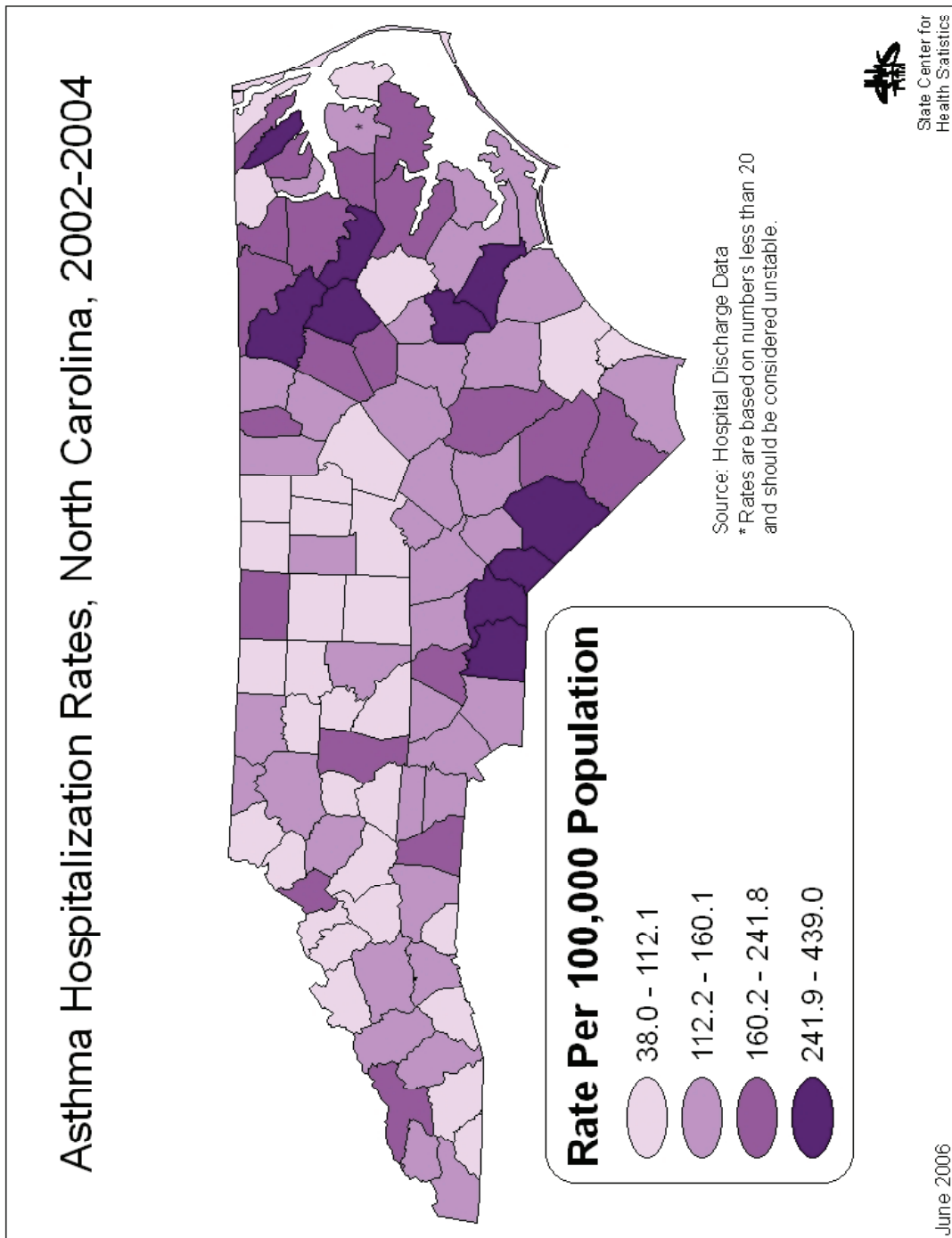
Below are two maps showing asthma hospitalization rates (per 100,000) for all North Carolinians for two time periods. Map 1 looks at total hospitalization rates for the years 1999 through 2001 and Map 2 focuses on the years 2002 through 2004.

Map 1. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by County, North Carolina, 1999-2001



¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals
²Rates may be smaller than actual asthma-related hospital use for counties that border other states

Map 2. Hospitalizations^{1,2} With a Primary Cause of Asthma per 100,000 Population, by County, North Carolina, 2002-2004³



¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals.

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 data are provisional.

Cost of Asthma

Asthma is a significant economic burden at national, state and local levels. An economic analysis commissioned by the American Lung Association estimated the 2004 annual cost for asthma increased to \$16.1 billion from the previous number of \$14 billion in 2001.^{42, 50}

The 2004 American Lung Association's national estimate examined both direct and indirect costs of asthma. Direct costs included physician visits, hospital stays, and medications. Out of the \$16.1 billion total estimate, approximately \$11.5 billion was attributed to direct costs. Prescription drugs represented the largest single direct medical expenditure, at \$5 billion.⁵⁶

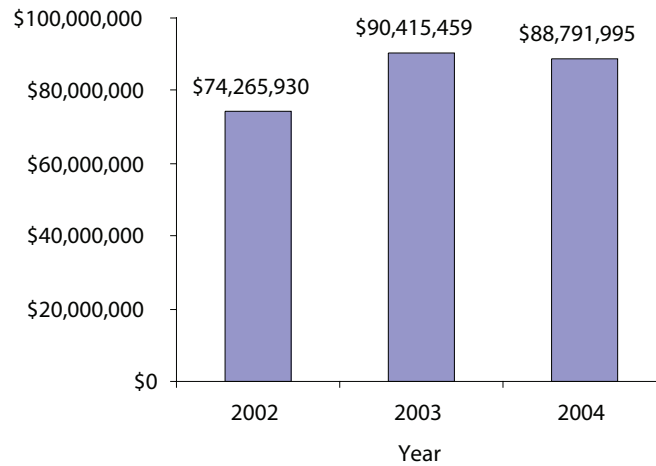
Indirect costs included but were not limited to lost work days, school absenteeism, loss of productivity, and lost earnings, all of which were approximated to result in \$4.6 billion of the total asthma cost in 2004. This number represented \$1.5 million in lost school days, and \$1.4 million in loss of work.⁴² However, the largest single indirect cost of asthma was loss of productivity due to death, which was estimated at \$1.7 billion dollars.⁵⁶

The Agency for Healthcare Research and Quality published the *Asthma Care Quality Improvement: A Resource Guide for State Action in 2006*. In this document, the economic burden of asthma (including direct and indirect costs) was estimated for each of the fifty states. For North Carolina in 2003, direct costs were estimated at over \$362 million dollars and indirect costs were estimated at more than \$269 million dollars. The total estimated asthma cost for North Carolina for 2003 exceeded \$631 million dollars.⁴²

The North Carolina State Center for Health Statistics provided information on the amount billed for hospitalization due to a primary cause of asthma for the years 2002 through 2004. Figure 36 shows the total cost of hospitalizations for a primary diagnosis of asthma for all ages in North Carolina. Figure 37 then presents the cost of hospitalization per individual stay for a primary diagnosis of asthma.



Figure 37. Total Charges for Hospitalizations for a Primary Diagnosis of Asthma^{1,2}, All Ages, North Carolina, 2002-2004³



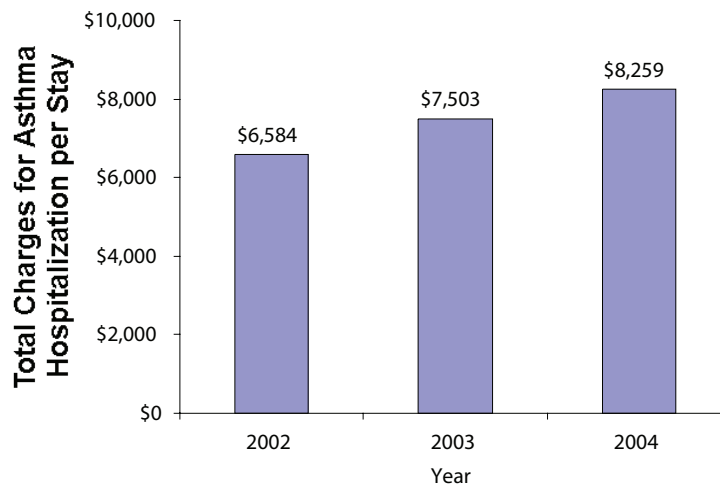
¹ICD-9 diagnostic codes 493.00 through 493.92

²Data includes only N.C. residents served in N.C. hospitals. Numbers and rates shown may be smaller than the actual hospital use for counties that border other states.

³2004 data provisional.

Data Source: North Carolina State Center for Health Statistics, 2002-2004

Figure 38. Total Charges for Asthma Hospitalizations, per Stay, for a Primary Diagnosis of Asthma^{1,2}, All Ages, North Carolina, 2002-2004³



¹ICD-9 diagnostic codes 493.00 through 493.92

²Data includes only N.C. residents served in N.C. hospitals. Numbers and rates shown may be smaller than the actual hospital use for counties that border other states.

³2004 data provisional.

Data Source: North Carolina State Center for Health Statistics, 2002-2004

Table 19. Total Charges Hospitalization For a Primary Diagnosis of Asthma, by Average Charges per Stay and Total Hospital Charges per year, 2002-2004

	Total Discharges	Avg. Length of Stay (days)	Total Hospital Charges	Average Charges per Stay
2002	11,280	3.4	\$74,265,930	\$6,584
2003	12,051	3.6	\$90,415,459	\$7,503
2004*	10,753	3.6	\$88,791,995	\$8,259

*2004 data provisional

Emergency Room Visits

Emergency room visits for asthma are often preventable. The goals of asthma therapy is to control asthma through ongoing and effective management, prevent recurrent exacerbations from asthma, and minimize the need for emergency department and more frequent visits in the medical home for urgent management and care. A visit to the emergency department is often an indication of inadequate long-term management of asthma and/or inadequate plans for management of exacerbations.¹⁶

In order to decrease the amount of emergency department visits, action plans, education, and other self-management tools need to be provided and reinforced with adults, children, and their families to help them to effectively manage asthma. Research on adults with asthma who were referred by emergency department providers to an asthma education program showed that education can decrease utilization of emergency services.¹⁶

The 2005 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 your asthma?” Although responses showed less than 25% of adults with current asthma had visited an emergency room or urgent care center for their asthma in the past year, out of those who had visited an emergency room, over half had made multiple visits in the same twelve month period.

Figure 39. How Many Times in the Past 12 Months Have Persons with Asthma Visited an Emergency Room or Urgent Care Center Because of Their Asthma, Adults (≥ 18 years), North Carolina, 2005

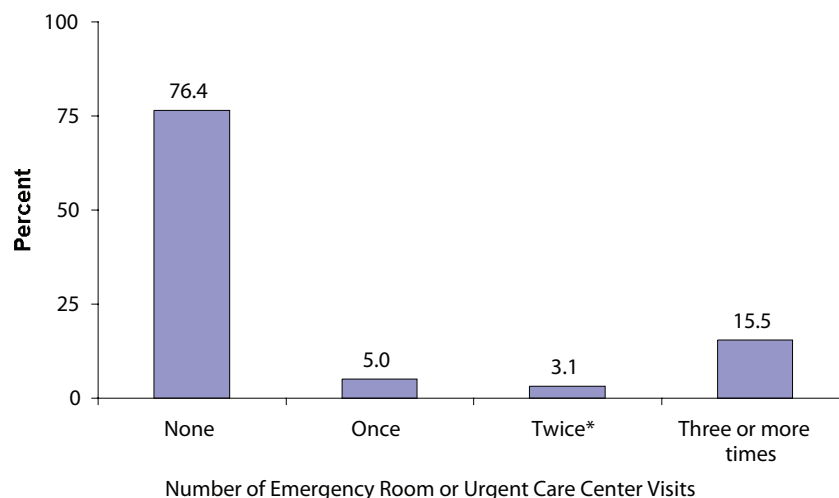


Table 20. Number of Emergency Room or Urgent Care Center Visits, Total and by Race, North Carolina, 2005

	None	Once	Twice	Three or more times
Total %	76.4%	5.0%	3.1%*	15.5%
(95% CI)	(72.7, 79.8)	(3.4, 7.3)	(1.9, 5.0)	(12.7, 18.8)

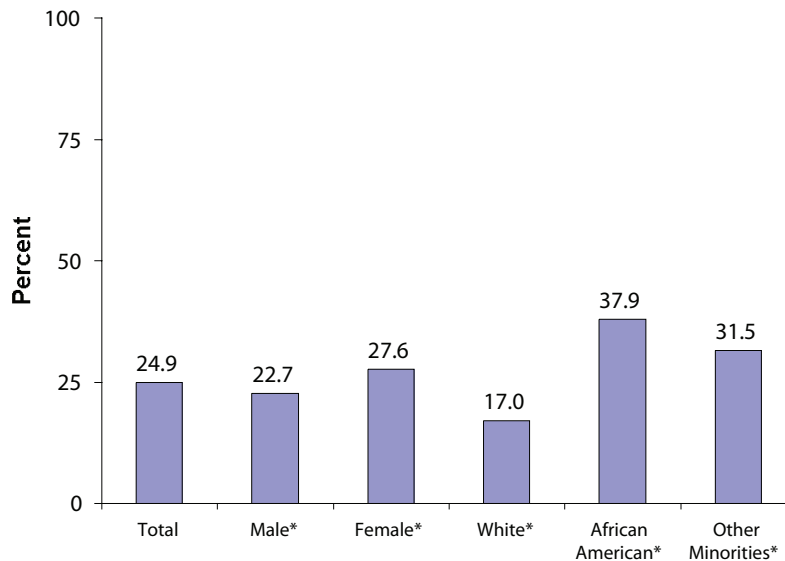
*Based on numerator less than 50, interpret with caution.
 Confidence intervals rounded to the nearest tenth
 Data Source: BRFSS, North Carolina, 2005

Summary of Figure 39 and Table 20:

- Twenty-three percent of persons with current asthma visited an emergency room or urgent care center at least once because of asthma in the past 12 months.
- Of the 24% who visited an ER or urgent care center in the past 12 months, two-thirds went three or more times. This number is significantly greater than for those who just made one or two visits to the ER or urgent care center.

The 2005 N.C. CHAMP survey asked a similar question about children age 17 and younger with current asthma, “During the past 12 months, has your child had to visit a hospital emergency room or urgent care clinic because of their asthma?”

Figure 40. During the Past 12 Months, Did Your Child Visit an Emergency Room or Urgent Care Clinic because of Their Asthma, Children (≤ 17 years), North Carolina, 2005



	Total	Male	Female	White	African American	Other Minorities
%	24.9	22.7*	27.6*	17.0*	37.9*	31.5*
95% CI	19.9-30.7	16.5-30.4	19.9-36.8	11.8-23.7	27.4-49.6	16.9-51.1

*Based on numerator less than 50, interpret with caution.
 Confidence intervals rounded to the nearest tenth
 Data Source: North Carolina CHAMP, 2005

Summary of Figure 40:

- About 25% of children with current asthma visited the hospital emergency room or urgent care clinic because of their asthma in the past 12 months.
- African American children were more than twice as likely as white children to have visited the hospital emergency room or urgent care clinic because of their asthma.

North Carolina Emergency Department Database

The North Carolina Hospital Emergency Surveillance System (NCHESS) is a statewide surveillance system that collects data from all of the 24 hour access emergency departments attached to hospitals. According to the North Carolina Emergency Department Database (NCEDD) website, data is submitted to the system every 12 hours, where it is stored. Hospital emergency department (ED) visit data offers a unique source of information for public health surveillance, research and clinical operations.⁴⁴

This system has the ability to generate reports based on several different factors, including age or gender of patient, month, day, or time of arrival, chief complaint, and final diagnosis. Asthma is among the many diseases specifically included in this system. Although no asthma emergency department data will be displayed in this document because of the limitation from the fact that all ED's are not currently on line, the NCEDD will play a key role in asthma surveillance in the near future. The state asthma program will have the ability to generate reports on ED visits for a primary diagnosis of asthma based on ICD-9 codes.

For more information on the NCEDD system, visit the website at <http://www.ncedd.org>.



Asthma Medication

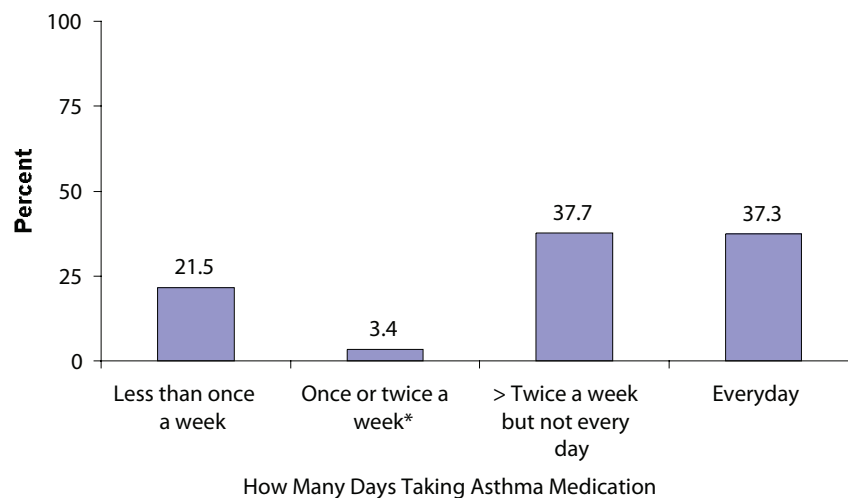
Long-Term Control Medication Usage

The goal of asthma therapy is to achieve and maintain control of asthma. Ideally, this would be accomplished by using the least amount of medications, experiencing the least amount of side effects and experiencing limited to no acute asthma episodes. The daily medications prescribed for long-term asthma control differ according to the severity of the patient's asthma (Table 10 in the Asthma Management and Quality of Life section). Asthma medications can be categorized in two general classes: long-term control medications taken on a daily basis to achieve and maintain control of persistent asthma and quick relief medications used to control acute and often urgent symptoms, which will be discussed later in this chapter.¹⁶ The following figures review daily use of long-term control medications. The following figures 41 and 42 present data on daily use of long-term control medications. According to the 2005 N.C. BRFSS, 37.3% of adults with current asthma and 52.6% of children with current asthma took their asthma medication everyday.

While these questions examine compliance of persons taking long-term asthma medication, it is important to note that persons with current asthma are not distinguished by severity. Therefore, persons with current asthma at the mild intermittent severity level who would not normally receive daily control medication would not be designated as compliant.

Adults

Figure 41. How Many Times in the Past 30 Days Have Persons With Asthma Taken Their Asthma Medication to Prevent an Asthma Attack from Occurring, Adults (≥18 years), North Carolina, 2005



	Less than once a week	Once or twice a week	> Twice a week but not every day	Everyday
%	21.5%	3.4%*	37.7%	37.3%
(95% CI)	(18.4, 25.0)	(2.1, 5.6)	(34.0, 41.7)	(33.5, 41.3)

*Based on numerator less than 50, interpret with caution.
 Confidence intervals rounded to the nearest tenth
 Data Source: North Carolina BRFSS, 2005

Summary of Figure 41:

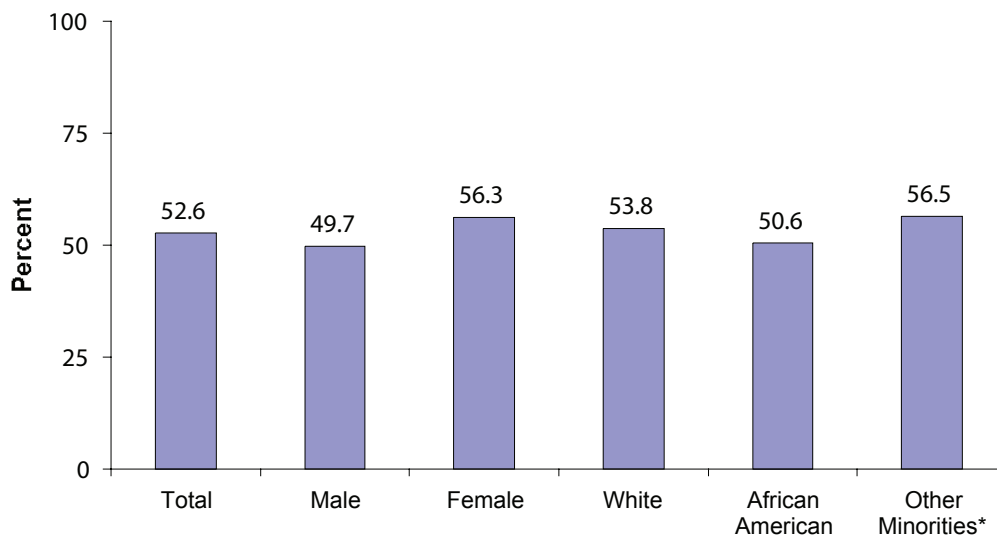
- Only 37.3% of adults with current asthma in North Carolina reported using their medication daily to manage their disease.
- These data are difficult to interpret without knowing the asthma severity or what type of medication that respondents have been prescribed. Some people who do not understand the purpose of their medications may use a medication to prevent an asthma attack which is usually not meant to be used that way.

There are no gender or racial differences noted as to how often North Carolinians with current asthma took their medication to prevent an asthma attack from occurring.

Children

Unlike the BRFSS question that asked adults with asthma how many times a week they took their long-term control medication, the 2005 N.C. CHAMP simply asked “*Is your child using a medicine everyday (such as a Beclovent, Asmacort, Pulmicort, Flovent, Advair, Singulair, or Vanceril inhaler) that was prescribed by a doctor to keep them from having asthma problems?*”

Figure 42. What Percentage of Children With Current Asthma are Using Medicine Every Day That Was Prescribed by a Doctor to Keep Them From Having Asthma Problems, Children (≤ 17 years), North Carolina, 2005



	Total	Male	Female	White	African American	Other Minorities
%	52.6	49.7	56.3	53.8	50.6	56.5*
95% CI	46.6-58.6	41.7-57.8	47.2-65.1	46.2-61.2	39.2-61.9	38.5-73.0

*Based on numerator less than 50, interpret with caution.
 Confidence intervals rounded to the nearest tenth
 Data Source: CHAMP, North Carolina, 2005

Summary of Figure 42:

- Approximately half of all children in North Carolina with current asthma use a medicine every day that was prescribed by a doctor to keep them from having asthma problems.
- There are no gender or racial differences seen among children who use everyday medication to prevent asthma symptoms.

Additional information that is not currently available, but would be helpful to investigate in the future would include if asthma action plans were being utilized by these persons with current asthma, and how asthma severity affects compliance with the medications prescribed. It would also be interesting to discern if insurance status of the child could be studied and determine if that affected asthma medication compliance.

