

Tennessee
Department
of Health

The Burden of Asthma in Tennessee 2001-2010



Division of Policy, Planning & Assessment
Surveillance, Epidemiology and Evaluation

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TENNESSEE DEPARTMENT OF HEALTH ORGANIZATION

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The mission of the Tennessee Department of Health is to protect, promote and improve the health and prosperity of people in Tennessee.

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Abbreviations and Definitions

95% Confidence Interval (CI) – A 95% CI is a range of values around an estimate that has a 95% chance of including the true value in the population.

Age-adjusted Rate – An age-adjusted rate is a rate that controls for age effects, allowing better comparability of rates across geographic areas, demographic groups, and/or time periods.

Age-specific Rate – An age-specific rate is a rate in which both the numerator (number of events) and denominator (number in population at risk) are limited to a specific age group.

Asthma Prevalence (Current) – A positive response to the lifetime asthma question, as well as a positive response to “Do you still have asthma?” on the BRFSS (self-report for adults) or NSCH (parent-report for children).

Asthma Prevalence (Lifetime) – A positive response to the question “Have you ever been told by a doctor, nurse or health care professional that you had asthma?” on the BRFSS (self-report for adults) or NSCH (parent-report for children).

BRFSS – Behavioral Risk Factor Surveillance System.

Contributing Cause of Death – The secondary cause of death.

DSS – Death Statistical System.

ED – Emergency Department.

HDDS – Hospital Discharge Data System.

Hospital Charges – Hospital charges are the amount the hospital billed for the entire visit. These billed charges are not necessarily the same as reimbursements or costs, and do not include most professional (physician) fees.

Inpatient – Patients who were admitted to the hospital for treatment.

Length of Stay – Length of stay is the number of nights the patient spent in the hospital. A patient admitted and discharged on the same day has a length of stay equal to zero.

Mean – A mean (also called an average) is the sum of all observations divided by the number of observations.

Median – A median is the value that divides a set of data into two equal parts, with half the observations below the median and half of them above the median.

NHDS – National Hospital Discharge Survey

NSCH – National Survey of Children’s Health.

Outpatient – Patients who were treated in a hospital setting without being admitted.

Prevalence – The proportion of persons in a population who have the disease at a specific point in time or over a specified period of time.

Primary Diagnosis – The first listed diagnosis within the HDDS.

Rate – An expression of the frequency of an event (e.g. asthma hospitalization or death) in a defined population during a specific period of time. Rates are calculated by dividing the number of events during a specified time period by the population at risk for the event during the same time period. Rates are typically multiplied by some factor of ten so that the results are whole numbers. The use of rates rather than event counts allows for comparisons across geographic areas, demographic groups, and/or time periods.

Abbreviations and Definitions

Secondary Diagnosis – Diagnosis other than the first listed diagnosis within the HDDS.

South East Central States – Tennessee, Kentucky, Mississippi and Alabama.

TennCare – TennCare is the state of Tennessee's managed care Medicaid program. Coverage is provided for low income children and families, pregnant women, disabled persons and persons in nursing homes. Coverage has recently been extended to children who do not meet Medicaid guidelines but lack access to insurance.

Trend – A trend is a view of multiple years of data so rate changes over time can be analyzed. Trends are often shown as a simple line graph so that they are easily visible.

Underlying Cause of Death – The primary cause of death within the DSS.

Key Findings

Asthma Prevalence

- Asthma prevalence in Tennessee remained stable between 2001 and 2010.
- Current asthma prevalence was 6.0% in adults and 9.5% in children in 2010.
- Among adults, asthma was more common among females than males.
- Among children, asthma was more common among males than females.
- There were no racial or ethnic differences in asthma prevalence among adults.
- Adult asthma prevalence increased with decreasing income and education.

Health Care Utilization and Cost*

Inpatient Hospitalizations

- In 2010 there were 7,059 inpatient hospitalizations in Tennessee for a primary diagnosis of asthma and the age-adjusted rate was 109/100,000.
- Between 2001 and 2010 there was a statistically significant decrease in the inpatient hospitalization rate for primary asthma among males. There were no increases or decreases in the inpatient rate for the total population, females, blacks or whites.
- Black females had the highest asthma inpatient hospitalization rate, followed by black males, white females and white males. Hispanics had a higher inpatient hospitalization rate than non-Hispanics.
- Between 2001 and 2010 there was a statistically significant decrease in the asthma inpatient rate among children aged 1-17 years.
- Among children, boys had a higher asthma inpatient rate than girls. However, for adults this pattern switched, with females having a higher rate.
- Blacks had a higher asthma inpatient rate for asthma than whites at all ages.
- Children ages 1-4 years had the highest inpatient hospitalization rate for asthma followed by adults aged 65 and older. Children aged 11-17 had the lowest inpatient rate.
- In 2010, length of stay for inpatient asthma hospitalizations ranged from 0-52 days, with a mean of 3.4 days and a median of 3 days.
- In general, mean length of stay for asthma inpatient hospitalizations increased with increasing age group.
- Inpatient hospitalizations for asthma peaked during the fall (October and November) and were at their lowest in the summer (June and July).

Emergency Department (ED)

- In 2010, there were 37,462 ED visits for a primary diagnosis of asthma and the age-adjusted rate was 612/100,000.
- Between 2001 and 2010 the ED visit rate for a primary asthma diagnosis increased among blacks and decreased among whites.
- Black females had the highest asthma ED visit rate, followed by black males, white females and white males. Non-Hispanics had a higher ED visit rate than Hispanics.
- Among children, boys had a higher asthma ED visit rate than girls. Among adults, females had a higher rate.
- Blacks had higher asthma ED visit rates than whites at all ages.
- Asthma ED visit rates were highest among young children and decreased with increasing age.

* All 2010 hospital data are provisional.

Key Findings

- Elderly patients were more likely to be subsequently admitted to the hospital following an ED visit for asthma than younger adults and children.
- Seasonal trends in ED visits were similar to those observed for inpatient hospitalizations with fall peaks and summer lows.

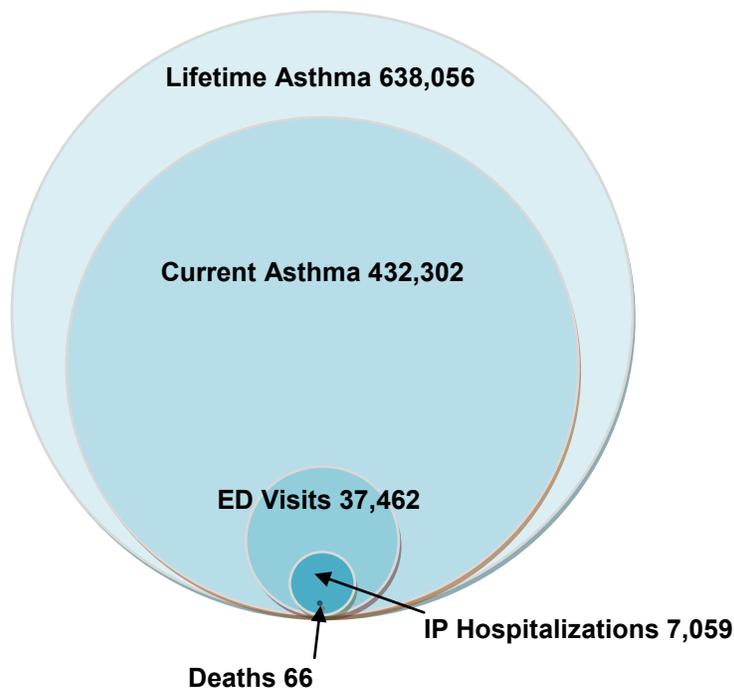
Hospital Charges

- Hospital charges for a primary asthma diagnosis totaled \$178.8 million in 2010.
- Almost two-thirds of asthma charges, \$113.6 million, were for inpatient hospitalizations, and \$65.2 million were for outpatient hospital visits.

Asthma Mortality

- Between 2001 and 2010, the age-adjusted asthma mortality rate in Tennessee declined by 22%, from 13.2/1,000,000 to 10.3/1,000,000.
- In 2010, 66 Tennesseans died due to an underlying diagnosis of asthma and there were 174 deaths for which asthma was listed as any cause of death.
- There was no statistically significant difference in asthma mortality rates in Tennessee compared to the United States.
- There were no gender differences in the asthma mortality rate in Tennessee.
- Age-adjusted asthma mortality rates for both primary and any asthma diagnosis were higher among blacks than whites.
- Adults age 65 years and older had the highest asthma mortality rates.

Figure 1



Asthma Burden in Tennessee, 2010

Estimated number of Tennesseans with asthma and reported number of ED visits, hospitalizations and deaths due to asthma.

Introduction

WHAT IS ASTHMA?