Asthma Quick Relief Medication Usage

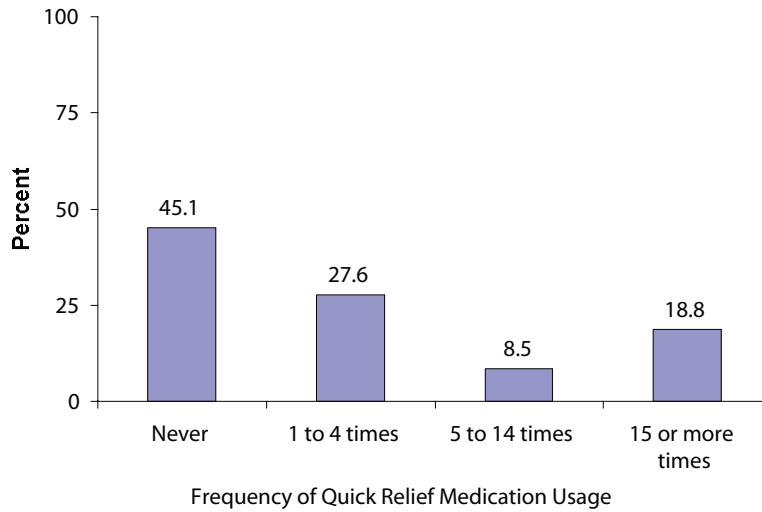
Long-term control medications are recommended only for persons with mild persistent, moderate persistent, or severe persistent asthma. Quick relief medications are recommended for all persons with asthma. Quick relief medications are used to provide prompt relief of bronchoconstriction and its accompanying acute symptoms such as cough, chest tightness, and wheezing.¹⁶

Adults

The 2005 N.C. BRFSS asked adults ages 18 and older with current asthma “During the past 30 days, how often did you use a prescription asthma inhaler during an asthma attack to stop it?”



Figure 43. How Often in the Past 30 Days Did Persons With Asthma Use a Prescription Asthma Inhaler During an Asthma Attack to Stop it, Adults (≥ 18 years), North Carolina, 2005



	Never	1 to 4 times	5 to 14 times	15 or more times
%	45.1%	27.6%	8.5%	18.8%
(95% CI)	(41.1- 49.2)	(24.0- 31.4)	(6.6-10.7)	(16.1-21.9)

Confidence intervals rounded to the nearest tenth
Data Source: BRFSS, North Carolina, 2005

Summary of Figure 43:

- Fifty-five percent of adults with current asthma have used an inhaler in the past 30 days during an asthma attack to stop it.

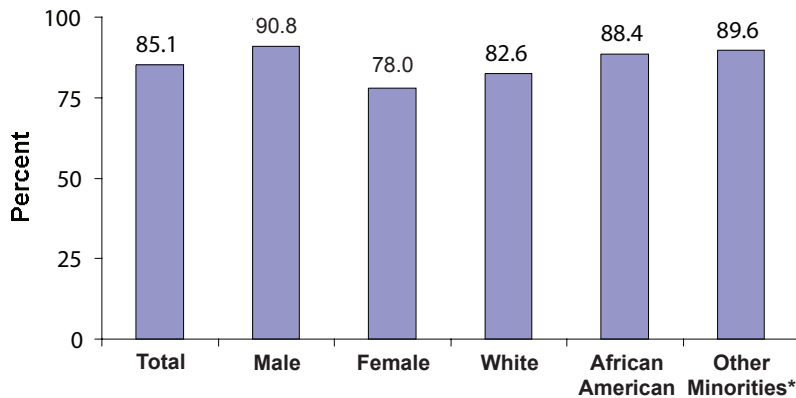
Males were more likely (53.8%) to not have used a prescription asthma inhaler in the past 30 days during an asthma attack to stop it than were females (40.7%). There were no significant racial differences in how many times in the past 30 days North Carolinians with current asthma used an inhaler during an asthma attack to stop it.

Children

The 2005 N.C. CHAMP asked “Does your child use a rescue medication such as Albuterol, Alupent, Ventolin, Proventil, Xopenex or Maxair inhaler?”



Figure 44. What Percentage of Children With Current Asthma are Using a Rescue Medication, Children (≤ 17 years), North Carolina, 2005



	Total	Male	Female	White	African American	Other Minorities
%	85.1	90.8	78.0	82.6	88.4	89.6*
95% CI	80.3-88.9	85.3-94.4	69.4-84.7	75.8-87.8	79.8-93.6	75.0-96.1

*Based on numerator less than 50, interpret with caution.
Confidence intervals rounded to the nearest tenth
Data Source: CHAMP, North Carolina, 2005

Summary of Figure 44:

- Eighty-five percent of children with current asthma used a rescue medication.
- Males were significantly more likely than females to use a rescue medication.

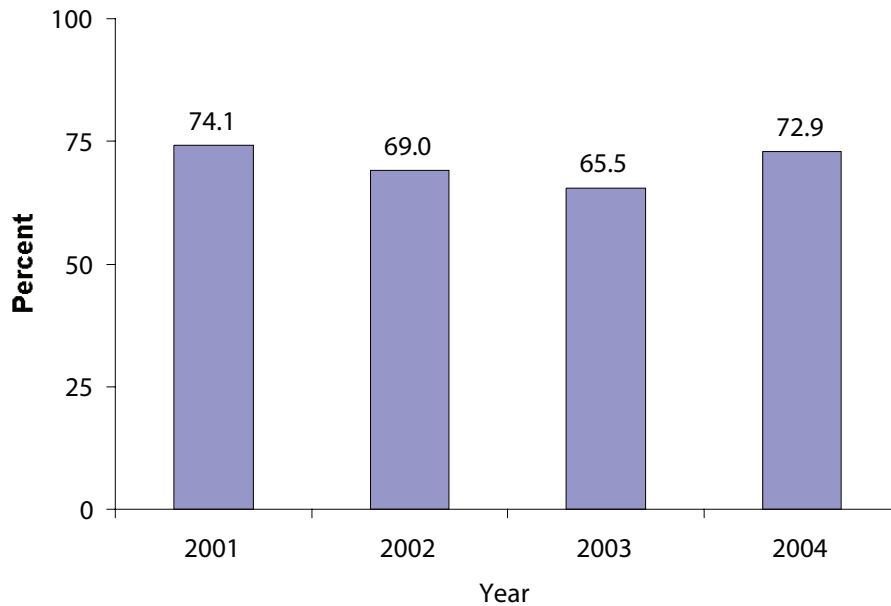
HEDIS Measures

The Health Plan Employer Data and Information Set, or HEDIS, is a set of standardized performance measures designed to ensure that purchasers and consumers have the information they need to reliably compare the performance of managed health care plans (including Medicaid). HEDIS is sponsored, supported and maintained by the National Committee for Quality Assurance (NCQA). The performance measures in HEDIS are related to many significant public health issues and include asthma.⁴⁵

The specific HEDIS measure related to asthma is the Use of Appropriate Medications for People with Asthma. This measure specifically looks at the percentage of enrolled members five to 56 years of age during the measurement year who were identified as having persistent asthma during the year prior to the measurement year and who were appropriately prescribed medication during the measurement year. This process measure evaluates whether members with persistent asthma are prescribed medications that are acceptable as primary therapy for long term asthma control.⁴⁶ (Please note that this is the description for the HEDIS measure for the study year 2004. Specifications are subject to change every year.)

Figure 45 denotes the use of appropriate medications for persons continuously enrolled in Medicaid with persistent asthma by year. The years 2002 and 2003 demonstrated decreases in the percentage of persons with persistent asthma who were on Medicaid and receiving appropriate medications; however in 2004 there was a 7.4% increase.

Figure 45. Use of Appropriate Medications¹ for Persons Continuously Enrolled in Medicaid with Persistent Asthma², North Carolina, 2001–2004



¹While there are a number of acceptable therapies for people with persistent asthma, the best available evidence indicates that inhaled corticosteroids are the preferred primary therapy.⁴⁶
²NCQA standards for “persistent asthma” within the Medicaid population defined as: 1) four or more prescription medications used in the treatment of asthma in a year, OR 2) One or more inpatient hospital visits with a primary diagnosis of asthma in a year, OR 3) One or more ED visits with a primary diagnosis of asthma in a year, OR 4) Four or more outpatient visits with asthma listed anywhere as one of the diagnosis AND two or more claims for prescription drugs used in the treatment of asthma within one year.
 Data Source: North Carolina DMA HEDIS Reports, 2002 – 2005

Key Findings From This Chapter

- About forty-five percent of North Carolina adults with current asthma have not seen a doctor or health professional for a routine checkup for their asthma in the past 12 months.⁵²
- In 2004, females in North Carolina had a significantly higher asthma hospitalization rate (158 per 100,000) than males (92.8 per 100,000).
- In 2004, the highest asthma hospitalization rates in North Carolina occurred in the youngest age group, ages 0-4 years (312.7 per 100,000). The rates then steadily decreased through middle age, and then began increasing again in the 65+ age group to an asthma hospitalization rate of 210.2 per 100,000.
- Almost a quarter (23.6%) of adults with current asthma in North Carolina visited an ER or urgent care center in the past 12 months. Of that 23.6%, two-thirds went three or more times.
- Almost 25% of children with current asthma in North Carolina visited the hospital emergency room or urgent care clinic because of their asthma in the past 12 months. In North Carolina, African American children were more than twice as likely as white children to have visited the hospital emergency room or urgent care clinic because of their asthma.⁵³
- In 2004, total charges for hospitalizations in North Carolina for a primary diagnosis of asthma exceeded \$88 million dollars. This represented an average charge of \$8,259 per asthma hospitalization stay.



Chapter 4:
Mortality



Mortality

Deaths due to asthma, while not common, are preventable and represent a breakdown in successful disease management. The national data from 2002 show that 4,261 persons died in the United States that year from a primary cause of asthma, while 110 persons in North Carolina died from a primary cause of asthma in that same year. Most recent data from North Carolina shows that in 2005, 116 persons died due to a primary cause of asthma. North Carolina mortality data was obtained from the North Carolina State Center for Health Statistics Detailed Mortality Reports that are published each year.

Since 1999, asthma deaths have been coded under the ICD-10 classification as either J45.x (Asthma) or J46.x (Status Asthmaticus). Prior to 1999, the ICD-9 classification system was in use, and asthma deaths were coded as 493.x. Following the change in the classification system, the National Center for Health Statistics (NCHS) reported a comparability ratio of 0.8938 for the coding of asthma mortality under ICD-10 as compared to ICD-9. That is, about 11% fewer deaths will be coded as indicating that asthma was the underlying cause of death compared to those deaths coded under ICD-9.⁴ Mortality rates that are seen in this document prior to 1999 have been adjusted using this comparability ratio.

Asthma as a Primary Cause of Death

Asthma mortality is examined in two ways in this chapter. In the first section, we evaluate asthma as a primary or underlying cause of death. In general terms, these are the cases where one would say asthma is the direct cause of death.

United States and North Carolina

North Carolina asthma mortality rates have been similar to national asthma mortality rates for the past 10 years.



Figure 46. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, All Ages, North Carolina and the United States, 1995 - 2005^{1,2,3,4,5}

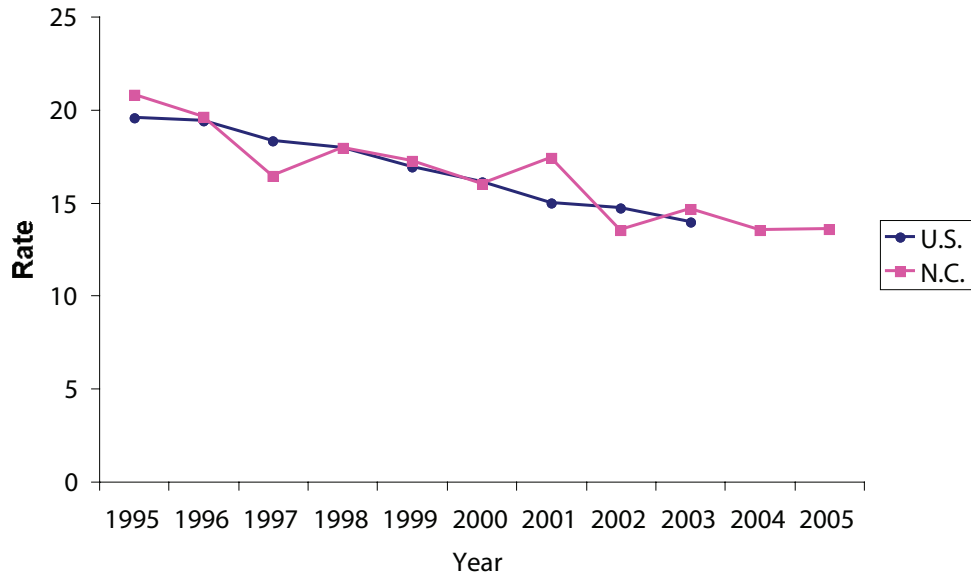


Table 21. Rates (per 1,000,000) and Counts of Deaths Due to Asthma, All Ages, United States and North Carolina, 1995-2004

YEAR	United States Rate (Count)	North Carolina Rate (Count)
1995	19.57 (5,637)	20.81 (180)
1996	19.39 (5,667)	19.59 (174)
1997	18.32 (5,434)	16.44 (150)
1998	17.97 (5,438)	17.92 (168)
1999	16.9 (4,657)	17.25 (132)
2000	16.1 (4,487)	16.01 (125)
2001	15 (4,269)	17.39 (138)
2002	14.78 (4,261)	13.53 (110)
2003	13.94 (4,099)	14.65 (122)
2004	*	13.50 (113)
2005	*	13.57 (116)

* Numbers not available

¹Rates are age adjusted to the 2000 U.S. standard population.

²National numbers obtained from CDC WONDER.

³North Carolina population estimates taken from the July 1 estimates for each year.

⁴1995-1998 deaths adjusted for the ICD-9 to ICD-10 comparability ratio.

⁵Asthma death defined as primary cause of death as asthma (ICD-9 493, ICD-10 J45-J46).

Data Source: CDC Wonder and North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1995-2004

Summary of Figure 46 and Table 21:

- Mortality rates due to asthma have been decreasing in North Carolina from 20.18 per million in 1995 to 13.57 per million in 2005. This decreasing trend is significant ($\rho=-0.864$, $p=0.001$).

North Carolina Data

The following tables 22 through 29 demonstrate mortality due to a primary cause of asthma in North Carolina.

Tables 22 and 23 examine mortality due to a primary cause of asthma for each separate year from 2000 through 2005. Table 22 looks at mortality due to a primary cause of asthma separately by age, race, and sex. (For 1999 data, see Appendix C, Table 1.)

Table 22. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Year, Age, Race, and Sex, North Carolina, 2000 – 2005^{1,2,3,4}

	2000	2001	2002	2003	2004	2005
	Rate (Count)	Rate (Count)	Rate (Count)	Rate (Count)	Rate (Count)	Rate (Count)
Age						
<5	*	*	(0)	(0)	*	*
5 to 14	*	*	*	*	4.33 (5)	6.83 (8)
15 to 34	3.42 (8)	3.39 (8)	2.51 (6)	2.90 (7)	3.69 (9)	3.66 (9)
35 to 64	7.71 (24)	14.81 (47)	12.68 (41)	13.97 (46)	10.42 (35)	12.21 (42)
65+	74.03 (72)	67.04 (66)	55.33 (55)	49.78 (50)	52.12 (53)	53.18 (55)
Race						
White	12.14 (76)	13.57 (86)	10.71 (69)	10.16 (67)	10.42 (69)	9.43 (64)
Minority	29.57 (49)	29.28 (52)	24.41 (41)	31.59 (55)	24.54 (44)	27.43 (52)
Sex						
Male	13.68 (46)	11.55 (39)	10.30 (37)	12.36 (44)	9.56 (38)	8.24 (32)
Female	17.65 (79)	22.25 (99)	15.84 (73)	16.76 (78)	15.67 (75)	17.48 (84)

*Number of deaths <5 and >0

¹North Carolina population estimates taken from the July 1 estimates for each year.

²Numbers rounded to the nearest hundredth.

³Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

⁴Minority includes African American, Asian, and American Indian and Alaskan Native.

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 2000-2004

Summary of Table 22:

- Between 1999 and 2005, mortality rates for the age group 65 and older decreased from 72.35 per million in 1999 to 53.18 per million in 2005. This decreasing trend is significant ($\rho=-0.821$, $p=0.028$).
- Mortality rates due to asthma for age groups 15 to 34 and 35 to 64 remained relatively the same over the seven years from 1999-2005.
- Mortality rates for both whites and minorities showed decreasing trends, however, the decreasing trend for whites was significant for the years 1999-2005 ($\rho=-0.857$, $p=0.019$).
- Mortality rates by gender decreased overall in the past seven years, with the decreasing trend for men being significant for the years 1999-2005 ($\rho=-0.857$, $p=0.019$).

Table 22 looks at mortality due to a primary cause of asthma by sex and race for each year from 2000 through 2005. (For 1999 data, see Appendix C, Table 2.)

Table 23. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Year, Sex, and Race, All Ages, North Carolina, 2000—2005^{1,2,3}

	2000	2001	2002	2003	2004	2005
White Males						
Rate	10.03	7.93	7.19	7.46	5.9	4.4
(95% CI)	(6.6, 14.8)	(4.7, 12.5)	(4.3, 11.2)	(4.5, 11.6)	(3.5, 9.3)	(2.3, 7.6)
Count	27	20	20	20	18	13
White Females						
Rate	13.27	18.05	13.45	12.68	13.33	12.96
(95% CI)	(9.8, 17.6)	(13.9, 23)	(9.9, 17.8)	(9.3, 16.9)	(9.9, 17.6)	(9.6, 17.08)
Count	49	66	49	47	51	51
Minority Males						
Rate	28	27.13	23.23	32.21	23.27	24.1
(95% CI)	(16, 45.5)	(15.8, 43.4)	(13.3, 37.7)	(19.9, 49.2)	(13.6, 37.3)	(13.8, 39.1)
Count	19	19	17	24	20	19
Minority Females						
Rate	31.36	32.25	24.7	31.38	24.07	30.65
(95% CI)	(21, 45)	(22.1, 45.5)	(15.8, 36.8)	(21.3, 44.5)	(15.4, 35.8)	(21.5, 42.4)
Count	30	33	24	31	24	33

Confidence Intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 U.S. standard population.

²Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

³Minority includes African American, Asian, and American Indian and Alaskan Native.

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 2000-2005

Summary of Table 23:

- Overall, white males had the lowest mortality rates, followed by white females, then minority males. Minority females had the highest mortality rates of these four groups, at more than three times the rate of white males.
- Each year from 1999 through 2005, white males had significantly lower mortality rates than both minority males and minority females.
- Mortality rates for white males from 1999-2005 showed a significant decreasing trend ($\rho=-0.929$, $p=0.006$).
- White females had significantly higher mortality rates than white males in 2001, 2004, and 2005.
- Minority males had a significantly higher mortality rate than white females in 2003.
- Minority Females had a significantly higher mortality rate than white females in 1999, 2000, 2003, and 2005.

Because mortality due to a primary cause of asthma is a relatively rare event, it is helpful to combine years of data to get an accurate look at some of the variables that might be factors in asthma related deaths. Tables 24 through 29 review asthma mortality over a six year period, from 1999 through 2005. Mortality rates were developed using the sum of the deaths for the seven years, and the sum of the North Carolina population (for that group) at the mid year point for each year.

Table 24 looks at mortality due to a primary cause of asthma by age group.

Table 24. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Age, North Carolina, 1999-2005¹

Age	Rate (Count)	95% CI
<5	2.03 (8)	0.9-4
5 to 14	3.02 (24)	1.9-4.5
15 to 34	4.37 (73)	3.4-5.5
35 to 64	14.05 (318)	12.3-15.8
65+	62.21 (433)	56.4-68.1

Confidence intervals rounded to nearest tenth

¹Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005



Summary of Table 24:

- Asthma mortality increases with age.
- The total number of deaths for those under age 65 is 423 and for those 65 and older, it is 433. The majority of deaths occur in those over age 65.

Table 25. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Sex, All Ages, North Carolina, 1999-2005

	Rate (Count)	95% CI
Male	11.15 (278)	9.8-12.5
Female	18.02 (578)	16.6-19.5

Confidence intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 U.S. standard population.

²Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 25:

- Females have a significantly higher mortality rate due to a primary cause of asthma (18.02 deaths per million) than males (11.15 deaths per million).

Table 26. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Sex and Age, North Carolina, 1999-2005¹

Sex and Age	Rate (Count)	95% CI
Male <5	*	*
Male 5 to 14	2.95 (12)	1.5-5.1
Male 15 to 34	4.18 (36)	2.9-5.8
Male 35 to 64	9.22 (102)	7.4-11
Male 65+	43.97 (124)	36.2-51.7
Female <5	*	*
Female 5 to 14	3.1 (12)	1.6-5.4
Female 15 to 34	4.57 (37)	3.2-6.3
Female 35 to 64	18.67 (216)	16.2-21.2
Female 65+	74.64 (309)	66.3-83

*Number of deaths <5 and >0

Confidence intervals rounded to nearest tenth

¹Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 26:

- The data indicates that there is no significant difference in mortality rates between males and females, until the age group of 35 to 64.
- Females have mortality rates twice that of males in the age group 35 to 64, and have a significantly larger mortality rates in the age group 65+ than males.

Table 27. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Race, All Ages, North Carolina, 1999-2005^{1,2}

	Rate (Count)	95% CI
White	11.21 (505)	10.2-12.2
African Americans	30.39 (333)	27.1-33.7
American Indian or Alaskan Native[§]	27.9 (13)*	14.5-48.9

*Less than 20 deaths are included in this rate, interpret with caution.

§Based on 1999-2004 numbers

Confidence Intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 U.S. standard population.

²Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 27:

- African Americans have a significantly higher mortality rate (30.39 deaths per million) than whites (11.21 deaths per million).
- There were a total of four deaths due to a primary cause of asthma attributed to persons identified as Asian from 1999-2005, so those numbers were omitted due to the small size.
- There were a total of 13 deaths due to a primary cause of asthma attributed to persons identified as Native American.

In the remainder of data in this section, Native Americans and Asians will be included in the minority group with African Americans.

Table 28. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Race and Age, North Carolina, 1999-2005¹

Race and Age	Rate (Count)	95% CI
White <5	*	*
White 5 to 14	1.1 (6)	0.4-2.4
White 15 to 34	2.73 (33)	1.9-3.8
White 35 to 64	8.73 (152)	7.3-10.1
White 65+	54.22 (312)	48.2-60.2
Minority [§] <5	5.12 (6)	1.9-11.1
Minority [§] 5 to 14	7.17 (18)	4.3-11.3
Minority [§] 15 to 34	8.66 (40)	6.2-11.8
Minority [§] 35 to 64	31.79 (166)	27-36.6
Minority [§] 65+	100.35 (121)	82.5-118.2

*Number of deaths <5 and >0

Confidence Intervals rounded to nearest tenth

[§]Minority includes African American, Asian, and American Indian and Alaskan Native.