Asthma is a chronic, inflammatory disease of the airways. This inflammation makes the airways of people with asthma very sensitive, and they tend to react strongly to various stimuli (i.e. asthma triggers).¹ When asthma symptoms become worse than usual, it is called an asthma episode or attack.¹

In An Asthma Attack²:

- The lining of the airways swells and becomes more inflamed
- Mucus clogs the airways
- Muscles tighten around the airways
- These changes narrow the airways until breathing becomes difficult and stressful, like trying to breathe through a straw stuffed with cotton

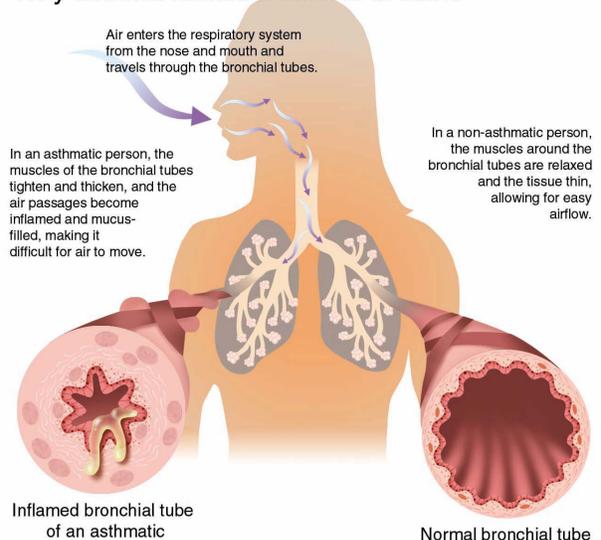
In severe asthma attacks, the airways close so much that not enough oxygen gets to vital organs and the condition becomes life-threatening.¹ Although asthma cannot be cured, it *can* be controlled and managed. Effective asthma management reduces the need for hospitalizations and urgent care visits, and enables patients to enjoy normal activities.³

WHAT CAUSES ASTHMA?

The exact cause of asthma (i.e. what causes the initial airway inflammation) is largely unknown and triggers for asthma attacks differ by person. However, there may be a hereditary component to the disease because those with a family history of asthma are more likely to develop it.¹ There are many recognized asthma triggers that can lead to asthma symptoms and attacks (Table 1). The community you live, work and play in may also increase your risk of experiencing an asthma attack due to variations in air pollution, pollen/allergens and secondhand smoke exposure.²

Figure 2

Why asthma makes it hard to breathe



Source: American Academy of Allergy, Asthma and Immunology

Introduction

WHO IS AT GREATEST RISK OF ASTHMA?

Asthma is seen more often among children, females, and those with family income below the poverty level. Nationally, there are also disparities in prevalence between different race and ethnic groups.²

Pollen	Cold air or changes in weather
Mold	Physical exertion (including exercise)
Dust mites	Strong emotions or stress
Animal dander	Certain medications
Cockroaches	Sulfites (preservatives in foods such as dried fruit and wine)
Tobacco smoke	Gastroesophageal reflux disease (GERD)
Respiratory infections	Strong odors or scented products/ chemicals
Air pollutants (e.g. ozone)	

WHY IS ASTHMA A PROBLEM?

Approximately 25.7 million persons in the United States have asthma; 7.0 million of them children less than 18 years of age.⁵ The burden of asthma affects not only these individuals, but also their families and society in terms of lost work and school, lessened quality of life, and avoidable emergency department visits, hospitalizations, and deaths.⁶

There is no cure for asthma, but there are effective means available to control the disease and prevent asthma attacks. Although health care visits for asthma declined in primary care settings, and asthma emergency department visits and hospitalization rates remained stable in the U.S. between 2001 and 2009, over one-half (52%) of those with current asthma experienced an asthma attack in 2009.^{5,7} Nationwide, asthma was responsible for the following in 2007:

- 13.9 million physician office visits,
- 1.8 million emergency department visits,
- 456,000 hospitalizations, and
- 3,447 deaths.⁷

Introduction

In 2007, the national economic burden of asthma to society was estimated to be \$56 billion (2009 dollars).⁸ Of this, medical expenses (\$50.1 billion) were the majority of the expense, followed by loss of productivity resulting from missed school or work days (\$3.8 billion), and premature death (\$2.1 billion).⁸ In 2008, 14.2 million work days and 10.5 million school days were missed as a result of asthma.⁷

A statewide asthma report was produced in 2008 as an initial effort to describe the burden of asthma in Tennessee in terms of disease prevalence, mortality, medical facility utilization and associated costs. This report was the most comprehensive source of information about asthma in Tennessee and was used to develop a comprehensive asthma management plan for the state. In order to have a more current picture of the burden of asthma in Tennessee, the data were updated in 2012 and the results are presented in this document. It again includes time trends as well as disparities among demographic characteristics such as age, gender, race, ethnicity, and county of residence. The authors hope that this report will offer the most up-to-date data on asthma prevalence and health care utilization; will aid in informing health professionals, policy makers and the general public of the importance of this disease and its impact on personal health, the health care system and society; and will bring individuals and organizations together to decrease the burden of this disease in Tennessee.

The State of Tennessee Asthma Task Force

The State of Tennessee Asthma Task Force (STAT) was convened to develop the *The STAT Plan to Reduce Asthma in Tennessee, 2009*. Members of STAT examined the state's current asthma burden document and developed specific goals, objectives and evidence-based intervention strategies with measurable outcomes to address needs and inequities. The team believes in a systems approach to asthma control and is comprised of members representing the Department of Health, Department of Education and the TennCare Bureau. They meet bi-annually to review progress and revise targets. There are four workgroups to address asthma control issues: Surveillance and Epidemiology, Environmental Quality, Education and Clinical Care.

The STAT plan seeks:

- 1) continued surveillance of asthma to identify needs and gaps in asthma management;
- 2) public awareness of and education about asthma as a public health problem;
- 3) medical management of asthma as a chronic disease by both the health care provider and the patient;
- 4) reduction of indoor and outdoor environmental triggers relevant to asthma management and control.

Prevalence

Symptoms and clinical manifestations of asthma are episodic. There may be symptom-free periods and/or the disease process may appear to resolve, and in many cases the diagnosis may be made only after an extended period of observation and testing.⁹ As a result, prevalence is a more appropriate means of describing the burden of asthma in a population than is incidence.⁹ The prevalence rate of a disease is the proportion of persons in a population who have the disease at a specific point in time or over a specified period of time. In the case of asthma, prevalence is often determined through the use of surveys. There are currently several available sources of survey data regarding both lifetime and current asthma prevalence, including the Behavioral Risk Factor Surveillance System (BRFSS) and the National Survey of Children's Health (NSCH).[†]

Core asthma questions were included in the BRFSS beginning in 2000 and the NSCH began in 2003. The BRFSS defines lifetime asthma as a positive response to the question *"Have you ever been told by a doctor, nurse or other health care professional that you had asthma?"*[‡] Current asthma is defined as a positive response to the lifetime asthma question, as well as a positive response to the subsequent question *"Do you still have asthma?"* The questions used in the NSCH are similar, but are answered by a parent on behalf of the child. This report uses BRFSS asthma estimates for adults and NSCH asthma estimates for children, and focuses on asthma prevalence in the U.S. and in Tennessee since 2001.

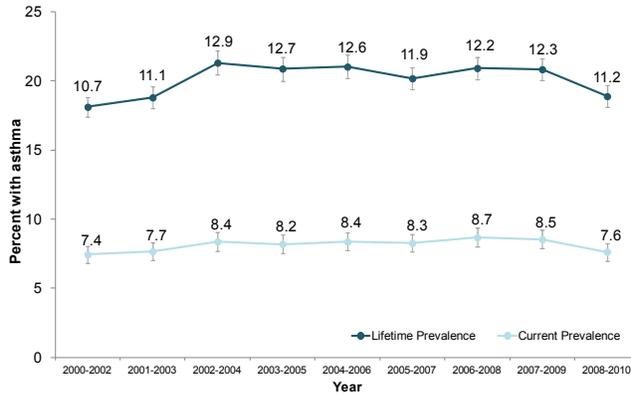
[†] See Technical Notes for detailed descriptions of each of these surveillance systems.

[‡] The wording of this question is slightly different in each survey- please see Technical Notes.

Prevalence

Adult Asthma Prevalence

Figure 3



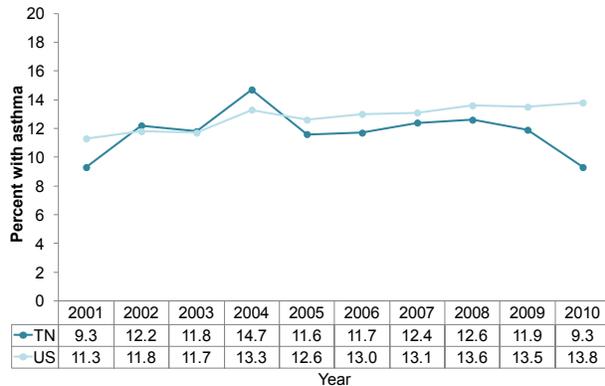
Lifetime and current asthma prevalence in adults, Tennessee, 2000-2010 3-year moving average (BRFSS)

Based on BRFSS data, the lifetime prevalence of asthma among adult Tennesseans (≥18 years old) averaged 11.2% between 2008 and 2010.