¹Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 28:

- Mortality rates increase with age in all racial groups.
- Minorities have mortality rates more than three times the mortality rates than whites in each age group up to age 64. In the age group 65+, minorities have a mortality rate almost twice that of whites



Table 29. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population, by Race, Sex, and Age, North Carolina, 1999-2005¹

	Rate (Count)	95% CI
Sex and Race and Age		
White Male <5	*	*
White Male 5 to 14	*	*
White Male 15 to 34	2.52 (16)	1.4-4.1
White Male 35 to 64	4.85 (42)	3.5-6.6
White Male 65+	32.85 (73)	26-41
White Female <5	*	*
White Female 5 to 14	*	*
White Female 15 to 34	2.96 (17)	1.7-4.7
White Female 35 to 64	12.56 (110)	10.3-15.1
White Female 65+	69.23 (234)	60.6-78.7
Minority§ Male <5	*	*
Minority§ Male 5 to 14	7.08 (9)	3.2-13.4
Minority§ Male 15 to 34	8.85 (20)	5.4-13.7
Minority§ Male 35 to 64	24.9 (60)	19-32
Minority§ Male 65+	103.17 (46)	75.5-137.6
Minority§ Female <5	*	*
Minority§ Female 5 to 14	7.26 (9)	3.3-13.8
Minority§ Female 15 to 34	8.46 (20)	5.2-13.0
Minority§ Female 35 to 64	37.7 (106)	31-45.6
Minority§ Female 65+	98.6 (75)	77.6-123.7

*Number of deaths <5 and >0

Confidence Intervals rounded to nearest tenth

§Minority includes African American, Asian, and American Indian and Alaskan Native.

¹Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999-2005

Summary of Table 29:

- While the majority of the mortality rates for the age group 15 to 34 are based on less than 20 deaths, the data indicates that minority males and females have significantly higher mortality rates than both white males and white females.
- In the 35 to 64 age group, white females have a significantly higher mortality rate than white males. Minority males and females have significantly higher mortality rates than both white males and white females. Although it is not significant, data



indicates minority females have a higher mortality rate in this age group than minority males.

- For the age group 65+, white females, minority males, and minority females all have mortality rates significantly greater than white males. Although not significant, data indicates that minority males and females have higher mortality rates than white females.
- This data indicates that both racial and gender disparities exist in asthma mortality rates in North Carolina.

Asthma as a Contributory Cause of Death

When looking at cause of death, analysis of the underlying (primary) cause of death allows for simplified, consistent reporting of data and provides a means of evaluating the impact of public health initiatives. However, when more than one cause is reported on a death certificate, the tabulation of only one cause for mortality statistics may lead to a loss of information on any condition that is an element in the death but that is not selected as the underlying cause of death. Death certificates provide for the inclusion of more information than the underlying cause of death alone. The immediate cause of death, antecedent causes giving rise to the immediate cause, and other significant conditions contributing to the death also may be entered by the medical certifier. The data provides a way of estimating the impact of significant co-factors contributing to a death and offer a means of utilizing information on causes, such as hypertension, asthma, bronchitis, and diabetes, that are frequently present at death but that are usually not lethal by themselves. Each death is assigned one underlying cause and up to 19 contributing causes of death.⁴⁷

The North Carolina State Center for Health Statistics provided the information for asthma as a contributory cause of death for this report. Tables 30, 32, and 33 examine asthma as a contributory cause of death for each separate year from 2000 through 2005. Table 31 looks at asthma as a contributory cause of death for the years 1999 through 2005 combined. Similar to the previous section, asthma as a primary cause of death, the rates were developed using the sum of the deaths for the six years, and the sum of the North Carolina population (for that group) at the mid-year point for each year.

Table 30. Mortality Due to a Primary or Contributory Cause of Asthma per 1,000,000 Population, by Year, All Ages, North Carolina, 2000-2005^{1,2,3} (For 1999 data, see appendix C, table 3.)

	2000	2001	2002	2003	2004	2005
Primary						
Rate	16.01	17.39	13.54	14.65	13.50	13.57
(95% CI)	(13.2, 18.8)	(14.5, 20.0)	(10.0, 17.08)	(12.0, 17.3)	(11.0, 16.0)	(11.1, 16.0)
Count	125	138	110	122	113	116
Contributory						
Rate	23.96	24.56	21.20	25.92	21.31	24.37
(95% CI)	(20.5, 27.5)	(21.2, 28.0)	(18.0, 24.4)	(22.4, 39.4)	(18.2, 24.4)	(21.0, 27.7)
Count	182	192	171	211	179	209

Confidence Intervals rounded to nearest tenth
¹Rates are age adjusted to the 2000 U.S. standard population.
²North Carolina population estimates taken from the July 1 estimates for each year.
³Asthma death defined as cause of death as asthma (ICD-10 J45-J46).
 Data Source: North Carolina State Center for Health Statistics, 2000-2005

Summary of Table 30:

- From 2000 through 2005, mortality rates for asthma as a contributory cause of death in North Carolina are significantly higher than mortality rates for asthma as a primary cause of death.

Table 31. Mortality Due to a Primary or Contributory Cause of Asthma per 1,000,000 Population, by Age Group, North Carolina, 1999-2005^{1,2,3}

	<5	5 to 14	15 to 34	35 to 64	65+
Primary					
Rate	2.03	3.02	4.37	14.05	62.21
(95% CI)	(0.9, 4)	(1.9, 4.5)	(3.4, 5.5)	(12.3, 15.8)	(56.4, 68.1)
Count	8	24	73	318	433
Contributory					
Rate	3.05	*	1.98	18.69	121.69
(95% CI)	(1.58, 5.33)		(1.6, 2.8)	(16.9, 20.5)	(113.5, 129.9)
Count	12		33	423	720

*Number of deaths <5 and >0.
 Confidence Intervals rounded to nearest tenth
¹Rates developed by using the sum of deaths for 6 years, and the sum of N.C. population at mid year for each year.
²Numbers were rounded to the nearest hundredth.
³Asthma death defined as cause of death as asthma (ICD-10 J45-J46).
 Data Source: North Carolina State Center for Health Statistics, 1999-2005

Summary for Table 31:

- Mortality rates for asthma as a contributory factor of death increase significantly from age group 15 to 34, to age group 35 to 64, and significantly increase still through the 65+ age group.

- Mortality rates for asthma as a contributory cause of death in age groups 35 and older are significantly higher than mortality rates for asthma as a primary (underlying) cause of death.

Table 32. Mortality Due to a Contributory Cause of Asthma per 1,000,000 Population, by Sex and Year, All Ages, North Carolina, 2000-2005^{1,2,3}
(For 1999 data, see Appendix C, Table 4.)

	2000	2001	2002	2003	2004	2005
Males						
Rate	19.54	18.44	14.36	21.65	14.94	17.37
(95% CI)	(14.7, 25.5)	(13.9, 24)	(10.3, 19.5)	(16.7, 27.5)	(11, 19.8)	(13.2, 22.7)
Count	59	58	44	71	51	64
Females						
Rate	26.79	28.81	27.10	29.50	26.29	29.02
(95% CI)	(22, 31.5)	(23.9, 33.7)	(22.4, 31.8)	(24.6, 34.4)	(21.7, 30.9)	(24.3, 33.8)
Count	123	134	127	140	128	145

Confidence Intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 U.S. standard population.

²North Carolina population estimates taken from the July 1 estimates for each year.

³Asthma death defined as cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics, 2000-2005

Summary of Table 32:

- Females tend to have a higher rate of asthma as a contributory cause of death than males (similar to the results seen with asthma as a primary cause of death). The difference is significant for females having a higher rate of asthma as a contributory cause of death in 1999, 2002, 2004, and 2005.



*Table 33. Mortality Due to a Contributory Cause of Asthma per 1,000,000 Population, by Race and Year, All Ages, North Carolina, 2000-2005^{1,2}
(For 1999 data, see appendix C, table 5.)*

	2000	2001	2002	2003	2004	2005
Whites						
Rate	22.69	21.06	17.55	20.58	19.33	19.02
(95% CI)	(18.9, 26.5)	(17.5, 24.7)	(14.3, 20.8)	(17.1, 24.1)	(16, 22.7)	(15.8, 22.3)
Count	140	132	114	135	131	131
Minorities[§]						
Rate	28.59	39.61	35.94	46.43	28.62	45.64
(95% CI)	(20.4, 38.9)	(30.1, 51.2)	(27.1, 46.8)	(36.4, 58.4)	(21, 38.2)	(35.8, 57.3)
Count	42	60	57	76	48	78

[§]Minority includes African American, Asian, and American Indian and Alaskan Native.

¹Rates are age adjusted to the 2000 U.S. standard population.

²North Carolina population estimates taken from the July 1 estimates for each year.

³Asthma death defined as cause of death as asthma (ICD-10 J45-J46).

Data Source: North Carolina State Center for Health Statistics, 2000-2005

Summary of Table 33:

- Minorities have had a higher rate of asthma as a contributory cause of death than whites each year for the past six years, with that rate being significant in 1999, 2001, 2002, and 2003.



Key Findings From This Chapter

- In North Carolina in 2005, females have a significantly higher mortality rate (17.48 per 1,000,000) due to a primary cause of asthma than males (8.24 per 1,000,000). This data is consistent with previous years.
- Over the previous six years, African American's mortality rate due to asthma (30.39 deaths per million) is significantly higher than the mortality rate due to asthma for whites (11.21 deaths per million).
- Native Americans have a mortality rate due to asthma from 1999 to 2004 (2005 census data not yet available) of 27.9 per 1,000,000. This number is similar to the mortality rate for other minorities in North Carolina, and significantly greater than the white mortality rate due to asthma. However, this mortality rate is based on a small number of deaths (13), and therefore should be interpreted with caution.

Chapter 5:
Healthy People 2010



Healthy People 2010

Healthy People 2010 presents a comprehensive, nationwide health promotion and disease prevention agenda. It is designed to serve as a roadmap for improving the health of all people in the United States during the first decade of the 21st century. Healthy People 2010 is designed to achieve two overarching goals: 1) increase quality and years of healthy life, and 2) eliminate health disparities. These two goals are supported by specific objectives in 28 focus areas. Each objective was developed with a target to be achieved by the year 2010, including objectives focusing on asthma.⁴⁸

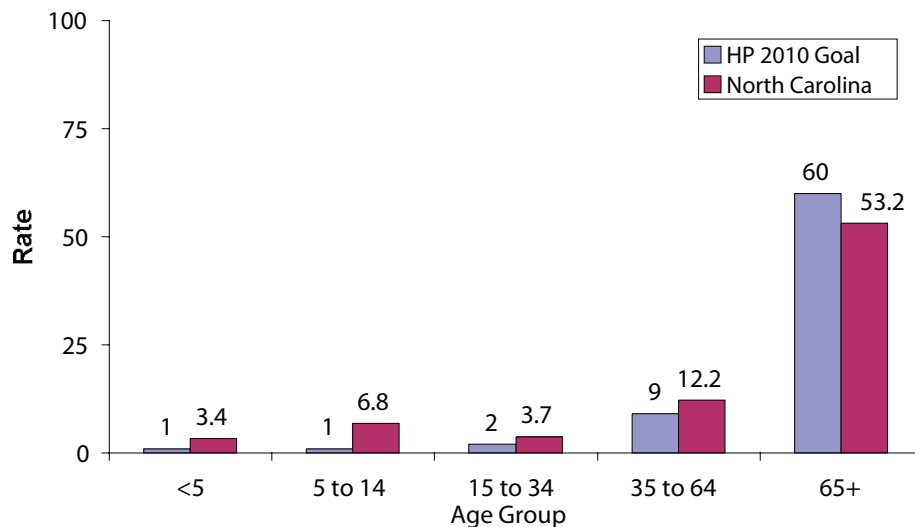
Asthma is addressed in the Healthy People 2010 document in section 24, Respiratory Disease. There are eight objectives directly related to addressing asthma as a public health problem.

Objective 24-1 Reduce Asthma Deaths

Healthy People 2010 Target:

Children under the age of 5:	1 death per million
Children ages 5 to 14:	1 death per million
Adolescents and adults 15 to 34:	2 deaths per million
Adults 35 to 64:	9 deaths per million
Adults 65 and older:	60 deaths per million

Figure 47. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population versus Healthy People 2010 Goal, North Carolina, 2005¹



¹Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46)

Table 34. Rates (per 1,000,000) of Mortality Due to Asthma versus Healthy People 2010 Goal, North Carolina, 2005

All	Health People 2010 Goal Rate (per 1,000,000)	North Carolina 2005 Rate (per 1,000,000)
Age 0 to 4	1.0	3.4
Age 5 to 14	1.0	6.8
Age 15 to 34	2.0	3.7
Age 35 to 64	9.0	12.2
Age 65+	60.0	53.2

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 2005

Summary of Figure 47 and Table 34:

- Currently, North Carolina is only reaching the Healthy People 2010 target in the age group 65+.

However, when we look at the data by sex and race, we see a different picture. For the following table, deaths from the years 1999 through 2005 were combined, because of the small number of deaths that occur every year.

Table 35. Mortality Due to a Primary Cause of Asthma per 1,000,000 Population versus Healthy People 2010 Goal, by Sex and Race, North Carolina, 1999-2005^{1,2}

	Health People 2010 Goal Rate (per 1,000,000)	White Males	White Females	Minority Males	Minority Females
Age 0 to 4	1.0	0.70*	0.74*	5.04*	5.19*
Age 5 to 14	1.0	1.07*	1.14*	7.08	7.26
Age 15 to 34	2.0	2.52	2.96	8.85	8.46
Age 35 to 64	9.0	4.85	12.56	24.9	37.7
Age 65+	60.0	32.85	69.23	103.17	98.6

*<5 but >0 deaths

¹Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46).

²Minority includes African American, Asian, and American Indian and Alaskan Native.

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 2005



Summary of Table 35:

- White males, age 35 and older, successfully met the Healthy People 2010 target goals. No other groups did.
- Minority males fail to meet any of the Healthy People 2010 goals. Minority males have a mortality rate due to asthma six times that of both white males and females in the 5 to 14 age group. They have more than three times the rate of mortality than white males in the age group 15 to 34, and more than five times the rate of white males in the 35 to 64 age group. For the age group 65+, minority males have more than three times the mortality rate of white males.
- For ages 34 and younger, the mortality rates for white females are only slightly higher than the Healthy People 2010 target goals. Mortality rates for white females fail to meet Healthy People 2010 target goals for those 35 years and older.
- Mortality rates for white females are more than twice that of white males for the age group 35 to 64 years, as well as for the age group 65+. White female mortality rates are, however, lower than the mortality rates in each age group than minority males and females.
- Minority females have the highest mortality rates for age group 35 to 64. For age group 35 to 64, mortality rates for minority females are over seven times that of white males, and three times that of white females. For those older than 65, mortality rates for minority females are three times that of white males.

Objective 24-2 Reduce Hospitalizations for Asthma

Healthy People 2010 Target:

Children under 5 years:	25 per 10,000
Children and adults age 5 to 64:	7.7 per 10,000
Adults age 65 and older:	11 per 10,000



Figure 48. Hospitalizations with a Primary Cause of Asthma per 100,000 Population versus Healthy People 2010 Goal, North Carolina, 2004^{1,2,3}

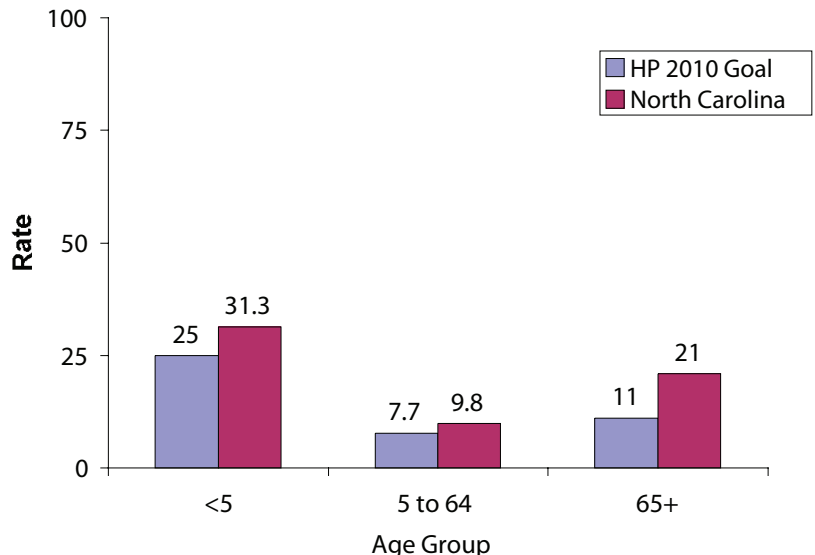


Table 36. Hospitalizations with a Primary Cause of Asthma per 100,000 Population versus Healthy People 2010 Goal, North Carolina, 2004^{1,2,3}

All	Health People 2010 Goal Rate (per 10,000)	North Carolina 2004 Rate (per 1 0,000)
Age 0 to 4	25	31.3
Age 5 to 64	7.7	9.8
Age 65+	11	21

¹Only includes primary diagnoses of asthma for North Carolina Residents served in North Carolina hospitals

²Rates may be smaller than actual asthma-related hospital use for counties that border other states.

³2004 data are provisional.

Data Source: North Carolina State Center for Health Statistics, 2004

Summary of Figure 48 and Table 36:

- Hospitalization rates for North Carolina in 2004 exceeded the Healthy People 2010 target for each age group, with the largest discrepancy being seen in the 65+ age group.

Objective 24-3 Reduce hospital emergency department visits for asthma.

Healthy People 2010 Target:

Children under 5 years:	80 per 10,000
Children and adults age 5 to 64:	50 per 10,000
Adults age 65 and older:	15 per 10,000

Accurate hospital emergency department data is not available at the time of publication of this report. Within the next 12 months, the North Carolina Asthma Program plans to utilize the new North Carolina Emergency Department Database System to look at the rates of emergency department visits in each of the age groups.

Objective 24-4

Reduce activity limitations among persons with asthma

Objective 24-5 (Developmental)

Reduce the number of school or work days missed by persons with asthma due to asthma.

Objectives 24-4 and 24-5 are being combined here. The N.C. BRFSS asked adults age 18 and older “During the past 12 months, how many days were you unable to work or carry out your usual activities because of your asthma?” The N.C. CHAMP looked at children ages 17 and younger in North Carolina, and asked if, “During the Past 12 months, how many days of daycare or school did your child miss due to asthma?”

Objective 24-4 - Healthy People 2010 Target: 10%

Objective 24-5 – Developmental: There is currently not a Healthy People 2010 target.

The 2005 N.C. BRFSS results show that 32.5% of adults with current asthma responded that they experience activity limitations because of their asthma. This is well above the Healthy People 2010 target of 10%.

The 2005 N.C. CHAMP showed that, of children with current asthma, 47.5% of them missed at least one day of school in the last year due to their asthma.

Objective 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.

Healthy People 2010 Target: 30%

North Carolina data related to this question are currently available only for those North Carolinians age 17 and younger. N.C. CHAMP asks the question “Has a doctor or other health professional ever given you an asthma management plan for (your child)?”

While this Healthy People 2010 objective is meant to cover a broader scope than just asthma management plans, asthma management plans are used as part of an overall effort to educate patients in self-management.¹⁸ An individualized asthma management plan should include strategies for: identifying and controlling asthma triggers; taking medication(s) as recommended by a health care professional as needed or on a daily basis; 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 will also include contact information for the health care provider and even for a local hospital. An asthma management plan helps the patient and his or her health care provider to establish a course of action for managing asthma.¹⁷ Asthma Management Plans are needed for use in schools and child and adult care facilities and should be provided to patients, families, school staff, and other providers who care for the child or adult.

According to the 2005 N.C. CHAMP, 56.9% of children age 17 and younger with current asthma have been given an asthma management plan by a doctor or other health professional.

Healthy Carolinians

North Carolina's 2010 Health Objectives set out a comprehensive and ambitious statewide agenda that provides a direction for improving the health and well being of North Carolinians over the next decade. In 1999, Governor James B. Hunt, Jr., appointed the Governor's Task Force for Healthy Carolinians through an Executive Order. A major assignment of the Governor's Task Force for Healthy Carolinians was to develop a list of health objectives for the Year 2010.

North Carolina's 2010 Health Objectives contained two asthma specific objectives, including a measurable objective and a developmental objective. Measurable objectives have a baseline using valid and reliable data derived from currently established data systems. These data provide the point from which the 2010 target has been set. Developmental objectives are not measurable at this time because there are no data on these subjects.⁴⁹

Measurable Objective: Reduce the rate of asthma related hospitalizations.

Target: 118 per 100,000

Baseline, 1998: 143.9 per 100,000 persons were hospitalized for asthma

Target setting method: 18% improvement

2004: 125.9 per 100,000 persons were hospitalized for asthma.

Current improvement from the 1998 baseline asthma hospitalization rate of 143.9 per 100,000 persons to the 2004 asthma hospitalization rate is a 12.5% improvement.

Developmental objective:
Reduce the number of school days missed by children with asthma

Target: Developmental. There is currently not a Healthy Carolinians 2010 target.

According to the 2005 N.C. CHAMP data, 52.5% of children with current asthma in North Carolina did not miss any days of school or daycare due to their asthma in the past 12 months. Of the remaining 47%, 37.4% of children with current asthma reported missing between one and nine days of school or daycare due to their asthma in the past 12 months, and 10% missed 10 or more days of school or daycare.



Discussion



Discussion

Although asthma prevalence data in North Carolina are demonstrating downward trends, asthma is still a huge issue in the state. In 2005, 6.5% of adults and 11.5% of children reported currently having asthma. While the percentage of adults with current asthma in North Carolina is below the national median, the percentage of children in North Carolina with asthma exceeds the national median number from the most recent national numbers (2004).

Although asthma affects the whole population, certain subgroups appear to be more adversely affected than others. Gender differences are seen in each of the surveillance measures in this document. Male children in North Carolina have a higher asthma prevalence than female children. Conversely, adult females have a higher prevalence of asthma than adult men in North Carolina. Females also have a higher rate of hospitalization due to a primary cause of asthma than men, as well as a higher rate of mortality due to asthma than North Carolina men.

Age is also factor when looking at who asthma affects. The very young, ages 0 to 4, have the highest rates of hospitalization due to a primary cause of asthma. Adults age 65 and older have the second highest asthma hospitalization rate, following the 0 to 4 age group. Adults in the age group 65+ have a significantly higher mortality due to a primary cause of asthma than all other age groups in North Carolina.