During this same time period the current prevalence of asthma averaged 7.6%. This represents approximately 480,000 Tennesseans with asthma.

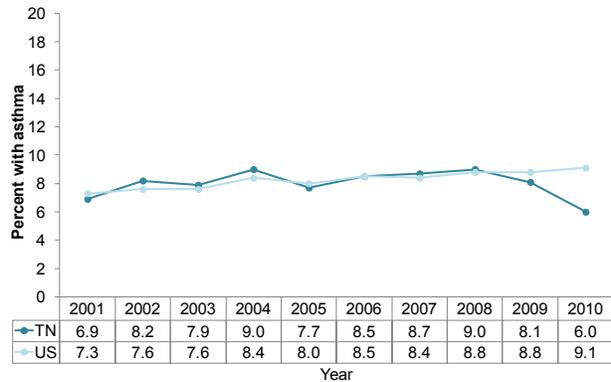
Between 2001 and 2010, there was no statistically significant increase or decrease in the lifetime or current prevalence of asthma in Tennessee (Figure 4 and Figure 5).

Figure 4



Lifetime asthma prevalence, Tennessee and the United States, 2001-2010 (BRFSS)

Figure 5



Current asthma prevalence, Tennessee and the United States, 2001-2010 (BRFSS)

The lifetime prevalence of asthma in Tennessee fluctuated from 2001 to 2010 in some years higher than the U.S. and in some years lower. However, starting in 2005, lifetime prevalence of asthma in Tennessee remained lower than in the U.S. (Figure 4).¹¹

Current asthma prevalence in Tennessee also fluctuated between 2001 and 2010. Most recently, estimates from 2009 and 2010 show that current asthma prevalence in Tennessee was lower than current asthma prevalence in the U.S. (Figure 5).¹¹

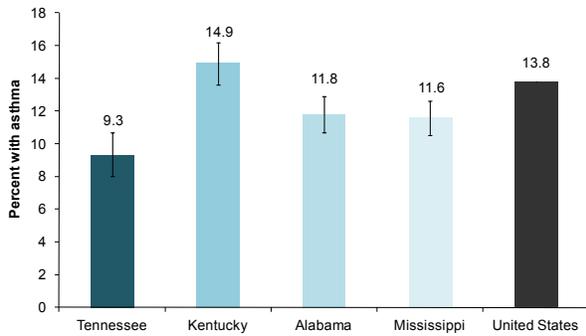
Prevalence

Adult Asthma Prevalence

Nationwide, Tennessee had both the lowest lifetime and current asthma prevalences in 2010.¹¹

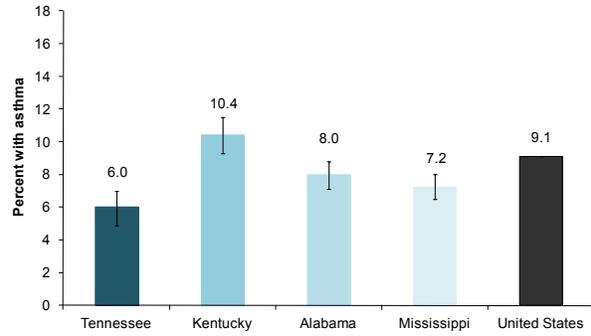
For comparison, state-specific asthma prevalence rates from the BRFSS for 2010 are presented in Figure 6 and Figure 7. Among the four south east central states, Tennessee had the lowest prevalence and Kentucky had the highest for both lifetime and current asthma.¹¹

Figure 6



Lifetime asthma prevalence in adults, south east central states and the United States, 2010 (BRFSS)

Figure 7



Current asthma prevalence in adults, south east central states and the United States, 2010 (BRFSS)

Prevalence

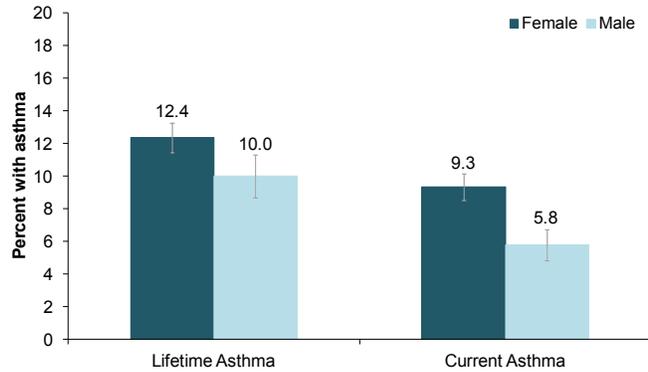
Adult Asthma Prevalence

Based on 2008-2010 Tennessee BRFSS data, both lifetime and current asthma prevalence rates were higher among adult females than adult males (Figure 8).