Disparities between racial groups, especially between African Americans, Native Americans and whites in North Carolina, are an issue. According to the 2005 N.C. YRBS, both male and female African American high school students have higher prevalence of asthma than white high school students. Although the 2005 N.C. BRFSS data did not show a statistically significant difference for Native Americans having a higher

asthma prevalence of asthma than whites, it has been shown in previous years. This data is consistent with national estimates that show Native Americans are 25% more likely to have been diagnosed with asthma than whites.¹²

Exploring health care utilization data, according to the 2005 N.C. BRFSS, African American adults were more likely than white adults to visit an emergency room or urgent care center three or more times in the previous year because of their asthma. African American children were also more likely than white children to have visited an emergency room or urgent care center in the past year because of asthma. Unfortunately, due to inconsistency in reporting race and ethnicity data, we cannot provide racial and ethnic data on actual hospitalizations.

Although there were only 116 deaths due to asthma in 2005 in North Carolina, African Americans were disproportionately affected. The mortality rate due to a primary cause of asthma in 2005 for African Americans was more than twice that of whites. Looking at the past 6 years (1999-2005), African Americans^a had a mortality rate due to asthma 2.5 times higher than whites. Minorities^b have a higher mortality due to a primary cause of asthma in each age group of North Carolinians age 5 and older.

Additionally, low income households were disproportionately affected by asthma. North Carolina adults with a household income less than \$15,000 a year were more likely to have higher asthma prevalence than all other income groups. This is similar to national trends, which show that adults in poor families have higher percentages of asthma than adults in families that are not poor.¹³

Currently, very little data is available on provider practices and asthma management, specifically providing each child or adult with asthma with an up to date asthma management plan. According to the 2005 N.C. CHAMP survey, 43% of children

^aThis rate includes Asians and other minorities. These groups make up for such a small number of deaths over the 6 year (23) that they were grouped with African Americans.

^bThe minority group being discussed here is comprised mainly of African Americans (328), but also includes Asians, American Indians, and other non-white racial groups.

with current asthma in North Carolina have reported (parental/guardian report) not receiving an asthma management plan from their physician or other health care professional. North Carolina Asthma Program is working on obtaining similar information from adults, and questions will be included on future statewide telephone surveys, as well in other physician specific project that the Chronic Disease and Injury Section of the North Carolina Division of Public Health, is conducting.

Limitations

While the *Burden of Asthma in North Carolina* is a comprehensive report, there are data gaps and limitations. Data gaps include limited available data on Native Americans, lack of prevalence data on asthma triggers (outside of tobacco smoke), lack of information on health care providers' practices, and a lack of accurate race and ethnicity data in hospitalization records.

Other data gaps concerning hospitalization records include the inability to track repeat visits for persons with asthma to the emergency room or admissions to the hospital. The ability to identify who with current asthma is making multiple emergency room visits and hospitalized repeatedly, would be an extremely beneficial tool for determining asthma management techniques. There is currently no way to track how many repeat visits a patient makes other than self report through the N.C. BRFSS.

Lack of data regarding work related asthma is also an issue in North Carolina. Several methods are currently being investigated as possible methods for filling this gap. The North Carolina Asthma Program will look at how other states are satisfying this data need and try to determine if any of those methods would be appropriate here.

Next Steps

The North Carolina Asthma Program will work together with the statewide coalition, the North Carolina Asthma Alliance, and other partners and stakeholders, to use this data to develop a state asthma plan. The North Carolina State Asthma Plan, that will be available March 2007, will address strategies for reducing the burden of asthma in North Carolina, with a specific emphasis on the disproportionately affected groups described herein. The State Asthma Plan will also provide methods for addressing the limitations discussed above.

The North Carolina Asthma Program will continue to conduct surveillance across the state utilizing a variety of available methods. We will work to fill any data gaps, while continuing to make the most out of the data that we already have. The Asthma Program will also investigate new ways to capture populations that we know are being negatively affected by asthma, but we do not have sufficient data on; including Native Americans and low income households.

References



References

1. Boss, L.P., Kreutzer, R.A., Luttinger, D., Leighton, J., Wilcox, K., Redd, S.C. (2001) The Public Health Surveillance of Asthma. *Journal of Asthma*, 38(1), 83-89.
2. Gordis, L. (2000) *Epidemiology*. 2nd ed. Philadelphia, Pennsylvania: W.B. Saunders Company.
3. CSTE POSITION STATEMENT 1998-EH/CD 1: Asthma Surveillance and Case Definition. Retrieved 5/24/2006. From Council for State and Territorial Epidemiologists. Web page. <http://www.cste.org/ps/1998/1998-eh-cd-01.htm>.
4. Centers for Disease Control and Prevention (CDC). 2004 National asthma training curriculum. Version 1. [CD ROM]. Atlanta; CDC; 2004.
5. North Carolina State Center for Health Statistics (SCHS). 2005 Behavioral Risk Factor Surveillance System (BRFSS). Retrieved 6/5/2006. Web Page: <http://www.schs.state.nc.us/schs/brfss/>.
6. North Carolina State Center for Health Statistics (SCHS). 2004 BRFSS Annual Results Technical Notes. Retrieved 6/5/2006. Web Page: <http://www.schs.state.nc.us/SCHS/brfss/2004/technical.html>.
7. Rhodes, L., Moorman, J.E., Redd, S.C., Mannino, D.M. (2003) Self-Reported Asthma Prevalence and Control Among Adults—United States, 2001. *MMWR*, 52 (17), 381-384.
8. Asthma in Minnesota: 2005 Epidemiology Report. Minnesota Department of Health. Minneapolis, MN. September 2005.
9. National Institute of Health (NIH) (1999) *National Heart, Lung, and Blood Institute Data Fact Sheet: Asthma Statistics*. Retrieved 6/5/2006. From National Heart, Lung, and Blood Institute. Web site: <http://www.nhlbi.nih.gov/health/prof/lung/asthma/asthstat.pdf>.
10. Centers for Disease Control and Prevention (CDC). 2005 Behavioral Risk Factor Surveillance System Survey Data. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2005.
11. State Center for Health Statistics (SCHS) and Office of Minority Health and Health Disparities. (OMH) 2005 North Carolina Minority Health Facts: American Indians. North Carolina Department of Health and Human Services. Retrieved 6/5/2006. Web site: <http://www.schs.state.nc.us/SCHS/pdf/FactsAI2005.pdf>.
12. National Center for Health Statistics (NCHS). (2002) *Asthma Prevalence, Health Care Use and Mortality, 2002*. Centers for Disease Control and Prevention. Retrieved 6/30/2006. Web site: <http://www.cdc.gov/nchs/products/pubs/pubd/hestats/asthma/asthma.htm>.
13. Lethbridge-Cejku M, Rose D, Vickerie J. (2006) *Summary health statistics for U.S. Adults: National Health Interview Survey, 2004*. National Center for Health Statistics. Vital Health Stat 10(229).
14. Bloom B, Dey AN. (2006) *Summary Health Statistics for U.S. Children: National Health Interview Survey, 2004*. National Center for Health Statistics. Vital Health Stat. 10(227).

15. Centers for Disease Control and Prevention (CDC). (2006) *Youth Risk Behavior Surveillance – United States, 2005*. Surveillance Summaries, June 9, 2006. MMWR 2006; 55 (No. SS-5).
16. National Heart, Lung, and Blood Institute (NHLBI). 1997. Expert Panel Report 2: Guidelines for the Diagnosis and Management of Asthma. National Institutes of Health, Bethesda, MD. Web site: <http://www.nhlbi.nih.gov/guidelines/asthma/asthgdln.pdf>.
17. Asthma and Allergy Foundation of America (AAFA), Florida Chapter, Inc. *Adult Onset Asthma*. Retrieved 5/25/2006. Web site: http://www.aafaflorida.org/features/answers/adult_onset_asthma.htm.
18. National Heart, Lung, and Blood Institute (NHLBI). (2003). *Guidelines for the Diagnosis and Management of Asthma, Update on Selected Topics, 2002*. National Institutes of Health, Bethesda, MD. Retrieved 7/10/2006. Web site: <http://www.nhlbi.nih.gov/guidelines/asthma/asthmafullrpt.pdf>.
19. National Heart, Lung, and Blood Institute. 1997. *Problem Sleepiness in Your Patient*. National Institutes of Health, Bethesda, MD.
20. Janson C, Gislason T, Boman G, Hetta J, Roos BE. Sleep disturbances in patients with asthma. *Respiratory Medicine*. 1990 Jan/ 84 (1): 37-42.
21. Centers for Disease Control and Prevention. *Measuring Healthy Days*. Atlanta, Georgia: CDC, November 2000.
22. Ford, ES, Mannino, DM, Homa, DM, Gwynn, C, Redd, SC, Moriarty, DB, Mokdad, AH. Self-reported asthma and health-related quality of life: Findings from the behavioral risk factor surveillance system. *Chest* 2003; 123 (1): 119-127.
23. N.C. Department of Health and Human Resources, Division of Public Health. *The Health of North Carolinians: A Profile*. Retrieved 5/16/2006. Web Page: <http://www.schs.state.nc.us/SCHS/pdf/HealthProfile.pdf>.
24. Asthma Initiative of Michigan. *For Healthy Lungs: Written Asthma Actions Plan Components and Distribution*. Retrieved 7/12/2006. Web page: http://www.getastmahelp.org/actionplan_components.asp.
25. Asthma and Allergy Foundation of America. *Asthma Overview*. Retrieved 6/17/2006. Web site: <http://aafa.org/>.
26. Centers for Disease Control and Prevention. *Strategies for Addressing Asthma Within a Coordinated School Health Program with Updated Resources*. Atlanta, Georgia: Centers for Disease Control and Prevention. National Center for Chronic Disease Prevention and Health Promotion, 2005. Available at: www.cdc.gov/healthyYouth/asthma/pdf/strategies.pdf.
27. Public Schools of North Carolina, Department of Public Instruction. *North Carolina's School Health Education Profile: 2004 Principal's Survey*. Department of Health and Human Services, Division of Public Health.
28. National Heart, Lung, and Blood Institute, National Institutes of Health. *Asthma and Physical Activity in the School: Making a Difference*. NIH Publication No. 95-3651. September 1995.

29. Environmental Protection Agency. *Asthma and Outdoor Air Pollution*. Retrieved 5/31/2006. Web page: <http://www.epa.gov/asthma/outdoorair.html>.
30. Environmental Protection Agency. Indoor Environmental Asthma Triggers. Retrieved 5/31/2006. Web page: <http://www.epa.gov/asthma/triggers.html>.
31. NC Department of Health and Human Services and the University of North Carolina School of Public Health. *Asthma in North Carolina: The North Carolina School Asthma Survey, 1999-2000*. Retrieved 5/17/2006. Web site: <http://wch.dhhs.state.nc.us/Asthma/pdf/Leg%204%20Pager.pdf>.
32. Environmental Protection Agency. Indoor Environmental Asthma Triggers – Secondhand Smoke. Retrieved 5/31/2006. Web page: <http://www.epa.gov/asthma/shs.html>.
33. U.S. Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006.
34. U.S. Department of Health and Human Services. *The Health Consequences of Smoking: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2004.
35. U.S. Department of Health and Human Services, National Heart, Lung, and Blood Institute. U.S. Department of Education. Revised 2003. *National Asthma Education and Prevention Program: Managing Asthma – A Guide For Schools*. Available at: http://www.nhlbi.nih.gov/health/prof/lung/asthma/asth_sch.pdf.
36. Centers for Disease Control and Prevention. Tobacco Information and Prevention Source. Retrieved 8/10/2006. Web Page: http://www.cdc.gov/tobacco/overview/Fast_Facts.htm.
37. U.S. Department of Health and Human Services, Health Resources and Services Administration, Maternal and Child Health Bureau. *The National Survey of Children’s Health 2003*. Rockville, Maryland: U.S. Department of Health and Human Services, 2005.
38. North Carolina Tobacco Prevention and Control Branch. *North Carolina 2005 Youth Tobacco Survey (YTS): High School Fact Sheet*. Division of Public Health, Department of Health and Human Services.
39. North Carolina Tobacco Prevention and Control Branch. *North Carolina 2005 Youth Tobacco Survey (YTS): Middle School Fact Sheet*. Division of Public Health, Department of Health and Human Services.
40. Weiss KB, Gergen, PJ, Hodgson T. An economic evaluation of asthma in the United States. *New England Journal of Medicine* 1992; 326: 862-866.
41. Akinbami, L.J., Schoendorf, K.C. *Trends in Childhood Asthma: Prevalence, Health Care Utilization, and Mortality*. *Pediatrics* 2002; 110: 315-322.

42. Coffey, RM, Ho, K, Adamson, DM, Matthews, TL, Sewell, J. *Asthma Care Quality Improvement: A Resource Guide for State Action*. (Prepared by Thomson Medstat and The Council of State Governments under Contract No. 290-000-0004). Rockville, MD: Agency for Healthcare Research and Quality, Department of Health and Human Services; April 2006. AHRQ Pub No. 06-0012-1.
43. Grunbaum JA, Di Pietra J, McManus T, Hawkins J, Kann L. *School Health Profiles: Characteristics of Health Programs Among Secondary Schools (Profiles 2004)*. Atlanta, GA: Centers for Disease Control and Prevention, 2005.
44. North Carolina Emergency Department Database. Retrieved 7/12/2006. Web page: <http://www.ncedd.org/>.
45. National Committee for Quality Assurance. Retrieved 7/17/2006. Web site: <http://www.ncqa.org/programs/hedis/>.
46. National Committee for Quality Assurance (NCQA). HEDIS 2004. Health plan employer data & information set. Vol. 2, Technical specifications. Washington (DC): National Committee for Quality Assurance (NCQA); 126 p.
47. South Carolina Department of Health and Environmental Control. South Carolina Community Assessment Network. Death Certificate Definitions. Retrieved July 19, 2006. Web Page: <http://scangis.dhec.sc.gov/scannet/defn/dthdefn.htm#mult%20cause>.
48. U.S. Department of Health and Human Services. *Healthy People 2010: Understanding and Improving Health*. 2nd ed. Washington, DC: U.S. Government Printing Office, November 2000.
49. Healthy Carolinians. North Carolina 2010 Health Objectives. North Carolina Division of Public Health. Retrieved 7/20/2006. Web site: <http://www.healthycarolinians.org/healthobj2010.htm>.
50. Centers for Disease Control and Prevention (CDC). *Behavioral Risk Factor Surveillance System Survey Data*. Atlanta, Georgia: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, 2000-2005.
51. Herrick, H, Gizlice, Z. North Carolina State Center For Health Statistics. *Spanish-Speaking Hispanics in North Carolina: Health Status, Access to Health Care, and Quality of Life*. Results from the 2002 and 2003 NC BRFSS Surveys. North Carolina Division of Public Health. Retrieved 8/18/2006. Web site: <http://www.schs.state.nc.us/SCHS/pdf/SCHS143.pdf>.
52. State Center for Health Statistics. *Behavioral Risk Factor Surveillance System (BRFSS) 2005 Results*. North Carolina Department of Health and Human Services, Division of Public Health. Retrieved 8/18/2006. Web site: <http://www.schs.state.nc.us/SCHS/brfss/2005/index.html>.
53. State Center for Health Statistics. *Child Health Assessment and Monitoring Program (CHAMP) 2005 Results*. North Carolina Department of Health and Human Services, Division of Public Health. Retrieved 8/18/2006. Web site: <http://www.schs.state.nc.us/SCHS/champ/2005/topics.html>.
54. Department of Public Instruction. *Youth Risk Behavior Survey (YRBS) 2005*. North Carolina Department of Health and Human Services. Retrieved 6/27/2006. Web site: <http://www.nchealthyschools.org/data/yrbs/>.

55. Yeatts, K, Shy, C, Sotir, M, Music, S, Herget, C. *Health Consequences for Children with Undiagnosed Asthma-Like Symptoms*. *Archives of Pediatric Adolescent Medicine* 2003; 157: 540-544.
56. American Lung Association. *Trends in Asthma Morbidity and Mortality*. Epidemiology and Statistics Unit, Research and Program Services. July 2006. Retrieved 9/25/2006. Web site: <http://www.lungusa.org/atf/cf/%7B7A8D42C2-FCCA-4604-8ADE-7F5D5E762256%7D/ASTHMA06FINAL.PDF>.
57. Centers for Disease Control and Prevention. *Asthma: Basic Facts*. Environmental Hazards and Health Effects Program, Air Pollution and Respiratory Health Branch. Retrieved 6/5/2006. Web site: <http://www.cdc.gov/asthma/faqs.htm>.
58. National Heart, Lung, and Blood Institute (NHLBI). *Disease and Conditions Index: Asthma*. National Institutes of Health, Bethesda, MD. Retrieved 6/15/2006. Web site: http://www.nhlbi.nih.gov/health/dci/Diseases/Asthma/Asthma_WhatIs.html.
59. Interview with Dr. Gerri Mattson, M.D, MSPH, Pediatric Medical Consultant, Children and Youth Branch, NC Division of Public Health. April, 2006.
60. National Toxicology Program. 9th Report on Carcinogens, 2000. Research Triangle Park, NC: U.S. Department of Health and Human Sciences, National Institute of Environmental Health Sciences, 2000. Retrieved June 2006. Web site: <http://ntp.niehs.nih.gov/ntp/roc/elev-enth/profiles/s176toba.pdf>

Technical Notes



Technical Notes

Part 1. 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.¹

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	C

Odds Ratio (OR) = $\frac{\text{Odds that an exposed person (female) develops the disease (asthma)}}{\text{Odds that a non-exposed person (male) develops the disease (asthma)}}$
 $OR = A \cdot D / B \cdot C$

Part 2. 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.²

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

Part 3 . 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 death rates to assess the relative risk of death. The direct method of age-adjustment is frequently used to compare the death rates of different populations, by controlling for differences in age distribution. Sum the products of the age-specific death rates and the proportion of the standard population in that age group across all ten age groups. This weighted sum is represented in the following formula:

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

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

The standard population used to calculate age-adjusted rates in this document is the 2000 United States Standard Population.

Part 4. 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% confidence interval states that we are 95% certain that the true measure lies within this specified range.¹

For example, the estimated current asthma prevalence among North Carolina adults (from a random sample of the population) is 6.5%, with a 95% confidence interval of 6.0% to 7.0%. This means that we are 95% confident that the true prevalence of current asthma for North Carolina adults is no less than 6.0%, and no greater than 7.0%. A 95% confidence uses a multiplier of 1.96.

The formula for the 95% 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 ($\leq .01$) q is small and may be ignored)⁴

Part 5. Confidence Intervals for Death Rates

Confidence intervals are used when looking at the age adjusted death rates in this document. The formula is the age-adjusted proportion of persons who died in this time period (p) plus/minus 1.96 (for a 95% confidence interval) multiplied by the standard error of an age-adjusted death rate, which is:

$$RSE(R'') = 100 \frac{\sqrt{\sum \left\{ w_i^2 R_i^2 \left(\frac{I}{D_i} \right) \right\}}}{R''}$$

Approximate 95% Confidence Interval: 1-99 deaths

Lower: $R'' * L(1 - \alpha = .95, D_{adj})$

Upper: $R'' * U(1 - \alpha = .95, D_{adj})$

where

R'' = age-adjusted rate (per 100,000 population) = $\sum w_i R_i$

w_i = i^{th} age-specific Standard Population such that $\sum(w_i) = 1.0$

R_i = age-specific rate (per 100,000) for the i^{th} age group

D_i = total number of deaths for the i^{th} age group upon which age-specific rate is based

$$S(R'') = R'' * \frac{RSE(R'')}{100} = \text{standard error of age-adjusted rate}$$

$L(1 - \alpha = .95, D_{adj})$ and $U(1 - \alpha = .95, D_{adj})$ are lower and upper 95% confidence limit factors and are shown in table S

$$D_{adj} = \frac{1}{\left(\frac{RSE(R'')}{100}\right)^2} = \text{adjusted number of deaths rounded to nearest integer}$$

Table S found in Technical Appendix from the *Vital Statistics of United States 1999 Mortality*.⁶

Age-Specific confidence intervals for less than 100 deaths.

$$RSE(R) = RSE(D) = 100 \sqrt{\frac{1}{D}}$$

Approximate 95% Confidence Interval: 1-99 deaths

Lower: $R * L(1 - \alpha = .95, D)$

Upper: $R * U(1 - \alpha = .95, D)$

where

R = rate (deaths per 100,000 population)

D = total number of deaths upon which rate is based

$$S(R) = R * \frac{RSE(R)}{100} = \text{standard error of rate}$$

$L(1 - \alpha = .95, D)$ and $U(1 - \alpha = .95, D)$ are lower and upper 95% confidence limit factors and are shown in table S

Table S found in Technical Appendix from the *Vital Statistics of United States 1999 Mortality*.⁶

Part 6. Trend Analysis

The Spearman Rank Order Correlation test was utilized to determine if there was a trend in total mortality rates from 1995 through 2005, and for age, race, and gender specific mortality rates from 1999 through 2005. This test quantifies the extent to which there is a linear relationship between the rate and year.¹

The correlation coefficient (ρ) can vary between +1.0 and -1.0. If the coefficient equals -1.0, it indicates a perfect negative correlation, with each year having a lower mortality rate for that specific group than the previous year, for example. If the coefficient equals +1.0, it indicates a perfect positive correlation, where each year has a higher mortality rate for that specific group than the previous year. As the correlation coefficient approaches 0.0, from either direction, the relationship between the variables weakens.³

The p-value for the Spearman Rank Order Correlation test ranges from 0.0 to 1.0, and gives the probability of finding a significant overall trend when no trend actually exists. The standard used to assess the significance of a statistical test is a p-value of 0.05. A p-value less than or equal to 0.05 indicates that there is at most a 5% chance of observing a trend that, in reality, does not exist. If the p value is greater than 0.05, chance cannot be excluded as a likely explanation for the trend, so the result is not statistically significant.³

References

1. Hennekens, C, Buring, J. (1987). *Epidemiology in Medicine*. Boston, MA: Little, Brown, and Company.
2. Gordis, L. (2000) *Epidemiology*. 2nd ed. Philadelphia, Pennsylvania: W.B. Saunders Company.
3. Wasilevich, E, Lyon-Callo, S. *Epidemiology of Asthma in Michigan: 2004 Surveillance Report*. Michigan Department of Community Health. June 2004.
4. Buescher, P. 1997. *Problem With Rates Based On Small Numbers*. State Center for Health Statistics. North Carolina Division of Public Health. North Carolina Department of Health and Human Services. Retrieved 10/4/06. Web site: <http://www.schs.state.nc.us/SCHS/pdf/primer12.pdf>.
5. Buescher, P. 1998. *Age-Adjusted Death Rates*. State Center for Health Statistics. North Carolina Division of Public Health. North Carolina Department of Health and Human Services. Retrieved 10/4/06. Web site: <http://www.schs.state.nc.us/SCHS/pdf/primer13.pdf>.
6. Mortality Statistics Branch. *Technical Appendix from the Vital Statistics of United States 1999 Mortality*. National Center for Health Statistics. Centers for Disease Control and Prevention. Department of Health and Human Services. Retrieved 2/14/2006. Web site: <http://www.cdc.gov/nchs/data/statab/techap99.pdf>.

Appendix A:
Data Sources



Appendix A. Data Sources

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 percent) in North Carolina. The cause of death is the underlying cause classified according to the tenth revision of the International Classification of Diseases (ICD).¹

Data for asthma as a contributory cause of death were also obtained by the North Carolina State Center for Health Statistics. They provided the analysis of vital statistics obtained from death certificates, which allow for the inclusion of more information than the primary cause of death.

HEDIS – Medicaid Data

The Health Plan Employer Data and Information Set, (HEDIS), is a set of standardized performance measures designed to ensure that purchasers and consumers have the information they need to reliably compare the performance of managed health care plans (including Medicaid). HEDIS is sponsored, supported, and maintained by the National Committee for Quality Assurance (NCQA). The performance measures in HEDIS are related to many significant public health issues and include asthma.²

Hospitalization Data

The North Carolina Asthma Program receives hospitalization data from the State Center for Health Statistics, which receives the data from a private data processor. 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

company, Solucient, 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. 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.

National Health Interview Survey

The National Health Interview Survey (NHIS) is the principal source of information on the health of the civilian non-institutionalized population of the United States and is one of the major data collection programs of the National Center for Health Statistics (NCHS). The main objective of the NHIS is to monitor the health of the United States population through the collection and analysis of data on a broad range of health topics. A major strength of this survey lies in the ability to display these health characteristics by many demographic and socioeconomic characteristics.³

The NHIS covers the civilian non-institutionalized population of the United States living at the time of the interview. Because of technical and logistical problems, several segments of the population are not included in the sample or in the estimates from the survey. Persons excluded are patients in long-term care facilities; persons on active duty with the Armed Forces (though their dependents are included); and U.S. nationals living in foreign countries.³

National Survey of Children's Health, 2003

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.⁴

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.⁵

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 will be revised each year to meet the child health surveillance needs of North Carolina.⁶

CHAMP, by collecting data for young children, will contribute 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 will help monitor child health status and identify child health problems, will help evaluate child health programs and services, will help health professionals make evidence-based decisions, policies and plans, and will help monitor progress towards selected health targets, such as Healthy Carolinians 2010.⁶

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.⁷ For national data, the CDC publication Grunbaum et al. (2005) was utilized.⁸

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.¹¹

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.⁹

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 (inc. chronic disease and injuries), to gain a profile of the student to nurse ratio across the state, and to identify health policies in schools.¹⁰

Youth Risk Behavior Survey (YRBS)

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

References

1. North Carolina State Center for Health Statistics. *Introduction to 2005 Detailed Mortality Statistics*. North Carolina Division of Public Health, Department of Health and Human Services. Retrieved 9/6/2006. Web site: <http://www.schs.state.nc.us/SCHS/deaths/dms/2005/intro.html>.
2. National Committee for Quality Assurance. Retrieved 7/17/2006. Web site: <http://www.ncqa.org/programs/hedis/>.
3. National Center for Health Statistics. *National Health Interview Survey (NHIS): Description*. Centers for Disease Control and Prevention. U.S. Department of Health and Human Services. Retrieved 9/6/2006. Web site: <http://www.cdc.gov/nchs/about/major/nhis/hisdesc.htm>.
4. National Survey of Children's Health. *Fast Facts about the Survey*. Retrieved 9/6/2006. Web site: http://nschdata.org/documents/NSCH_FAST_FACTS_final.pdf.
5. North Carolina State Center for Health Statistics (SCHS). *2005 Behavioral Risk Factor Surveillance System (BRFSS)*. Retrieved 6/5/2006. Web site: <http://www.schs.state.nc.us/schs/brfss/>.
6. North Carolina State Center for Health Statistics. *Child Health Assessment and Monitoring Program (CHAMP)*. North Carolina Division of Public Health. North Carolina Department of Health and Human Services. Retrieved 8/30/2006. Web site: <http://www.schs.state.nc.us/SCHS/champ/>.
7. Centers for Disease Control and Prevention. *Profiles: School Health Profiles*. U.S. Department of Health and Human Services. Retrieved 9/6/2006. Web site: <http://www.cdc.gov/healthyyouth/profiles/pdf/overview.pdf>.
8. Grunbaum JA, Di Pietra J, McManus T, Hawkins J, Kann L. *School Health Profiles: Characteristics of Health Programs Among Secondary Schools (Profiles 2004)*. Atlanta, GA: Centers for Disease Control and Prevention, 2005.
9. Public Schools of North Carolina, Department of Public Instruction. *North Carolina's School Health Education Profile: 2004 Principal's Survey*. Department of Health and Human Services, Division of Public Health.
10. Interview with Malyn Pratt, North Carolina State School Nurse Consultant, 8/31/2006.
11. Centers for Disease Control and Prevention (CDC). (2006) *Youth Risk Behavior Surveillance – United States, 2005*. Surveillance Summaries, June 9, 2006. MMWR 2006; 55 (No. SS-5).

Appendix B:
***Asthma Medication Possession
and Self Administration Law***



Appendix B. 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 C:
Additional Mortality Data



Table 1. Rates^{1,2} (per 1,000,000) of Mortality Due to a Primary Cause of Asthma³, by Year, Age, Race, and Sex, North Carolina, 1999

	Age					Race		Sex	
	>5	5 to 14	15 to 34	35 to 64	65+	White	Minority	Male	Female
Rate	*	*	5.16	15.86	72.36	12.29	35.26	12.90	20.70
(Count)			(12)	(48)	(69)	(74)	(58)	(42)	(90)

*Number of deaths <5 and >0

¹North Carolina population estimates taken from the July 1 estimates for each year

²Numbers rounded to the nearest hundredth

³Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46)

Minority includes African American, Asian, and American Indian and Alaskan Native.

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999

Table 2. Rates¹ (per 1,000,000) of Mortality Due to a Primary Cause of Asthma², by Year, Sex, and Race³, North Carolina, 1999

	White Males	White Females	Minority Males	Minority Females
Rate	8.99	14.9	28.23	40.39
(95% CI)	(5.5, 13.9)	(11.1, 19.6)	(16.4, 45.2)	(28.4, 55.7)
Count	22	52	20	38

Confidence Intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 US standard population

²Asthma death defined as primary cause of death as asthma (ICD-10 J45-J46)

³Minority includes African American, Asian, and American Indian and Alaskan Native

Data Source: North Carolina State Center for Health Statistics: Detailed Mortality Statistics, 1999

Table 3. Rates^{1,2} (per 1,000,000) of Mortality Due to Asthma³ as a Primary or Contributory Cause of Death, by Year, North Carolina, 1999

	Rate	(95% CI)	Count
Primary	17.25	(14.3, 20.2)	132
Contributory	23.35	(19.9, 26.8)	175

Confidence Intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 US standard population

²North Carolina population estimates taken from the July 1 estimates for each year

³Asthma death defined as cause of death as asthma (ICD-10 J45-J46)

Data Source: North Carolina State Center for Health Statistics, 1999

Table 4. Rates^{1,2}(per 1,000,000) of Mortality Due to Asthma³ as a Contributory Cause of Death, by Sex and Year, North Carolina, 1999

	Rate	(95% CI)	Count
Males	16.62	(12.3, 22)	51
Females	28.01	(23.1, 32.9)	124

Confidence Intervals rounded to nearest tenth

¹Rates are age adjusted to the 2000 US standard population

²North Carolina population estimates taken from the July 1 estimates for each year

³Asthma death defined as cause of death as asthma (ICD-10 J45-J46)

Data Source: North Carolina State Center for Health Statistics, 1999

Table 5. Rates^{1,2}(per 1,000,000) of Mortality Due to Asthma³ as a Contributory Cause of Death, by Race and Year, North Carolina, 1999

	Rate	(95% CI)	Count
Whites	18.26	(14.8, 21.7)	110
Minorities[§]	44.12	(33.9, 56.4)	65

[§]Minority includes African American, Asian, and American Indian and Alaskan Native

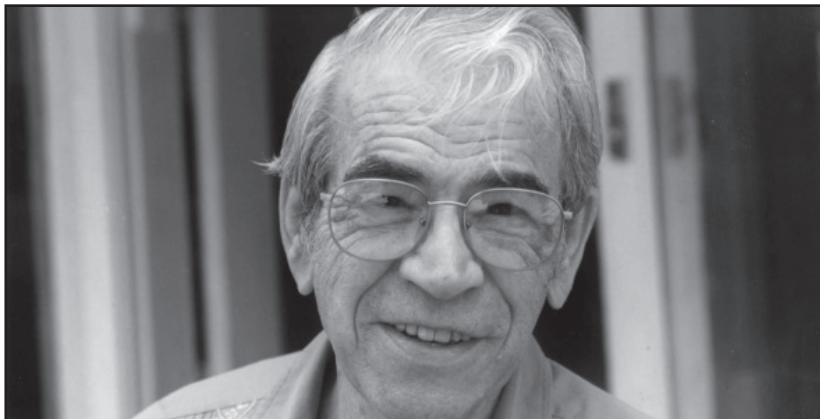
¹Rates are age adjusted to the 2000 US standard population

²North Carolina population estimates taken from the July 1 estimates for each year

³Asthma death defined as cause of death as asthma (ICD-10 J45-J46)

Data Source: North Carolina State Center for Health Statistics, 1999

Appendix D:
County Specific Data



Appendix D. County Specific Data

Table 1. Mortality Rates (per 1,000,000), North Carolina Counties, 1999-2005

County	Mortality Rate (per 1,000,000) 1999-2005	County	Mortality Rate (per 1,000,000) 1999-2005
Alamance	11.1*	Granville	12.9*
Alexander	9.6*	Greene	8.5*
Alleghany	77.1*	Guilford [§]	13.6
Anson	13.1*	Halifax	17.6*
Ashe	13.4*	Harnett	13.8*
Avery	9.3*	Haywood	18*
Beaufort	40.2*	Henderson	26.7*
Bertie	67.5*	Hertford	21.2*
Bladen	10.2*	Hoke	22.6*
Brunswick	4.1*	Hyde	29.1*
Buncombe [§]	13.4*	Iredell	6.3*
Burke	28.1*	Jackson	13.3*
Cabarrus	9.4*	Johnston	12.4*
Caldwell	10.6*	Jones	16.2*
Camden	21.4*	Lee	13.2*
Carteret	13.7*	Lenoir	22.6*
Caswell	14.1*	Lincoln	12.5*
Catawba	12.5*	Macon	21.4*
Chatham	12.6*	Madison	8.4*
Cherokee	13.2*	Martin	33.3*
Chowan	46.6*	McDowell	15.5*
Clay	53.7*	Mecklenburg [§]	11.2
Cleveland	12*	Mitchell	21*
Columbus	6.1*	Montgomery	18.4*
Craven	45.2	Moore	25.7*
Cumberland [§]	15.8	Nash	11.2*
Currituck	8.2*	New Hanover [§]	11.8*
Dare	10.2*	Northhampton	38.2*
Davidson [§]	18.8*	Onslow [§]	13*
Davie	13.5*	Orange	5.6*
Duplin	23*	Pamlico	64.2*
Durham [§]	10.7*	Pasquotank	32*
Edgecombe	18.4*	Pender	3.8*
Forsyth [§]	11.1	Perquimans	0*
Franklin	13.1*	Person	18.2*
Gaston [§]	15.6*	Pitt	22.9*
Gates	46.3*	Polk	26.6*
Graham	0*	Randolph	12.4*

Table 1. Continued

County	Mortality Rate (per 1,000,000) 1999-2005	County	Mortality Rate (per 1,000,000) 1999-2005
Richmond	10.7*	Tyrrell	0*
Robeson	22.6*	Union	10.5*
Rockingham	18.1*	Vance	15.2*
Rowan	8.8*	Wake [§]	7.2
Rutherford	18.4*	Warren	16.6*
Sampson	21.5*	Washington	36.9*
Scotland	27.7*	Watauga	11.7*
Stanly	11.3*	Wayne	13.1*
Stokes	0*	Wilkes	10*
Surry	9.3*	Wilson	24.3*
Swain	25.1*	Yadkin	13.6*
Transylvania	28.2*	Yancey	18.5*

[§]-denotes counties considered Urban

*-rates based less than 20 deaths should be interpreted with caution.

Data Source: North Carolina State Center for Health Statistics and Detailed Mortality Statistics, 1999-2004

Table 2. Hospitalization Rates (per 100,000), Total and by Sex, North Carolina Counties, 1999-2004

County	Total 1999-2001	Total 2002-2004	Male 1999-2001	Male 2002- 2004	Female 1999- 2001	Female 2002- 2004
Alamance	109.1	113.5	99.4	92.1	117.9	133.5
Alexander	88.2	102.0	67.5	67.6	108.8	136.3
Alleghany	87.3	123.1	*	*	146.9	164.3
Anson	205.6	325.0	204.1	282.0	206.9	367.5
Ashe	95.3	112.1	63.8	80.7	125.8	143.1
Avery	143.5	212.8	107.6	165.6	182.7	267.4
Beaufort	275.2	207.8	167.9	152.6	372.5	258.4
Bertie	235.7	180.3	170.7	147.2	291.8	209.6
Bladen	166.1	164.6	136.8	128.0	192.6	198.9
Brunswick	164.2	132.6	97.5	84.3	228.4	179.3
Buncombe [§]	128.5	130.6	87.8	82.3	165.9	175.4
Burke	113.5	94.4	76.7	57.4	150.0	131.7
Cabarrus	154.9	122.3	108.1	91.1	200.2	152.8
Caldwell	132.1	129.4	127.2	95.5	136.8	162.6
Camden	187.7	202.6	220.3	*	*	266.6
Carteret	124.1	144.7	93.7	100.6	153.6	187.0
Caswell	32.6	38.0	*	*	*	*
Catawba	74.8	71.5	60.8	59.1	88.4	83.6
Chatham	61.7	42.8	30.1	*	91.9	66.2

Table 2. Continued

County	Total 1999-2001	Total 2002-2004	Male 1999- 2001	Male 2002- 2004	Female 1999- 2001	Female 2002- 2004
Cherokee	101.3	135.4	70.7	97.3	130.0	171.6
Chowan	152.9	136.8	168.7	113.3	139.1	157.6
Clay	75.6	92.2	*	*	*	138.2
Cleveland	158.9	168.4	94.2	115.6	219.0	217.5
Columbus	233.5	219.5	219.9	186.7	245.8	250.2
Craven	156.9	158.0	109.9	108.1	204.4	209.0
Cumberland [§]	135.3	146.4	130.0	135.0	140.6	158.2
Currituck	100.1	96.6	*	*	145.2	130.9
Dare	52.9	91.2	*	45.7	93.0	137.6
Davidson [§]	117.0	116.9	69.5	71.2	163.0	160.8
Davie	75.8	101.0	*	45.3	119.5	155.0
Duplin	157.8	133.4	90.8	112.6	222.9	154.3
Durham [§]	99.5	99.9	82.7	70.4	115.0	127.5
Edgecombe	269.8	275.0	220.5	231.3	311.9	313.3
Forsyth [§]	91.8	104.7	64.0	73.3	117.2	133.7
Franklin	113.4	141.4	84.3	100.2	141.4	181.9
Gaston [§]	121.5	134.6	96.5	95.7	144.9	171.2
Gates	114.2	110.7	135.4	*	*	138.9
Graham	*	128.4	*	*	*	193.8
Granville	144.6	131.3	99.1	79.0	193.2	190.7
Greene	137.1	143.2	126.7	113.9	148.1	174.6
Guilford [§]	101.0	109.2	75.7	83.4	124.0	133.1
Halifax	167.6	266.9	129.9	176.1	201.7	349.6
Harnett	117.3	149.5	76.4	110.7	156.8	187.7
Haywood	132.4	136.8	79.9	74.6	180.5	194.2
Henderson	170.5	159.4	119.6	98.7	217.9	216.7
Hertford	209.2	168.2	121.3	110.0	283.6	217.5
Hoke	104.1	119.2	93.1	115.0	115.3	123.4
Hyde	440.9	180.1	389.5	*	495.3	279.6
Iredell	186.6	223.4	161.6	190.3	210.6	255.6
Jackson	147.8	129.8	118.0	105.1	175.9	153.7
Johnston	152.3	160.1	100.8	105.3	202.6	214.9
Jones	164.5	290.2	*	154.7	216.4	417.7
Lee	157.4	155.6	92.5	76.7	220.0	233.4
Lenoir	270.0	293.7	244.7	234.9	292.5	347.2
Lincoln	104.0	125.2	78.5	92.3	129.1	158.0
McDowell	70.8	75.0	49.1	46.3	92.2	103.9
Macon	108.1	80.8	76.7	59.8	137.0	100.2
Madison	108.7	104.9	78.9	*	137.9	144.8
Martin	270.9	439.0	163.1	313.0	364.8	547.2
Mecklenburg [§]	130.0	125.5	104.7	101.2	154.2	149.2
Mitchell	67.8	77.3	*	*	90.5	90.5
Montgomery	88.2	118.6	56.0	106.2	121.7	131.4
Moore	111.2	127.7	70.4	73.1	148.8	178.6

Table 2. Continued

County	Total 1999-2001	Total 2002-2004	Male 1999- 2001	Male 2002- 2004	Female 1999- 2001	Female 2002- 2004
Nash	140.1	191.4	99.2	143.6	177.7	236.2
New Hanover [§]	93.7	88.5	68.3	73.7	117.3	102.5
Northhampton	172.3	171.9	119.9	115.7	220.5	223.5
Onslow [§]	113.6	123.4	66.0	70.7	174.3	188.4
Orange	31.4	48.1	25.6	38.2	36.7	57.2
Pamlico	155.3	145.8	*	*	240.8	198.2
Pasquotank	332.7	280.4	271.5	216.2	388.7	341.7
Pender	103.6	94.7	57.0	70.4	149.6	119.7
Perquimans	192.8	241.8	152.3	167.2	230.2	309.6
Person	156.9	105.7	124.1	87.7	187.4	122.5
Pitt	145.6	109.5	142.1	95.0	148.7	122.6
Polk	67.0	95.2	*	*	102.9	117.8
Randolph	105.0	101.8	76.9	72.2	132.3	131.0
Richmond	564.8	396.0	433.6	259.8	689.2	528.5
Robeson	325.9	360.2	234.0	264.4	410.9	451.9
Rockingham	140.1	209.3	109.5	168.3	168.5	247.9
Rowan	126.7	97.2	110.4	72.2	142.5	121.9
Rutherford	115.9	143.2	76.6	78.4	152.7	203.8
Sampson	147.7	164.5	98.5	111.4	194.8	217.7
Scotland	259.9	259.9	246.8	209.0	271.4	304.8
Stanly	179.8	164.9	165.0	123.9	194.0	205.2
Stokes	43.2	59.9	*	43.3	65.9	75.9
Surry	119.9	158.1	89.6	124.1	148.6	191.1
Swain	138.5	179.5	103.7	159.7	172.5	198.1
Transylvania	70.6	88.1	49.5	*	90.3	130.2
Tyrrell	*	*	*	*	*	*
Union	120.3	116.9	110.8	105.3	129.7	128.5
Vance	235.4	214.3	168.5	137.3	295.1	283.8
Wake [§]	83.4	85.8	67.6	63.7	98.8	107.7
Warren	105.1	154.7	*	121.1	143.6	187.5
Washington	134.0	177.6	108.7	140.9	156.5	210.4
Watauga	101.7	110.5	69.5	90.3	133.1	130.7
Wayne	131.6	157.2	89.3	130.8	173.5	182.8
Wilkes	125.2	145.1	72.1	77.6	176.8	211.2
Wilson	200.3	168.4	140.0	150.0	254.4	185.4
Yadkin	103.5	90.2	63.6	64.1	141.8	115.6
Yancey	87.8	70.4	*	75.5	102.2	*

[§]-denotes counties considered Urban

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

Data Source: North Carolina State Center for Health Statistic, 1999-2004

Table 3. Hospitalization Rates (per 100,000), by Age, North Carolina Counties, 1999-2001

County	Age 0-4 1999-2001	Age 5-14 1999-2001	Age 15-34 1999-2001	Age 35-64 1999-2001	Age 65+ 1999-2001
Alamance	436.7	123.7	56.1	83.1	113.3
Alexander	504.7	*	*	58.7	*
Alleghany	*	*	*	*	*
Anson	579.8	431.9	145.8	128.5	*
Ashe	573.4	*	*	*	*
Avery	*	*	*	206.0	*
Beaufort	409.6	209.0	124.9	224.5	633.0
Bertie	*	*	*	271.4	222.7
Bladen	616.7	181.7	*	119.3	217.2
Brunswick	324.3	138.3	162.1	151.5	164.5
Buncombe [§]	351.5	84.3	80.6	116.4	189.5
Burke	352.3	102.9	74.6	85.0	168.9
Cabarrus	388.2	140.4	89.9	146.6	203.1
Caldwell	587.3	172.0	59.9	108.3	83.0
Camden	*	*	*	*	*
Carteret	307.3	115.1	68.3	139.7	113.0
Caswell	*	*	*	*	*
Catawba	286.1	76.0	37.6	60.8	86.1
Chatham	*	*	*	63.7	100.2
Cherokee	*	*	*	76.5	142.7
Chowan	*	*	*	161.0	*
Clay	N/A	N/A	N/A	*	*
Cleveland	457.5	97.7	55.0	145.6	307.5
Columbus	1305.3	320.1	102.1	136.8	133.4
Craven	299.8	144.1	71.5	166.9	259.8
Cumberland [§]	550.7	200.6	45.7	104.9	96.5
Currituck	*	*	*	131.8	*
Dare	*	*	*	61.3	*
Davidson [§]	311.1	125.4	51.9	111.6	158.3
Davie	*	*	*	69.4	*
Duplin	361.6	180.6	75.0	133.5	252.4
Durham [§]	238.3	152.3	45.1	87.0	167.3
Edgecombe	935.3	295.3	81.6	275.8	245.1
Forsyth [§]	144.5	88.1	60.0	100.0	111.7
Franklin	260.7	131.8	63.9	93.0	190.8
Gaston [§]	443.4	160.9	47.4	94.7	150.9
Gates	*	*	*	*	*
Graham	*	*	*	*	*
Granville	286.5	134.2	72.1	150.0	232.2
Greene	522.7	*	*	93.6	*
Guilford [§]	298.0	92.7	55.9	97.4	122.2