Average lifetime asthma prevalence was 12.4% for females and 10.0% for males.

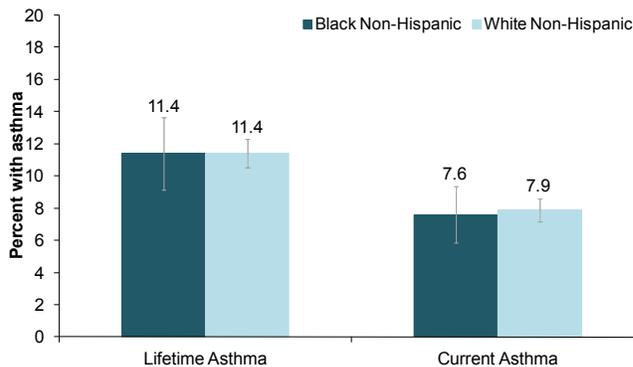
Average current asthma prevalence was 9.3% for females and 5.8% for males.

Figure 8



Lifetime and current asthma prevalence in adults by gender, Tennessee, 2008-2010 average (BRFSS)

Figure 9

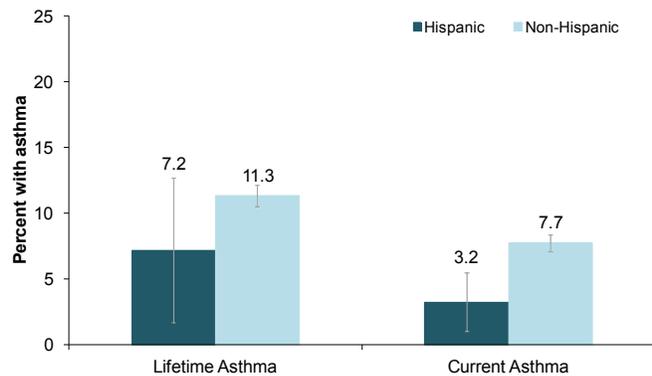


Lifetime and current asthma prevalence in adults by race, Tennessee, 2008-2010 average (BRFSS)

There were no statistically significant differences in average lifetime or current asthma prevalence in white non-Hispanics compared to black non-Hispanics (Figure 9).

Average lifetime asthma prevalence among Hispanics (7.2%) was not statistically significantly different from non-Hispanics (11.3%). Average current asthma prevalence was higher among non-Hispanics than among Hispanics (7.7% vs. 3.2%, respectively) (Figure 10).

Figure 10



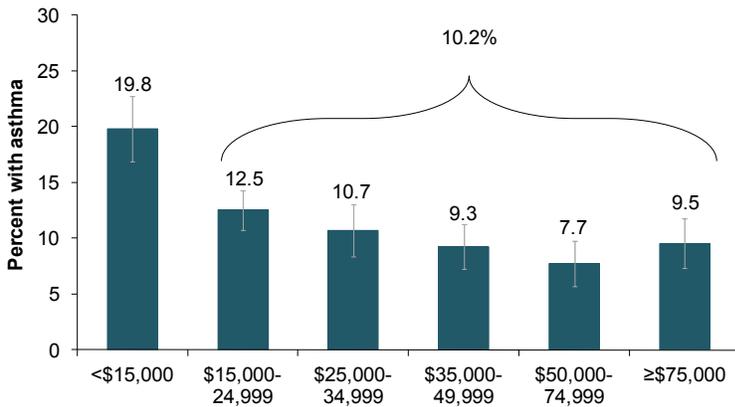
Lifetime and current asthma prevalence in adults by Hispanic ethnicity, Tennessee, 2008-2010 average (BRFSS)

Prevalence

Adult Asthma Prevalence

Between 2008 and 2010, both lifetime and current asthma prevalence were highest among persons with an annual household income of less than \$15,000 (Figure 11 and Figure 12).

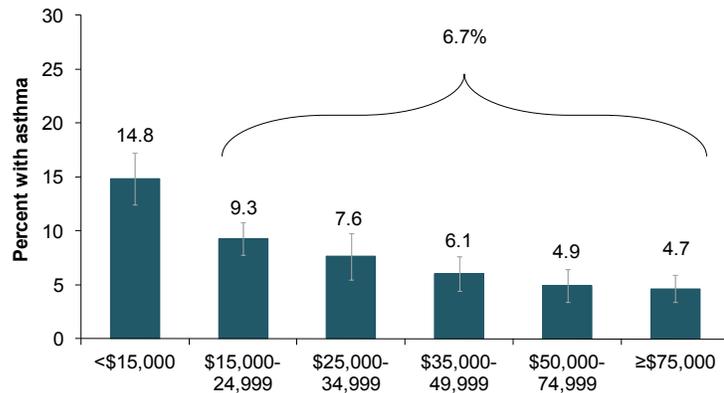
Figure 11



The average lifetime prevalence of asthma among those with an income of less than \$15,000 (19.8%) was almost twice as high as among those with an income of \$15,000 or more (10.2%).