Table 3. Continued

County	Age 0-4 1999-2001	Age 5-14 1999-2001	Age 15-34 1999-2001	Age 35-64 1999-2001	Age 65+ 1999-2001
Halifax	507.8	195.6	96.8	156.1	144.6
Harnett	240.6	160.0	71.9	97.7	161.9
Haywood	446.1	150.8	67.8	116.4	140.9
Henderson	396.1	196.3	108.6	124.2	240.2
Hertford	*	*	*	272.7	206.2
Hoke	277.8	*	71.5	91.7	*
Hyde	*	*	*	302.4	1229.9
Iredell	699.6	219.2	89.1	129.9	234.5
Jackson	755.2	*	*	157.6	139.6
Johnston	327.0	149.1	70.1	150.3	247.1
Jones	*	*	*	*	*
Lee	234.5	191.0	100.0	153.1	205.2
Lenoir	920.3	500.3	152.9	183.0	181.7
Lincoln	364.6	95.4	38.9	98.7	131.7
McDowell	*	*	*	43.2	153.8
Macon	*	*	*	131.3	*
Madison	*	*	*	115.3	*
Martin	*	*	208.1	312.7	340.1
Mecklenburg ^s	358.9	146.0	52.1	125.4	207.5
Mitchell	*	*	*	*	*
Montgomery	*	*	*	87.0	*
Moore	205.4	115.4	48.8	140.9	95.6
Nash	467.4	177.9	68.8	105.2	183.8
New Hanover ^s	266.0	77.2	66.4	88.6	109.1
Northhampton	547.2	*	133.8	113.3	223.3
Onslow ^s	206.2	135.2	31.9	135.4	409.1
Orange	109.2	54.7	*	25.4	*
Pamlico	*	*	*	145.8	*
Pasquotank	925.1	327.8	71.1	328.3	606.8
Pender	279.3	*	*	85.3	178.8
Perquimans	*	*	*	151.2	332.7
Person	506.5	196.2	*	129.7	193.2
Pitt	502.5	227.6	51.5	112.1	257.0
Polk	*	*	*	*	*
Randolph	395.7	72.5	73.2	80.7	125.8
Richmond	1577.2	416.5	422.2	631.1	318.1
Robeson	885.2	285.9	141.4	331.2	449.6
Rockingham	542.6	120.6	49.5	112.6	213.8
Rowan	554.5	154.7	52.8	101.2	105.4
Rutherford	227.0	*	45.8	133.9	215.6
Sampson	260.6	137.2	110.3	146.8	172.4
Scotland	769.7	331.8	115.1	200.6	376.6

Table 3. Continued

County	Age 0-4 1999-2001	Age 5-14 1999-2001	Age 15-34 1999-2001	Age 35-64 1999-2001	Age 65+ 1999-2001
Stanly	763.8	167.8	98.8	118.9	239.9
Stokes	*	*	*	52.0	*
Surry	377.1	77.9	74.2	116.5	129.5
Swain	1168.6	*	*	*	*
Transylvania	*	*	*	*	*
Tyrrell	*	*	*	*	N/A
Union	479.6	115.8	56.6	83.5	143.0
Vance	426.3	138.4	162.0	260.1	330.4
Wake [§]	185.8	116.6	38.1	80.7	127.2
Warren	*	*	*	152.3	*
Washington	*	*	*	*	*
Watauga	428.9	*	*	72.0	313.0
Wayne	258.1	107.2	75.5	150.3	158.8
Wilkes	231.4	92.8	67.6	154.9	123.7
Wilson	393.1	165.0	94.9	191.9	374.0
Yadkin	*	*	*	86.8	175.4
Yancey	*	*	*	*	*

[§]-denotes counties considered Urban

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

Data Source: North Carolina State Center for Health Statistics, 1999-2001

Table 4. Hospitalization Rates (per 100,000), by Age, North Carolina Counties, 2002-2004

County	Age 0-4 2002-2004	Age 5-14 2002-2004	Age 15-34 2002-2004	Age 35-64 2002-2004	Age 65+ 2002-2004
Alamance	317.5	129.9	28.9	105.7	191.8
Alexander	471.8	*	*	81.4	*
Alleghany	*	*	*	*	*
Anson	727.9	403.9	120.4	305.5	496.9
Ashe	*	*	*	83.6	*
Avery	805.5	*	140.0	189.7	268.6
Beaufort	460.1	134.0	69.1	175.9	450.3
Bertie	564.4	*	*	158.6	217.8
Bladen	573.2	180.2	*	171.7	170.9
Brunswick	306.8	70.9	103.5	131.6	156.9
Buncombe [§]	250.5	75.0	49.5	129.5	272.6
Burke	218.1	74.9	36.2	103.4	148.7
Cabarrus	280.8	117.0	50.8	110.9	235.4

Table 4. Continued

County	Age 0-4 2002-2004	Age 5-14 2002-2004	Age 15-34 2002-2004	Age 35-64 2002-2004	Age 65+ 2002-2004
Caldwell	578.3	136.2	63.8	91.2	155.3
Camden	*	*	*	*	*
Carteret	757.5	172.7	*	107.7	177.3
Caswell	*	*	*	*	*
Catawba	244.6	76.2	*	64.4	118.2
Chatham	*	*	*	42.0	*
Cherokee	*	*	*	99.1	189.4
Chowan	*	*	*	126.8	*
Clay	*	*	N/A	*	*
Cleveland	521.8	87.3	74.2	167.6	270.4
Columbus	894.9	265.5	117.6	171.7	179.6
Craven	273.9	121.5	58.7	190.0	254.6
Cumberland [§]	589.1	204.3	49.9	118.0	146.5
Currituck	*	*	*	117.4	*
Dare	*	*	*	117.0	*
Davidson [§]	326.4	79.8	51.2	121.0	166.3
Davie	*	*	*	96.5	232.0
Duplin	460.1	159.4	52.9	96.9	201.7
Durham [§]	245.3	140.2	32.2	95.9	190.6
Edgecombe	777.5	287.4	124.4	300.0	226.3
Forsyth [§]	159.8	83.2	48.4	131.7	137.4
Franklin	380.8	150.6	52.8	115.9	292.3
Gaston [§]	463.7	145.8	41.0	114.5	211.9
Gates	*	*	*	*	*
Graham	*	*	*	*	*
Granville	364.2	105.3	*	168.5	152.7
Greene	*	*	*	160.0	*
Guilford [§]	276.1	90.0	50.9	119.0	152.5
Halifax	709.6	197.2	94.0	317.4	305.4
Harnett	383.5	143.5	68.3	161.4	194.3
Haywood	307.5	*	82.3	131.4	204.6
Henderson	184.0	111.9	72.7	136.8	311.2
Hertford	*	*	*	192.9	215.5
Hoke	347.0	119.1	*	133.9	*
Hyde	*	N/A	*	*	*
Iredell	685.7	168.7	78.8	200.1	400.2
Jackson	607.1	*	*	143.7	164.9
Johnston	277.6	109.0	65.9	205.9	236.4
Jones	*	*	*	272.0	*
Lee	208.6	151.7	68.7	195.2	195.4
Lenoir	1012.5	292.6	158.4	280.0	247.5

Table 4. Continued

County	Age 0-4 2002-2004	Age 5-14 2002-2004	Age 15-34 2002-2004	Age 35-64 2002-2004	Age 65+ 2002-2004
Lincoln	522.4	86.0	65.8	99.3	180.3
McDowell	*	*	*	58.9	150.0
Macon	*	*	*	94.2	*
Madison	*	*	*	97.3	262.3
Martin	824.5	437.8	147.4	479.1	623.2
Mecklenburg [§]	327.1	137.5	42.4	121.0	251.7
Mitchell	*	*	*	*	*
Montgomery	579.7	*	*	99.7	*
Moore	208.4	99.5	40.3	143.7	184.0
Nash	423.2	210.6	97.2	178.6	289.6
New Hanover [§]	283.8	116.6	53.9	67.7	123.1
Northhampton	*	258.4	*	153.5	211.0
Onslow [§]	329.7	121.1	38.9	158.3	282.1
Orange	163.5	68.6	28.7	36.7	84.0
Pamlico	*	*	*	134.6	*
Pasquotank	932.5	229.2	83.5	251.5	510.6
Pender	*	*	*	97.1	108.6
Perquimans	*	*	*	244.1	482.2
Person	544.8	*	*	97.0	*
Pitt	274.4	112.8	38.7	102.2	282.7
Polk	*	*	*	116.7	*
Randolph	330.4	99.8	51.7	82.9	150.1
Richmond	694.4	375.7	235.3	473.7	379.4
Robeson	873.3	195.1	123.7	417.7	708.6
Rockingham	544.1	187.4	84.8	216.6	275.4
Rowan	304.8	77.8	47.2	105.2	92.9
Rutherford	275.4	*	57.8	177.7	217.0
Sampson	320.8	148.6	87.5	210.7	125.0
Scotland	566.5	198.9	154.7	276.7	353.8
Stanly	606.2	153.7	67.4	146.3	212.8
Stokes	*	*	*	72.0	*
Surry	264.9	72.4	66.4	160.8	330.1
Swain	923.3	*	*	166.6	*
Transylvania	*	*	*	88.4	*
Tyrrell	*	*	N/A	*	*
Union	411.7	126.1	31.1	88.9	201.7
Vance	341.4	117.8	121.7	272.5	280.2
Wake [§]	190.9	121.1	34.1	78.8	170.4
Warren	*	*	*	185.0	205.2
Washington	*	*	*	247.7	*
Watauga	497.9	210.3	*	81.2	310.5

Table 4. Continued

County	Age 0-4 2002-2004	Age 5-14 2002-2004	Age 15-34 2002-2004	Age 35-64 2002-2004	Age 65+ 2002-2004
Wayne	297.4	137.5	76.8	182.4	205.9
Wilkes	328.7	107.9	75.8	144.7	217.3
Wilson	399.6	203.5	67.7	146.4	281.4
Yadkin	*	*	*	97.4	*
Yancey	*	*	*	*	*

§-denotes counties considered Urban

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

Data Source: North Carolina State Center for Health Statistics, 2002-2005

Table 5. Lifetime and Current Asthma Prevalence by County and Region, North Carolina, 2001-2005
(Note: Unless marked with *, prevalence is based on a numerator less than 50, interpret with caution.)

County	Lifetime/ Current Asthma Prevalence (%) 2001		Lifetime/ Current Asthma Prevalence (%) 2002		Lifetime/ Current Asthma Prevalence (%) 2003		Lifetime/ Current Asthma Prevalence (%) 2004		Lifetime/ Current Asthma Prevalence (%) 2005	
	Alamance	•	•	•	•	•	•	14.3*	8.8	9.6	4.8
Alexander (w/ Burke, Caldwell, Cleveland, Lincoln)	•	•	•	•	•	•	•	•	10.2*	5.7
Alleghany* (w/ Wilkes)	•	•	•	•	6.7	4.2	•	•	8.2 ⁱ	3.5 ^j
Anson (w/ Hoke, Montgomery, Richmond, Scotland, Stanly)	•	•	•	•	•	•	•	•	13.7*	8.9
Ashe* (w/ Wilkes)	•	•	•	•	6.7	4.2	•	•	8.2 ⁱ	3.5 ^j
Avery	•	•	•	•	•	•	•	•	8.2 ⁱ	3.5 ^j
Bladen (w/ Columbus & Sampson)	•	•	•	•	12.8*	7.8	•	•	10.1 ^c	6.6 ^c
Brunswick (w/ Bladen, Columbus, Pender)	•	•	•	•	•	•	•	•	10.1	6.6
Buncombe [§]	11.2	6.5	13.4*	7.3	14.2*	7	16.3*	8.5	14.9*	10.0*
Burke (w/ Alexander, Caldwell, Cleveland, Lincoln)	•	•	•	•	•	•	•	•	10.2*	5.7

Table 5. Continued

County	Lifetime/ Current Asthma Prevalence (%) 2001		Lifetime/ Current Asthma Prevalence (%) 2002		Lifetime/ Current Asthma Prevalence (%) 2003		Lifetime/ Current Asthma Prevalence (%) 2004		Lifetime/ Current Asthma Prevalence (%) 2005	
Cabarrus	•	•	•	•	•	•	11.2	6	12.7*	8.5
Caldwell (w/ Alexander, Burke, Cleveland, Lincoln)	•	•	•	•	•	•	•	•	10.2*	5.7
Carteret (w/ Currituck, Craven, Dare, Hyde, & Pamlico)	•	•	•	•	•	•	10.3	6.9	9.2	7.2
Caswell (w/ Granville, Person, Vance)	•	•	•	•	•	•	•	•	11.5*	8.7
Catawba	•	•	•	•	•	•	9.5	5.6	10.7*	8.0
Chatham (w/ Lee)	•	•	•	•	6.7	4.3	•	•	7.3 ^{g*}	3.9 ^g
Cleveland (w/ Alexander, Burke, Caldwell, Lincoln)	•	•	•	•	•	•	•	•	10.2	5.7
Columbus (w/ Bladen & Sampson)	•	•	•	•	12.8*	7.8	•	•	10.1 ^c	6.6 ^c
Craven (w/ Pamlico)	•	•	•	•	13.6*	10.3	10.3 ^b	6.9 ^b	9.2 ^b	7.2 ^b
Cumberland [§]	7.5	4.5	•	•	•	•	14.7*	10.2	9.7	7.9
Currituck (w/ Carteret, Craven, Dare, Hyde, Pamlico)	•	•	•	•	•	•	10.3	6.9	9.2	7.2
Dare (w/ Carteret, Currituck, Craven, Dare, Hyde, Pamlico)	•	•	•	•	•	•	10.3	6.9	9.2	7.2
Davidson [§]	•	•	•	•	•	•	12.1	7.8	7.6	4.0
Davie (w/ Rockingham, Stokes, Surry, Yadkin)	•	•	•	•	•	•	•	•	7.1	5.1
Duplin (w/ Greene, Harnett, Jones, Lenoir, Sampson, Wayne)	•	•	•	•	•	•	•	•	9.0	7.1
Durham [§]	10.8	6.8	•	•	•	•	13*	5.4	9.7*	6.5

Table 5. Continued

County	Lifetime/ Current Asthma Prevalence (%) 2001		Lifetime/ Current Asthma Prevalence (%) 2002		Lifetime/ Current Asthma Prevalence (%) 2003		Lifetime/ Current Asthma Prevalence (%) 2004		Lifetime/ Current Asthma Prevalence (%) 2005	
Forsyth [§]	12.6*	8	7.7*	5	•	•	10.5	5.7	9.0*	4.4
Franklin (w/ Granville & Vance)	•	•	•	•	8.3*	5.8	14 ^c	10.1 ^c	8.4 ^c	5.6 ^c
Gaston [§]	6.8	5.4	•	•	•	•	14.2	9.4	13.4*	7.4
Graham (w/ Jackson & Swain)	•	•	•	•	12*	6.2	•	•	•	•
Granville (w/ Franklin & Vance)	•	•	•	•	8.3*	5.8	•	•	11.5 ^{f*}	8.7 ^f
Greene (w/ Duplin, Harnett, Jones, Lenoir, Sampson, Wayne)	•	•	•	•	•	•	•	•	9.0	7.1
Guilford [§]	10.2	5.9	12.8*	5.9	13.6*	7.9	11*	6.3	11.2*	8.5
Harnett (w/ Duplin, Greene, Jones, Lenoir, Sampson, Wayne)	•	•	•	•	•	•	•	•	9.0	7.1
Henderson (w/ Transylvania)	•	•	8.8*	4.2	•	•	•	•	•	•
Hoke (w/ Robeson & Scotland)	•	•	•	•	9.5*	7.5	•	•	13.7 ^{h*}	8.9 ^h
Hyde (w/ Carteret, Currituck, Craven, Dare, Hyde, & Pamlico)	•	•	•	•	•	•	10.3	6.9	9.2	7.2
Iredell	•	•	•	•	•	•	11.8	6.9	9.3	5.3
Jackson (w/ Graham & Swain)	•	•	•	•	12*	6.2	•	•	•	•
Johnston	•	•	•	•	•	•	11.3*	7.7	10.7	6.1
Jones (w/ Duplin, Greene, Harnett, Lenoir, Sampson, Wayne)									9.0	7.1
Lee (w/ Chatham)	•	•	•	•	6.7	4.3	•	•	7.3 ^g	3.9 ^g
Lenoir (w/ Duplin, Greene, Harnett, Jones, Sampson, Wayne)	•	•	•	•	•	•	•	•	9.0	7.1
Lincoln (w/ Alexander, Burke, Caldwell, Cleveland)	•	•	•	•	•	•	•	•	10.2*	5.7

Table 5. Continued

County	Lifetime/ Current Asthma Prevalence (%) 2001		Lifetime/ Current Asthma Prevalence (%) 2002		Lifetime/ Current Asthma Prevalence (%) 2003		Lifetime/ Current Asthma Prevalence (%) 2004		Lifetime/ Current Asthma Prevalence (%) 2005	
Mecklenburg [§]	7.2	5.3	10.6*	5.5	6.8	3.5	12.3*	6.6	11.7*	6.9*
Montgomery (w/ Anson, Hoke, Richmond, Scotland, Stanly)	•	•	•	•	•	•	•	•	13.7*	8.9
Moore (w/ Chatham and Lee)	•	•	•	•	•	•	•	•	7.3	3.9
Nash (w/ Wilson)	•	•	•	•	12.2	7.3	14 ^c	10.1 ^c	8.4 ^c	5.6 ^c
New Hanover [§]	9.7	6.4	•	•	•	•	11.4	5.2	10.4	4.8
Onslow [§]	10.1	5.5	•	•	•	•	12.7*	7.8	12.4*	5.3
Orange	•	•	10.9*	5.6	15.3	8.9	13.8*	9.5	8.2	5.2
Pamlico (w/ Craven)	•	•	•	•	13.6*	10.3	10.3 ^b	6.9 ^b	9.2 ^b	7.2 ^b
Pender (w/ Bladen, Brunswick, Columbus)	•	•	•	•	•	•	•	•	10.1	6.6
Person (w/ Caswell, Granville, Vance)	•	•	•	•	•	•	•	•	11.5*	8.7
Pitt	•	•	9.7	4.8	•	•	9.4	6	9.6	5.2
Randolph	•	•	10.1	5.6	•	•	12.2	8.7	11.4*	6.1
Richmond (w/ Anson, Hoke, Montgomery, Scotland, Stanly)	•	•	•	•	•	•	•	•	13.7	8.9
Robeson	•	•	12.3*	7.5	9.5 ^{a*}	7.5 ^a	16.9*	11.1	11.1*	6.9
Rockingham (w/ Davie, Stokes, Surry, Yadkin)	•	•	•	•	•	•	•	•	7.1	5.1
Rowan	•	•	•	•	•	•	13.4*	9.2	12.0	9.5
Sampson (w/ Bladen & Columbus)	•	•	•	•	12.8*	7.8	•	•	9.0 ^d	7.1 ^d
Scotland (w/ Hoke & Robeson)	•	•	•	•	9.5*	7.5	•	•	13.7 ^{h*}	8.9 ^h

County	Lifetime/ Current Asthma Prevalence (%) 2001		Lifetime/ Current Asthma Prevalence (%) 2002		Lifetime/ Current Asthma Prevalence (%) 2003		Lifetime/ Current Asthma Prevalence (%) 2004		Lifetime/ Current Asthma Prevalence (%) 2005	
Stanly (w/ Anson, Hoke, Montgomery, Richmond, Scotland)	13.7*	8.9
Stokes (w/ Surry & Yadkin)	12.6*	6.6	.	.	7.1 ⁱ	5.1 ⁱ
Surry (w/ Stokes & Yadkin)	12.6*	6.6	.	.	7.1 ⁱ	5.1 ⁱ
Swain (w/ Graham & Jackson)	12	6.2	.	.	.	.
Transylvania (w/ Henderson)	.	.	8.8*	4.2	.	.	.	.	.	.
Union	14.7*	9.8	11.2	5.0
Vance (w/ Franklin & Granville)	8.3*	5.8	.	.	11.5 ^f *	8.7 ^f
Wake ^s	9.1	6.5	10.8	4.7	9.4	6	11.2*	6.6	7.6*	5.2*
Watauga* (w/ Wilkes)	6.7	4.2	.	.	8.2 ⁱ	3.5 ^j
Wayne (w/ Duplin, Greene, Harnett, Jones, Lenoir, Sampson)	9.0	7.1
Wilkes (w/ Appalachian)	6.7	4.2	.	.	8.2 ⁱ	3.5 ^j
Wilson (w/ Nash)	12.2	7.3	14 ^c	10.1 ^c	8.4 ^c	5.6 ^c
Yadkin (w/ Stokes & Surry)	12.6*	6.6	.	.	7.1 ⁱ	5.1 ⁱ

*Appalachian Health District includes Alleghany, Ashe, and Watauga counties.

^a2003 Robeson prevalence calculated with Hoke and Scotland counties.

^b2004, 2005 Craven and Pamlico prevalence calculated with Carteret, Currituck, Dare, and Hyde.

^c2004, 2005 Franklin, Nash, and Wilson prevalence are calculated together.

^d2005 Sampson prevalence calculated with Duplin, Greene, Harnett, Jones, Lenoir, Sampson, and Wayne.

^e2005 Bladen and Columbus prevalence calculated with Brunswick and Pender.

^f2005 Caswell, Granville, Person, and Vance were calculated together

^g2005 Chatham, Lee, and Moore were calculated together

^h2005 Anson, Hoke, Montgomery, Richmond, Scotland, and Stanly were calculated together

ⁱ2005 Davie, Rockingham, Stokes, Surry, and Yadkin were calculated together.

^j2005 Appalachian Health District (Alleghany, Ashe, Watauga) were calculated with Avery and Wilkes.

•Data unavailable

Data Source: BRFSS, North Carolina, 2001-2005

The following counties are not included in this table because they have no specific asthma

prevalence data over the past 5 years: Beaufort, Bertie, Camden, Cherokee, Chowan, Clay, Edgecombe, Gates, Halifax, Henderson, Hertford, Macon, Madison, Martin, McDowell, Mitchell, Northhampton, Pasquotank, Perquimans, Polk, Rutherford, Tyrell, Warren, Washington, Yancy.

The BRFSS has used 37 different geographical strata since 2004. 22 of these strata are single counties which have the largest N.C. populations. This design allows for county level estimates on these 22 over sampled counties. The remaining 78 counties were grouped into 13 clusters of multi-county groups. The two primary factors used to determine these groups were population size and geographic contiguity. In some cases, counties that share health information were grouped together like the Mountain AHEC, for example. Other counties were grouped using cluster analysis. The remaining two strata were formed from 2 census tracts that contained a high proportion of American Indian households in order to allow for over sampling of American Indian populations in order to have a more representative sample.