Lifetime asthma prevalence in adults by annual household income, Tennessee, 2008-2010 average (BRFSS)

Figure 12



The average current prevalence of asthma among those with an income of less than \$15,000 (14.8%) was over twice as high as among those with an income of \$15,000 or more (6.7%).

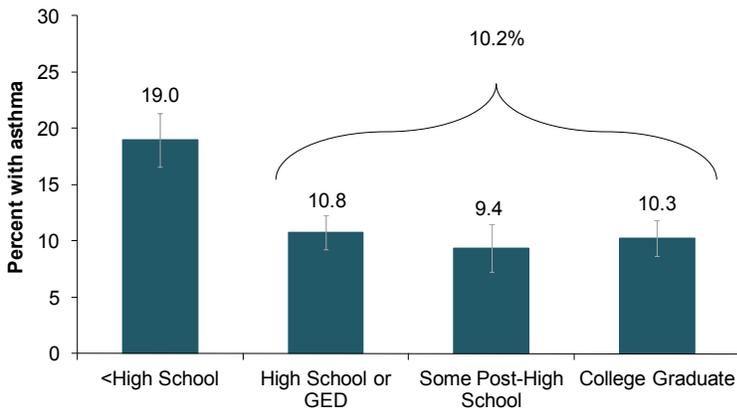
Current asthma prevalence in adults by annual household income, Tennessee, 2008-2010 average (BRFSS)

Prevalence

Adult Asthma Prevalence

Between 2008 and 2010, both lifetime and current asthma prevalence were highest among persons with less than a high school education (Figure 13 and Figure 14).

Figure 13

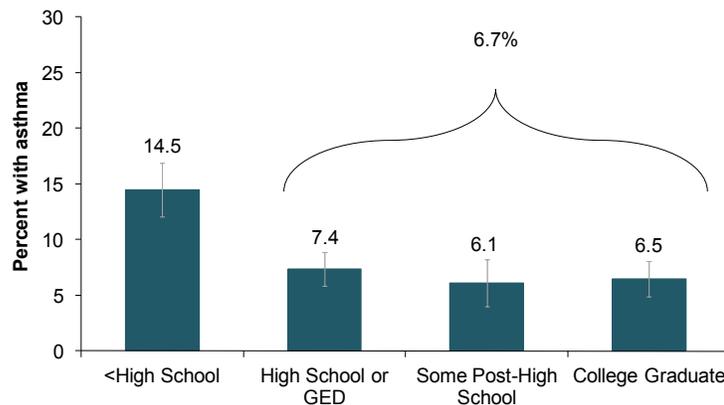


The average lifetime prevalence of asthma among those with less than a high school education (19.0%) was almost twice as high as among those with higher levels of education (10.2%).

Lifetime asthma prevalence in adults by highest level of education, Tennessee, 2008-2010 average (BRFSS)

Figure 14

The average current prevalence of asthma among those with less than a high school education (14.5%) was more than twice as high as among those with higher levels of education (6.7%).



Current asthma prevalence in adults by highest level of education, Tennessee, 2008-2010 average (BRFSS)