Appendix E:
Regional Specific Data



Appendix E. Regional Specific Data[§]

Table 1. Mortality Rates (per 1,000,000) Due to Asthma as a Primary Cause of Death, by Region, North Carolina, 1999 – 2004

Rate	2000	2001	2002	2003	2004	Total*
Eastern	19.6	22.8	18.4	15.4	19.1	96.5
Piedmont	13.2	11.9	9.4	13.4	11.2	58.9
Western	20.5	24.9	18.4	17.3	9.1	90.5

*2000-2004 combined

Data Source: North Carolina State Center for Health Statistics Detailed Mortality Statistics, 1999-2004

Table 2. Lifetime and Current Asthma Prevalence, by Region, North Carolina, 2001-2005

Region	Lifetime/ Current Asthma Prevalence (%) 2001		Lifetime/ Current Asthma Prevalence (%) 2002		Lifetime/ Current Asthma Prevalence (%) 2003		Lifetime/ Current Asthma Prevalence (%) 2004		Lifetime/ Current Asthma Prevalence (%) 2005	
	Eastern	11.5	7.2	10.4	6.8	12.2	8.3	13.3	8.1	9.6	6.4
Piedmont	10.8	6.9	11.8	7.6	10.6	6.3	11.9	7	10.0	6.3
Western	8.3	4.9*	9.9	6*	12.4	7.9	15.5	8.6	11.3	7.3

*Prevalence based on a numerator less than 50, interpret with caution

Data Source: BRFSS, North Carolina, 2001-2005

§Note: The three regions include the following counties:

Eastern: Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Cumberland, Currituck, Dare, Duplin, Edgecombe, Gates, Greene, Halifax, Harnett, Hertford, Hoke, Hyde, Johnston, Jones, Lenoir, Martin, Nash, New Handover, Northampton, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Pitt, Robeson, Sampson, Scotland, Tyrell, Washington, Wayne, and Wilson

Piedmont: Alamance, Alexander Anson, Cabarrus, Caswell, Catawba, Chatham, Cleveland, Davidson, Davie, Durham, Forsyth, Franklin, Gaston, Granville, Guilford, Iredell, Lee, Lincoln, Mecklenburg, Montgomery, Moore, Orange, Person, Randolph, Richmond, Rockingham, Rowan, Stanly, Stokes, Union, Vance, Wake, Warren, and Yadkin.

Western: Alleghany, Ashe, Avery, Buncombe, Burke, Caldwell, Cherokee, Clay, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Surry, Swain, Transylvania, Watauga, Wilkes, and Yancey.

Appendix F:
Youth Risk Behavior Survey – YRBS



APPENDIX F. Youth Risk Behavior Survey – YRBS

Middle School

Due to the fact that the 60% combined student and school participation response rates were not met for middle school in North Carolina (response rate was 58%), the data was not weighted, and therefore 95% confidence intervals were not provided.

Table 1. Lifetime Asthma Prevalence Among Middle School Students by Age, Grade, Race, and Sex, North Carolina, YRBS¹, 2005

	Total Percent (Count)	Males Percent (Count)	Females Percent (Count)
Total	18.6% (3,482)	19.4% (1669)	17.7% (1806)
AGE			
Age ≤ 11	17.8% (382)	21.4% (145)	14.9% (235)
Age 12	16.6% (957)	18% (434)	15.5% (523)
Age 13	19% (1,145)	19.9% (528)	18.3% (616)
Age ≥ 14	20.5% (995)	19.6% (561)	21.1% (431)
GRADE			
6 th Grade	18.2% (1,007)	20% (451)	16.3% (553)
7 th Grade	18.6% (1,168)	20.8% (558)	16.6% (609)
8 th Grade	19% (1,271)	17.8% (640)	20.1% (631)
RACE/ETHNICITY			
African American	21.8% (789)	23.0% (387)	20.5% (400)
Hispanic/Latino	13.7% (249)	16.2% (117)	10.7% (131)
White	18% (1,979)	18.5% (962)	17.4% (1,016)
All Other Races	16.7% (252)	14.8% (108)	16.9% (142)
Multiple Races	20.6% (199)	*	19.3% (109)

¹Data is unweighted due to the fact that the 60% combined student and school participation response rates were not met.

*fewer than 100 cases

Data Source: YRBS, North Carolina, 2005

Table 2. Current Asthma Prevalence Among Middle School Students by Age, Grade, Race, and Sex, North Carolina, YRBS¹, 2005

	Total Percent (Count)	Males Percent (Count)	Females Percent (Count)
Total	15.2% (3,455)	15.2% (1,654)	15.1% (1,794)
AGE			
Age ≤ 11	13.6% (382)	17.2% (145)	10.6% (235)
Age 12	14.1% (945)	14.5% (429)	13.8% (516)
Age 13	15.4% (1,138)	14.9% (524)	15.8% (613)
Age ≥ 14	16.7% (987)	15.7% (555)	17.9% (429)
GRADE			
6 th Grade	14.4% (999)	16% (449)	12.8% (547)
7 th Grade	15% (1,155)	15.3% (550)	14.7% (604)
8 th Grade	16% (1,266)	14.6% (636)	17.5% (630)
RACE/ETHNICITY			
African American	17.8% (782)	17.2% (383)	18.1% (397)
Hispanic/Latino	10.6% (245)	13% (115)	8.5% (129)
White	14.9% (1,966)	14.5% (956)	15.3% (1,009)
All Other Races	13.9% (251)	13.1% (107)	13.4% (142)
Multiple Races	14.7% (197)	*	11.9% (109)

¹Data is unweighted due to the fact that the 60% combined student and school participation response rates were not met

*Fewer than 100 cases

Data Source: YRBS, North Carolina, 2005

YRBS By Region

The following YRBS tables (3, 4, 5, 6) are regional numbers for the eastern, piedmont, and western regions of the state. The regions that the YRBS uses are slightly different from the regions shown in the regional specific data section of Appendix E. The regions are shown at the end of this section.

Table 3. Lifetime Asthma Prevalence for Middle Students, by Region^{1,2}, North Carolina, 2005

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
Eastern Region			
Total	19.4% (16.6,22.2)	18.8% (14.8, 22.7)	19.8% (16.2, 23.4)
AGE			
Age ≤ 11	17.4% (7.8, 27.0)	*	*
Age 12	16.1% (11.9, 20.4)	16.4% (9.5, 23.3)	15.8% (10.9, 20.8)
Age 13	21.1% (17.4, 24.8)	20.2% (15.1, 25.4)	22.1% (16.5, 27.7)
Age ≥ 14	21.8% (18.0, 25.6)	19.0% (14.9, 23.0)	25.2% (18.1, 32.3)
GRADE			
6 th Grade	18.7% (13.7, 23.7)	19.7% (11.2, 28.2)	16.7% (11.4, 21.9)
7 th Grade	19.4% (15.2, 23.5)	19.7% (14.2, 25.2)	19.1% (13.8, 24.5)
8 th Grade	20.5% (16.0, 25.0)	17.7% (12.3, 23.2)	23.4% (15.5, 31.2)
RACE/ETHNICITY			
African American	21.7% (17.4, 26.0)	23.5% (16.9, 30.1)	19.5% (13.6, 25.4)
Hispanic/Latino	10.0% (5.2, 14.7)	*	*
White	18.4% (14.6, 22.1)	16.5% (11.6, 21.4)	20.6% (16.1, 25.1)
All Other Races	*	*	*
Multiple Races	*	*	*
Central (Piedmont) Region			
Total	16.5%	19.0%	13.8%
AGE			
Age ≤ 11	*	*	*
Age 12	14.6%	18.0%	11.9%
Age 13	15.7%	16.7%	14.8%
Age ≥ 14	20.3%	23.6%	*
GRADE			
6 th Grade	13.0%	15.7%	9.2%
7 th Grade	19.1%	23.5%	15.1%
8 th Grade	17.3%	17.7%	17.0%
RACE/ETHNICITY			
African American	18.6%	19.4%	17.6%
Hispanic/Latino	*	*	*
White	17.5%	21.6%	13.8%
All Other Races	14.7%	*	*
Multiple Races	*	*	*

Table 3. Continued

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
Western Region			
Total	18.9% (15.5, 22.3)	20.7% (16.6, 24.8)	16.9% (12.8, 21.0)
AGE			
Age ≤ 11	22.3% (17.0, 27.7)	*	17.7% (8.7, 26.7)
Age 12	17.6% (11.3, 23.9)	18.8% (12.7, 24.9)	16.4% (7.4, 25.4)
Age 13	18.8% (14.9, 22.7)	20.1% (13.8, 26.4)	17.7% (12.3, 23.2)
Age ≥ 14	18.9% (13.8, 24.0)	20.9% (12.5, 29.2)	15.7% (10.2, 21.2)
GRADE			
6 th Grade	22.4% (16.1, 28.6)	23.7% (17.7, 29.8)	21.0% (13.0, 29.1)
7 th Grade	16.7% (12.2, 21.1)	19.4% (12.0, 26.8)	13.8% (9.4, 18.3)
8 th Grade	18.0% (14.1, 21.9)	19.3% (13.2, 25.4)	16.7% (12.0, 21.4)
RACE/ETHNICITY			
African American	*	*	*
Hispanic/Latino	*	*	*
White	17.7% (13.4, 22.0)	19.3% (14.1, 24.4)	16.0% (11.6, 20.4)
All Other Races	*	*	*
Multiple Races	*	*	*

¹Department of Public Instructions regions differ slightly in their designation from the other regions displayed in this report.

²Eastern and Western regions had enough responses to weight the data, the Central (Piedmont) region did not, so the data is unweighted (therefore, no 95% confidence intervals are available).

Data Source: YRBS, North Carolina, 2005

Table 4. Lifetime Asthma Prevalence for High School Students, by Region^{1,2}, North Carolina, 2005

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
Eastern Region			
Total	18.0% (15.2, 20.9)	18.6% (14.9, 22.2)	17.4% (14.4, 20.3)
AGE			
Age ≤ 15	17.6% (15.1, 20.0)	18.0% (14.5, 21.5)	17.9% (13.6, 20.8)
Age 16 or 17	17.5% (14.0, 21.0)	19.1% (15.8, 22.4)	15.9% (10.2, 21.6)
Age ≥ 18	20.7% (9.2, 32.2)	*	*
GRADE			
9 th Grade	17.5% (14.2, 20.8)	19.0% (14.5, 23.5)	16.0% (11.2, 20.8)
10 th Grade	18.0% (13.2, 22.8)	19.1% (13.2, 25.0)	16.8% (11.3, 22.3)
11 th Grade	17.5% (12.3, 22.7)	17.2% (11.0, 23.4)	17.1% (10.6, 23.6)
12 th Grade	19.1% (10.4, 27.8)	*	*
RACE/ETHNICITY			
African American	22.1% (18.8, 25.3)	24.0% (18.3, 29.8)	20.0% (16.1, 23.8)
Hispanic/Latino	*	*	*
White	15.7% (12.5, 18.8)	15.6% (11.4, 19.7)	15.8% (11.6, 20.0)
All Other Races	*	*	*
Multiple Races	*	*	*

Table 4. Continued

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
Central (Piedmont) Region			
Total	21.0% (17.8, 24.1)	23.3% (19.4, 27.2)	18.8% (14.9, 22.7)
AGE			
Age ≤ 15	21.2% (16.0, 26.4)	27.5% (19.2, 35.9)	15.7% (11.5, 20.0)
Age 16 or 17	21.5% (19.0, 24.1)	22.7% (18.6, 26.8)	20.4% (15.8, 25.0)
Age ≥ 18	18.0% (4.9, 31.1)	*	*
GRADE			
9 th Grade	22.2% (18.5, 25.9)	27.1% (19.3, 34.9)	17.2% (10.8, 23.5)
10 th Grade	20.9% (14.1, 27.7)	27.4% (19.6, 35.2)	14.4% (8.5, 20.3)
11 th Grade	19.8% (14.1, 25.5)	21.6% (16.6, 26.7)	18.5% (9.9, 27.1)
12 th Grade	19.4% (9.9, 29.0)	*	*
RACE/ETHNICITY			
African American	31.4% (22.1, 40.8)	35.2% (22.8, 47.6)	28.5% (17.7, 39.3)
Hispanic/Latino	17.9% (11.2, 24.5)	*	*
White	15.3% (12.4, 18.1)	16.8% (13.2, 20.5)	13.8% (10.1, 17.5)
All Other Races	*	*	*
Multiple Races	*	*	*
Western Region			
Total	19.6% (17.6, 21.7)	20.3% (17.6, 23.0)	18.7% (15.5, 22.0)
AGE			
Age ≤ 15	21.0% (18.2, 23.8)	22.2% (18.5, 26.0)	19.3% (15.0, 23.6)
Age 16 or 17	19.4% (16.0, 22.8)	19.8% (15.5, 24.2)	19.0% (14.1, 23.9)
Age ≥ 18	16.5% (10.8, 22.1)	*	*
GRADE			
9 th Grade	19.7% (17.0, 22.4)	19.6% (16.2, 22.9)	19.8% (14.2, 25.4)
10 th Grade	20.6% (16.5, 24.8)	22.2% (16.1, 28.3)	19.1% (13.5, 24.6)
11 th Grade	17.1% (12.4, 21.8)	20.3% (13.0, 27.6)	13.9% (7.8, 20.0)
12 th Grade	20.3% (14.9, 25.6)	18.6% (10.4, 26.7)	21.9% (14.1, 29.7)
RACE/ETHNICITY			
African American	21.5% (15.1, 28.0)	*	*
Hispanic/Latino	*	*	*
White	19.5% (17.1, 21.9)	20.0% (17.1, 22.9)	18.7% (15.2, 22.3)
All Other Races	*	*	*
Multiple Races	*	*	*

¹Data is weighted

*Fewer than 100 cases

Data Source: YRBS, North Carolina, 2005

Table 5. Current Asthma Prevalence for Middle Students, by Region^{1,2}, North Carolina, 2005

	Total Percent (95% CI)	Males Percent (95% CI)	Females Percent (95% CI)
Eastern Region			
Total	15.9% (13.5, 18.3)	14.7% (11.3, 18.2)	16.8% (14.0, 19.7)
AGE			
Age ≤ 11	15.2% (6.8, 23.6)	*	*
Age 12	14.6% (10.4, 18.9)	13.9% (7.7, 20.1)	15.5% (10.5, 20.5)
Age 13	15.9% (12.4, 19.5)	14.0% (10.0, 17.9)	17.9% (13.2, 22.5)
Age ≥ 14	17.6% (13.3, 21.8)	15.4% (10.5, 20.3)	20.1% (14.3, 25.9)
GRADE			
6 th Grade	15.7% (11.4, 20.1)	15.9% (8.7, 23.1)	14.6% (9.4, 19.8)
7 th Grade	15.0% (11.4, 18.5)	14.0% (10.2, 17.8)	16.0% (10.6, 21.5)
8 th Grade	17.3% (12.9, 21.8)	14.8% (9.4, 20.2)	19.9% (13.6, 26.2)
RACE/ETHNICITY			
African American	17.8% (14.2, 21.4)	17.5% (12.0, 22.9)	17.5% (12.4, 22.6)
Hispanic/Latino	8.3% (4.5, 12.1)	*	*
White	15.4% (12.2, 18.6)	13.3% (9.3, 17.4)	17.9% (14.4, 21.4)
All Other Races	*	*	*
Multiple Races	*	*	*
Central (Piedmont) Region			
Total	13.6%	14.6%	12.5%
AGE			
Age ≤ 11	*	*	*
Age 12	13.5%	16.2%	11.2%
Age 13	13.6%	13.5%	13.6%
Age ≥ 14	16.1%	16.9%	*
GRADE			
6 th Grade	10.0%	12.6%	7.1%
7 th Grade	15.8%	17.9%	13.9%
8 th Grade	15.0%	13.6%	16.3%
RACE/ETHNICITY			
African American	15.5%	14.0%	17.0%
Hispanic/Latino	*	*	*
White	13.9%	16.1%	11.9%
All Other Races	13.8%	*	*
Multiple Races	*	*	*

Table 5. Continued

Western Region			
Total	15.6% (12.7, 18.5)	16.3% (12.7, 19.9)	14.9% (11.2, 18.6)
AGE			
Age ≤ 11	18.9% (14.8, 23.0)	*	13.2% (5.0, 21.3)
Age 12	14.0% (8.4, 19.5)	14.4% (8.7, 20.1)	13.5% (6.1, 21.0)
Age 13	15.2% (11.6, 18.7)	13.9% (8.2, 19.6)	16.2% (11.5, 20.9)
Age ≥ 14	16.4% (11.8, 21.0)	17.4% (10.3, 24.5)	15.2% (9.8, 20.6)
GRADE			
6 th Grade	18.0% (12.7, 23.4)	19.8% (14.2, 25.4)	16.3% (10.0, 22.7)
7 th Grade	13.3% (9.9, 16.7)	13.4% (9.0, 17.7)	13.2% (8.6, 17.8)
8 th Grade	15.9% (12.3, 19.6)	16.4% (10.8, 22.0)	15.5% (10.9, 20.0)
RACE/ETHNICITY			
African American	*	*	*
Hispanic/Latino	*	*	*
White	14.9% (11.2, 18.5)	15.2% (11.0, 19.3)	14.6% (10.3, 18.8)
All Other Races	*	*	*
Multiple Races	*	*	*

*Eastern and Western regions had enough responses to weight the data, the Central (Piedmont) region did not, and the data is unweighted (therefore, no 95% confidence intervals are available).
Data Source: YRBS, North Carolina, 2005

Table 6. Current Asthma Prevalence for High School Students, by Region^{1,2}, North Carolina, 2005

	Total Percent (Count)	Males Percent (Count)	Females Percent (Count)
Eastern Region			
Total	14.2% (11.7, 16.7)	13.0% (9.1, 16.8)	15.2% (12.6, 17.8)
AGE			
Age ≤ 15	14.6% (11.9, 17.3)	13.6% (10.4, 16.9)	15.6% (11.9, 19.3)
Age 16 or 17	13.1% (10.1, 16.0)	12.2% (8.1, 16.3)	13.9% (8.6, 19.2)
Age ≥ 18	16.2% (7.6, 24.9)	*	*
GRADE			
9 th Grade	14.0% (10.5, 17.4)	13.5% (9.4, 17.5)	14.6% (9.9, 19.3)
10 th Grade	14.0% (9.9, 18.1)	12.8% (7.9, 17.7)	15.2% (9.7, 20.7)
11 th Grade	13.1% (9.1, 17.0)	11.3% (6.6, 16.0)	13.9% (8.9, 19.0)
12 th Grade	15.6% (7.9, 23.3)	*	*
RACE/ETHNICITY			
African American	16.1% (13.7, 18.5)	14.8% (9.4, 20.1)	16.8% (13.1, 20.4)
Hispanic/Latino	*	*	*
White	13.4% (10.1, 16.7)	12.0% (7.2, 16.9)	14.8% (10.5, 19.2)
All Other Races	*	*	*
Multiple Races	*	*	*

Table 6. Continued

Central (Piedmont) Region			
Total	17.1% (14.8, 19.3)	17.4% (13.9, 21.0)	17.0% (13.5, 20.5)
AGE			
Age ≤ 15	17.9% (13.6, 22.1)	20.8% (13.6, 28.0)	15.5% (11.1, 20.0)
Age 16 or 17	17.2% (14.1, 20.2)	16.8% (13.6, 20.1)	17.6% (12.2, 23.0)
Age ≥ 18	14.4% (5.7, 23.1)	*	*
GRADE			
9 th Grade	18.9% (15.6, 22.3)	20.7% (13.4, 28.0)	17.1% (10.6, 23.6)
10 th Grade	16.8% (11.6, 22.0)	20.7% (14.7, 26.6)	13.1% (7.9, 18.3)
11 th Grade	16.3% (10.5, 22.2)	15.7% (9.8, 21.6)	17.3% (9.3, 25.2)
12 th Grade	15.2% (8.8, 21.5)	*	*
RACE/ETHNICITY			
African American	26.8% (19.6, 34.1)	26.8% (15.2, 38.4)	27.2% (18.5)
Hispanic/Latino	9.9% (2.9, 16.9)	*	*
White	12.9% (10.3, 15.4)	13.2% (9.4, 17.0)	12.6% (9.3, 15.8)
All Other Races	*	*	*
Multiple Races	*	*	*
Western Region			
Total	17.2% (15.0, 19.3)	17.3% (14.6, 20.0)	16.9% (13.7, 20.1)
AGE			
Age ≤ 15	18.1% (15.1, 21.1)	18.8% (14.7, 23.0)	16.9% (12.8, 21.0)
Age 16 or 17	17.2% (13.8, 20.6)	16.9% (13.0, 20.9)	17.4% (12.4, 22.4)
Age ≥ 18	14.7% (9.4, 19.9)	*	*
GRADE			
9 th Grade	16.8% (13.8, 19.8)	16.6% (12.7, 20.4)	17.1% (11.8, 22.4)
10 th Grade	18.0% (13.7, 22.3)	18.4% (12.5, 24.4)	17.5% (12.0, 23.0)
11 th Grade	14.8% (10.2, 19.4)	17.9% (10.9, 24.9)	11.8% (5.4, 18.2)
12 th Grade	18.5% (13.4, 23.6)	15.7% (8.0, 23.4)	21.2% (13.3, 29.0)
RACE/ETHNICITY			
African American	18.5% (11.8, 25.1)	*	*
Hispanic/Latino	*	*	*
White	17.0% (14.5, 19.4)	17.0% (14.2, 19.9)	16.7% (13.2, 20.2)
All Other Races	*	*	*
Multiple Races	*	*	*

*Data is weighted

*Fewer than 100 cases

Data Source: YRBS, North Carolina, 2005

Table 7. High School Students with Current Asthma who had an Episode of Asthma or an Asthma Attack During the past 12 Months, By Region, YRBS¹, 2005

	Eastern Region Percent (95% CI)	Central (Piedmont) Region Percent (95% CI)	Western Region Percent (95% CI)
Total	34.0% (27.3, 40.8)	30.0% (24.3, 35.8)	32.9% (27.3, 38.4)

¹Data is weighted
Data Source: YRBS, North Carolina, 2005

Note: The three YRBS regions include the following counties:

Eastern: Beaufort, Bertie, Bladen, Brunswick, Camden, Carteret, Chowan, Columbus, Craven, Currituck, Dare, Duplin, Edgecombe, Gates, Greene, Halifax, Hertford, Hyde, Johnston, Jones, Lenoir, Martin, Nash, New Handover, Northampton, Onslow, Pamlico, Pasquotank, Pender, Perquimans, Pitt, Sampson, Tyrell, Warren, Washington, Wayne, and Wilson

Piedmont: Alamance, Anson, Cabarrus, Caswell, , Chatham, Cumberland, Davidson, Davie, Durham, Forsyth, Franklin, Gaston, Granville, Guilford, Harnett, Hoke, Iredell, Lee, Lincoln, Mecklenburg, Montgomery, Moore, Orange, Person, Randolph, Richmond, Robeson, Rockingham, Rowan, Scotland, Stanly, Stokes, Surry, Union, Vance, Wake, and Yadkin.

Western: Alleghany, Alexander, Ashe, Avery, Buncombe, Burke, Caldwell, Catawba, Cherokee, Clay, Cleveland, Graham, Haywood, Henderson, Jackson, McDowell, Macon, Madison, Mitchell, Polk, Rutherford, Swain, Transylvania, Watauga, Wilkes, and Yancey.

Appendix G:
***North Carolina Annual School Health
Services Report For Public Schools:
Summary Report of School Nursing Services***



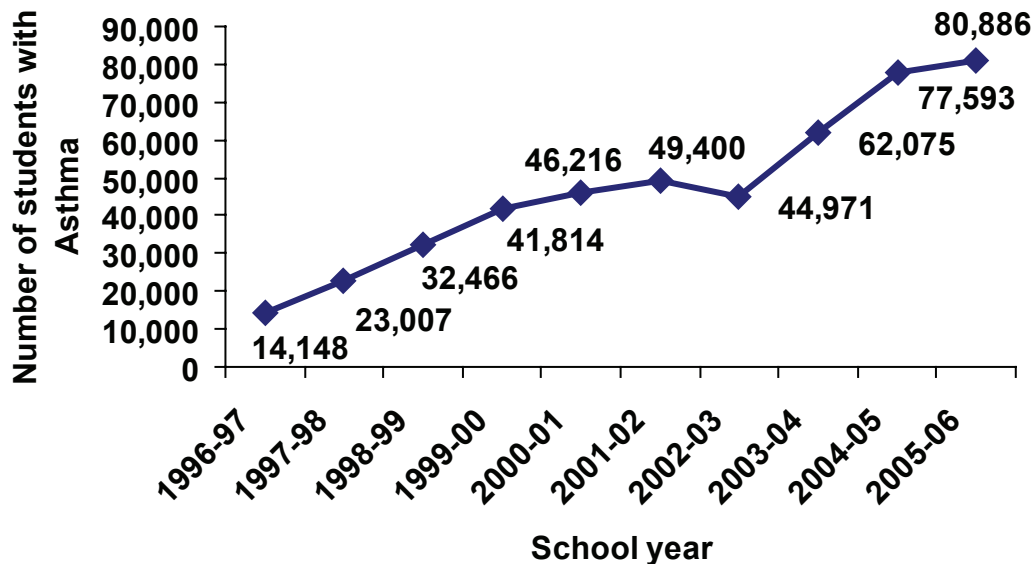
Appendix G. North Carolina Annual School Health Services Report For Public Schools: Summary Report of School Nursing Services

Another survey looking at asthma in school children is the North Carolina Annual 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 (inc. chronic disease and injuries), to gain a profile of the student to nurse ratio across the state, and to identify health policies in schools.¹

This survey contacts the 115 existing local education agencies (LEA). This is a decrease in LEA's across the state; until the 2004-2005 school year there were 117 LEA's. Since the 1997-1998 school year, a minimum of 95% of the LEA's responded to this survey, with the 2005-2006 school year reporting a 100% response rate.

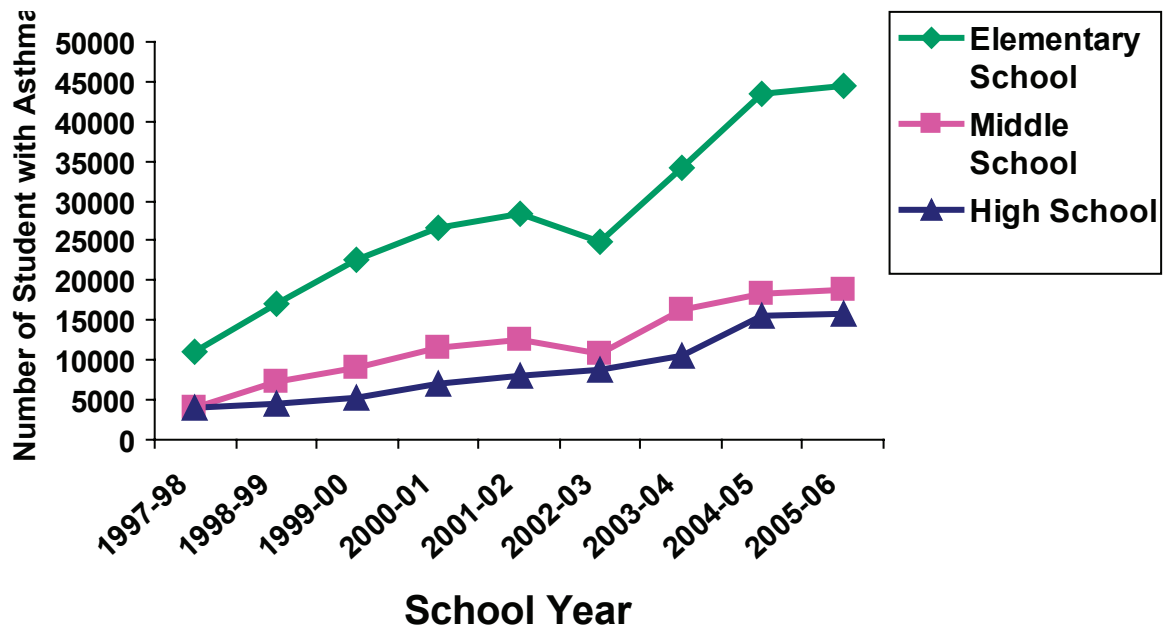
Number of Students with Asthma in Public Schools

Figure 1. Number of Students in Public Schools in North Carolina with Asthma, by School Year, 1996-2006.



Data Source: N.C. School Health Services Report for Public Schools 1996-2006

Figure 2. Number of Student in Public Schools in North Carolina with Current Asthma, by Grade Level, 1996-2006.



Data Source: N.C. School Health Services Report for Public Schools 1996-2006

Table 1. Prevalence of Current Asthma in Public Schools as Reported by School Nurses in the North Carolina Annual School Health Services Report, by School Level, North Carolina, 1996-2005

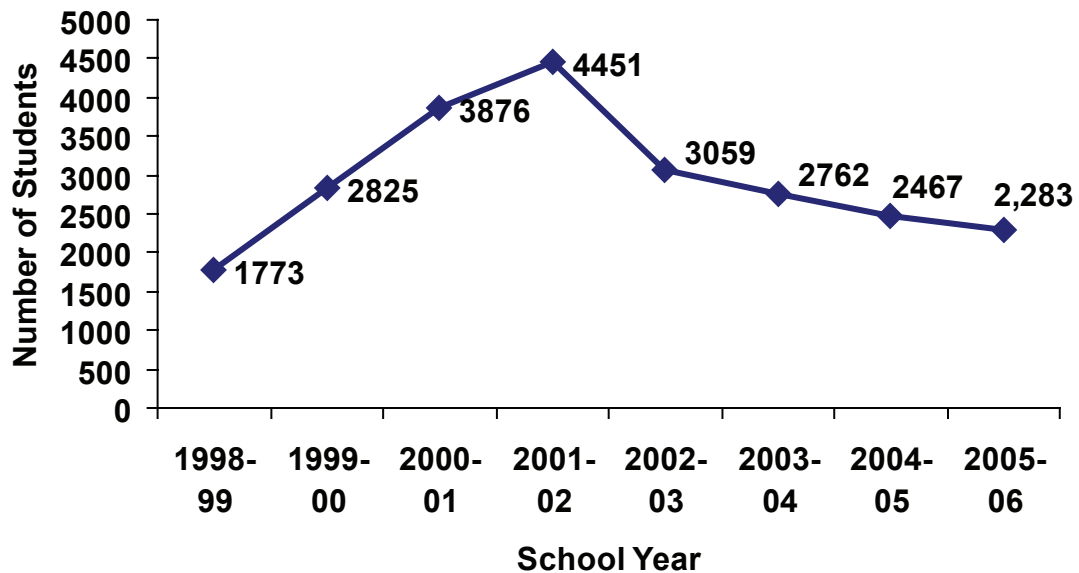
School Year	Elementary School	Middle School	High School	Grade Not	Total	Percent of Total Students with Asthma
1996-97	*	*	*	*	14,148	1.5%
1997-98	11,120	4,002	3,916	3,969	23,007	2.0%
1998-99	17,058	7,218	4,499	3,691	32,466	2.7%
1999-00	22,541	8,993	5,337	4,943	41,814	3.4%
2000-01	26,521	11,635	6,991	1,069	46,216	3.7%
2001-02	28,289	12,575	8,165	371	49,400	3.9%
2002-03	24,873	10,695	8,726	677	44,971	3.8%
2003-04	34,208	16,257	10,575	1,035	62,075	4.8%
2004-05	43,479	18,324	15,470	320	77,593	5.8%
2005-06	44,531	18,865	15,874	1,616	80,886	5.9%

Summary of Figure 1 and 2 and Table 1:

- Each year there are a number of students in North Carolina Public Schools who have asthma, but their grade level is unspecified.
- Because School nurses are not present full-time in the majority of North Carolina’s schools, the number of students with chronic conditions is likely to be under reported.
- Examining the column “percent of total students with asthma”, it is shown that the percent of public school students reported by the school nurse as having asthma is increasing. With the 2002 current asthma prevalence (according to the N.C. BRFSS) being 13.2% for children ≤ 17 years of age, and the 2005 current asthma prevalence (according to the N.C. CHAMP) for the same group being 11.5% (see figure 8 in the morbidity section), we see that the number of students with asthma shown in this survey are grossly under reported. More than half of the students in North Carolina Public Schools with current asthma are not identified to the school nurses. The number of students with actual asthma is potentially 2 times what is being reported here.

Asthma Management in Schools

Figure 3. Number of Students Participating in the “Open Airways” Asthma Management Curriculum.



Data Source: N.C. School Health Services Report for Public Schools, 1996-2006

The American Lung Association’s *Open Airways For Schools (OAS)* is an asthma management program for school children age 8-11 who have been diagnosed with asthma. The program’s goals are to:

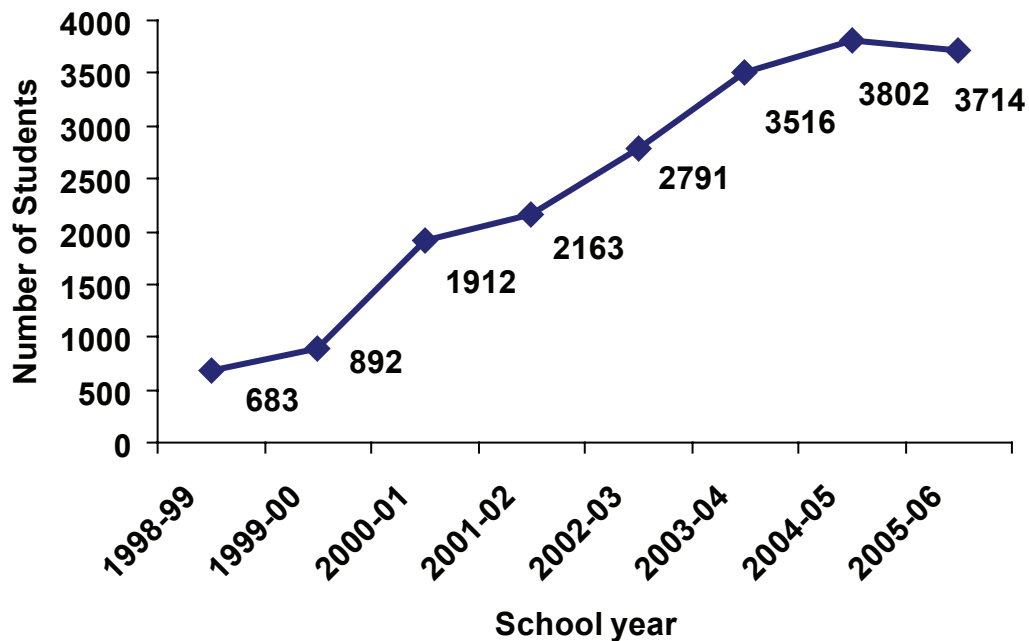
- improve asthma self-management skills
- decrease asthma emergencies
- raise asthma awareness among parents/guardians
- promote broader asthma management coordination among physicians, parents and schools

OAS consists of six 40-minute group lessons for children with asthma held during the school day, taught by a certified instructor. *OAS* uses group discussion, stories, games and role play to help students take part in the program. The class is taught as six 40 minute sessions during the school day by a certified instructor. Students are removed from their regular classrooms to participate in the class. The program works by teaching children that it is okay to have asthma and that they can take control of their asthma.²

The school nurse must get permission from the school to offer the program to students (not all schools allow the program to be offered), and also get parental permission for each student. Only students with signed permission slips are eligible to participate.

Asthma management in schools also occurs on a one-on-one basis between the school nurse and the student with asthma. These numbers are not tracked and therefore not available for this document.

Figure 4. Number of Students who use Peak Flow Monitoring at School.



Data Source: N.C. School Health Services Report for Public Schools, 1996-2006

Peak flow monitoring is done according to the student’s Asthma Action Plan, which is signed by both the healthcare provider and the parent. If peak flow monitoring is not indicated on the Action Plan and the school nurse feels that the student could benefit from it, she may decide to contact the parent and/or the healthcare provider to have it included in the child’s Action Plan. Peak flow monitoring is a tool to provide information on the student’s respiratory status. By including this information in the student’s Action Plan, the parents, health care provider, school nurse, and school staff can use this information to improve or maintain the student’s respiratory status.

In elementary school, peak flow monitoring can be done by the student with assistance from either the school nurse or the teacher or other school personnel, after training from the school nurse. It should be observed by an adult to ensure that the readings are accurate and documented. Students in middle or high school should be able to do their own peak flow monitoring once they have been checked out by the school nurse, if this is so indicated on the Asthma Action Plan.¹

Table 2. Asthma Education in Public Schools as Reported by School Health Nurses, 1996-2006

School Year	LEA’s Responding Count (Percent)	LEA’s with Asthma Education Programs	# of Students taught “Open Airways” curriculum	# of Student who use Peak Flow Monitoring at School
1996-97	*	*	*	*
1997-98	111 (95%)	47	*	*
1998-99	113 (97%)	50	1,773	683
1999-00	113 (97%)	59	2,825	892
2000-01	115 (99.6%)	58	3,876	1,912
2001-02	115 (99.7%)	64	4,451	2,163
2002-03	111 (93%)	64	3,059	2,791
2003-04	115 (99%)	65	2,762	3,516
2004-05	115 (100%)	58	2,467	3,802
2005-06	115 (100%)	54	2,283	3,714

*Data not available

References:

1. Interview with Malyn Pratt, North Carolina State School Nurse Consultant, 8/31/2006.
2. American Lung Association. Open Airways for Schools (OAS). Retrieved 9/5/2006. Web site: <http://www.lungusa.org/site/pp.asp?c=dvLUK9O0E&b=44142>

Appendix H:
Medicaid Data



Appendix H. Medicaid Data

Currently, managed care options for Medicaid recipients are available in all 100 counties. Options include Community Care of North Carolina, which encompasses Carolina ACCESS and ACCESS II, and until 2006 included a Risk Contracting with a state-licensed HMO in Mecklenburg County. The following descriptions of the managed care programs in North Carolina were obtained from the North Carolina Division of Medical Assistance (DMA) website (www.dhhs.state.nc.us/dma/).

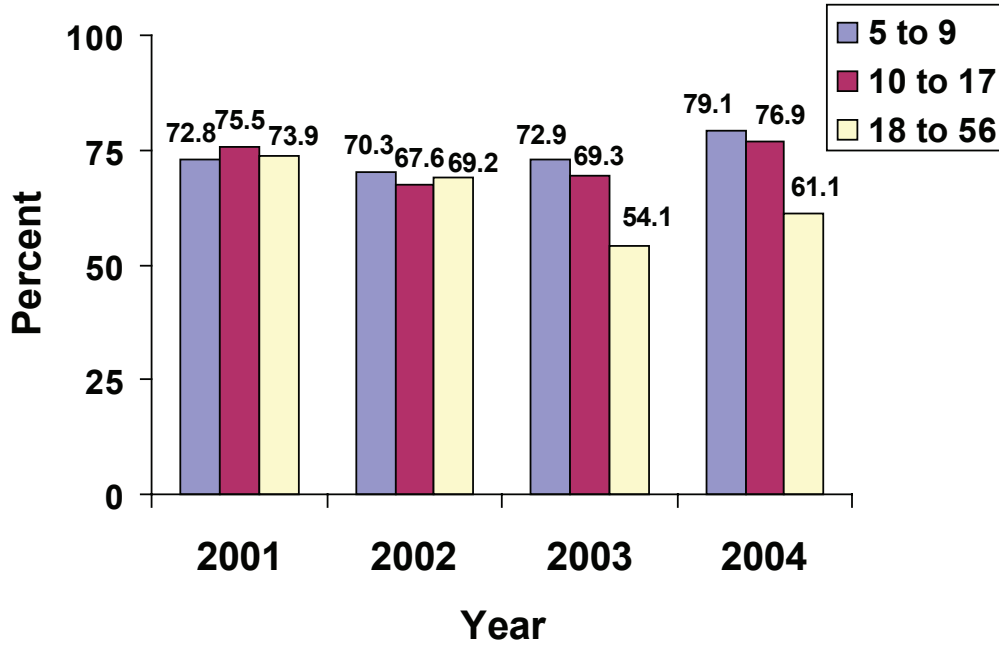
Carolina ACCESS was implemented in April 1991. It is North Carolina's Primary Care Case Management Program. It is designed to provide a more efficient and effective healthcare delivery system for Medicaid recipients. Carolina ACCESS links eligible recipients with a primary care provider (a medical home) who has agreed to provide or arrange for healthcare services for each enrollee.¹

ACCESS II/III, which is referred to as Community Care of North Carolina, was developed to build on Carolina Access by working with local providers and networks to manage the Medicaid population with processes that impact both the quality and cost of healthcare. ACCESS II/III include local networks comprised of Medicaid providers who have agreed to work together to develop the care management systems and supports that are needed to manage enrollee care.¹

Approximately 70% of the NC Medicaid population is enrolled in one of the Managed Care programs. The remaining 30% are enrolled in traditional fee for-service Medicaid. Managed care enrollment is dependent upon the recipients' eligibility classifications and/or special circumstances that would warrant an exemption from managed care.²

HEDIS measures

Figure 1. Use of Appropriate Medications¹ for Persons in Medicaid with Persistent Asthma², Age 5 to 56, North Carolina, 2001 – 2004³



¹While there are a number of acceptable therapies for people with persistent asthma, the best available evidence indicates that inhaled corticosteroids are the preferred primary therapy.⁴⁶

²NCQA standards for "persistent asthma" within the Medicaid population defined as: 1) four or more prescription medications used in the treatment of asthma in a year, OR 2) One or more inpatient hospital visits with a primary diagnosis of asthma in a year, OR 3) One or more ED visits with a primary diagnosis of asthma in a year, OR 4) Four or more outpatient visits with asthma listed anywhere as one of the diagnosis AND two or more claims for prescription drugs used in the treatment of asthma within 1 year.

³Please note that this is the description for the HEDIS measure for the study year 2004. Specifications are subject to change every year.

Data Source: North Carolina DMA HEDIS Reports, 2002 - 2005

Table 1. Use of Appropriate Medications for Persons in Medicaid with Persistent Asthma, by Age and System of Care, 2001-2004

		Use of Appropriate Asthma Medications				
		CA I %	CA II/III* %	Aggregate HMO %	Fee for Service %	Total DMA %
AGE	Year					
5 to 9	2001	68.11	82.07	62	71.08	72.87
	2002	69.53	76.9	66.67	65.09	70.39
	2003	68.97	78.49	50	71.06	72.92
	2004	78.85	80.60	50	78.27	79.14
10-17	2001	73.44	82.48	61.67	73.2	75.55
	2002	65.99	73.95	62.96	64.03	67.63
	2003	68.92	74	50	66.29	69.31
	2004	76.87	80.21	55.56	74.59	76.97
18-56	2001	73.62	78.21	66.67	73.83	73.98
	2002	68.83	70.25	57.41	69.41	69.20
	2003	53.57	59.97	54.55	53.27	54.12
	2004	59.90	61.22	11.11	61.63	61.65
All Ages	2001	72.41	81.46	63.35	73.23	74.14
	2002	68.21	74.33	61.81	67.60	69.05
	2003	63.99	73.86	51.22	62.25	65.57
	2004	72.47	77.55	44.44	70.65	72.98

*Community Care of North Carolina

References

1. North Carolina Division of Medical Assistance. Managed Care: Summary of North Carolina's Managed Care Programs. North Carolina Department of Health and Human Services. Retrieved 9/11/2006.
Web site: <http://www.dhhs.state.nc.us/dma/mangecarewho.html>.
2. North Carolina Division of Medical Assistance. HEDIS Report 2005. North Carolina Department of Health and Human Services. Retrieved 9/5/2006.
Web site: http://www.dhhs.state.nc.us/dma/hedis/HEDIS2005_report.pdf.

Appendix I:
***Population Distribution
of North Carolina***



Appendix I. Population Distribution of North Carolina

Table 1. North Carolina and US Census Data by Sex, Age Group, 2005¹, Race and Ethnicity data, 2004

	Population	North Carolina Population Distribution (%) 2005	US Population Distribution (%) 2005
Male	4,277,092	49.3	49.3
Female	4,404,974	50.7	50.7
Under 5 years	582,302	6.7	6.8
5 to 9 years	578,963	6.7	6.6
10 to 14 years	590,694	6.8	7.0
15 to 19 years	602,355	6.9	7.1
20 to 24 years	654,250	7.5	7.1
25 to 34 years	1,200,560	13.8	13.5
35 to 44 years	1,308,068	15.1	15
45 to 54 years	1,223,323	14.1	14.3
55 to 59 years	514,424	5.9	5.9
60 to 64 years	392,971	4.5	4.4
65 to 74 years	555,809	6.4	6.3
75 to 84 years	353,145	4.1	4.4
85 years and older	125,202	1.4	1.7
Race Data (from 2004)			
One Race		98.7 ²	97.6 ²
White	6,374,728*	74.6	75.1 ²
Black or African American	1,889,220*	22.1	12.3 ²
American Indian or Alaskan Native	115,010*	1.3	0.9 ²
Asian, Native Hawaiian or Pacific Islander	162,263*	1.9	3.7 ²
Other Race		2.3 ²	5.5 ²
Two or more races		1.3 ²	2.4 ²
Hispanic or Latino (of any race)	517,617*	6.1	12.5 ²
Overall North Carolina Population	8,682,066	100%	

*These numbers differ slightly from the rest and do not combine to make the actual overall population as noted. They are taken from a different data source -NCHS Bridged Population Data (<http://www.schs.state.nc.us/SCHS/data/population/nchspop.cfm>) and break up race/ethnicity data in a way that the state demographer does not.

¹Taken from July 1, 2005 estimates unless otherwise denoted.

²Taken from the US Census Bureau, 2000 Census Demographic.

Data Source: U.S. Census Bureau, NC SCHS, and North Carolina State Demographics