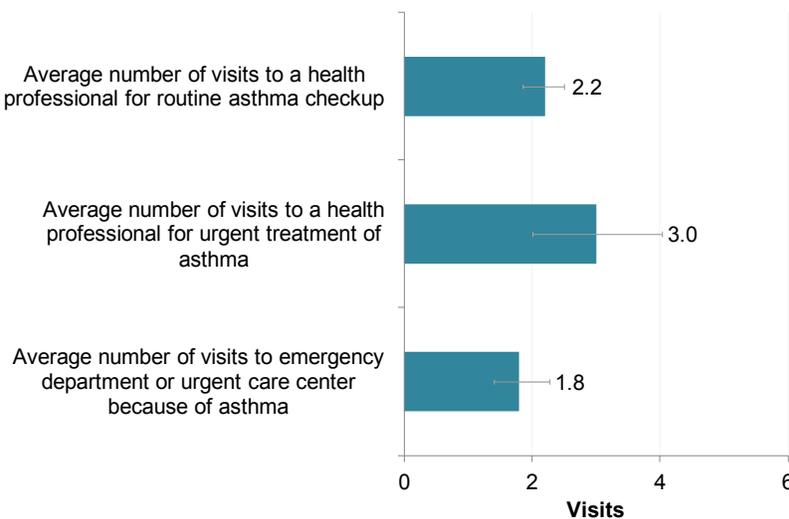
Prevalence

Secondary Prevention of Asthma in Adults

Once individuals are diagnosed with a chronic disease, secondary prevention (i.e. disease control) is important in order to reduce the consequences of the disease. For asthmatics, these strategies involve such activities as reducing and/or eliminating asthma triggers, regular interaction with health care providers and appropriate use of control medications. The primary goal of asthma secondary prevention is to maintain the highest quality of life and avoid adverse health outcomes such as hospitalizations and emergency department visits.

In 2010, approximately 28% of Tennessee adults with current asthma reported experiencing asthma symptoms every day, while 39% reported using prescription asthma medication 25-30 days per month to prevent an asthma attack from occurring. Approximately 40% of adults reported having an episode of asthma or an asthma attack in the past year.

Figure 15



On average, adults that currently have asthma visited a health professional for routine asthma checkups 2.2 times per year and for urgent asthma care 3.0 times per year. They also reported an average of 1.8 visits to an emergency department or urgent care center per year (Figure 15).

Healthcare utilization among adults with current asthma, Tennessee, 2010 (BRFSS)

Smoking & Asthma

Between 2008 and 2010, 28% of adults ever diagnosed with asthma were current smokers. During this same time, current smokers had greater odds of ever being diagnosed with asthma than those that never smoked. In fact, compared to individuals that had never smoked, current smokers had 60% higher odds of being ever diagnosed with asthma (OR: 1.6 95% CI: 1.3-2.0) and 70% higher odds of having current asthma (OR: 1.7 95% CI: 1.4-2.2).

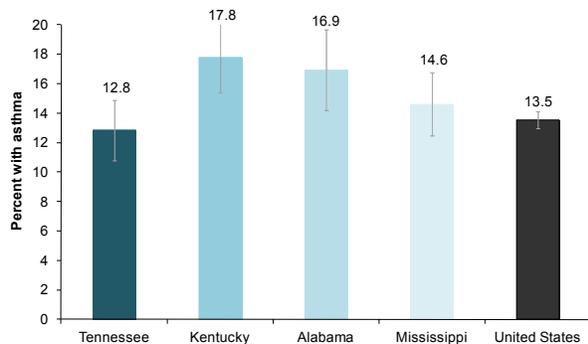
Childhood Asthma Prevalence

Nationwide, asthma prevalence rates in children 0-17 years of age are measured in the National Survey of Children’s Health. In 2007, Tennessee had the 22nd highest current childhood asthma prevalence and the 27th highest lifetime childhood asthma prevalence among the 50 states.¹² The range for current asthma prevalence across the country was 5.2%-14.4% with the lowest prevalence in South Dakota, Idaho, Minnesota, Alaska and Nebraska.¹² The range for lifetime asthma prevalence was 7.6%-19.0% with the lowest prevalence in South Dakota, Idaho, Minnesota, Nebraska and Montana.¹²

South east central state-specific lifetime asthma prevalence rates in children aged 0-17 years are presented in Figure 16.¹² Among these states, Kentucky had the highest lifetime asthma prevalence and Tennessee had the lowest. Tennessee’s lifetime asthma prevalence was statistically significantly lower than Kentucky’s. However, there were no other statistically significant differences between Tennessee compared to the U.S. or to the other south east central states.

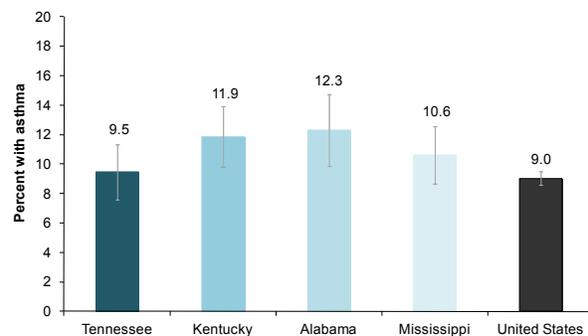
State-specific current asthma prevalence rates in south east central state children were highest in Alabama and lowest in Tennessee. However, there were no statistically significant differences between the prevalences in Tennessee compared to other south east central states or to the U.S. (Figure 17).

Figure 16



Lifetime asthma prevalence in children, south east central states and the United States, 2007 (NSCH)

Figure 17

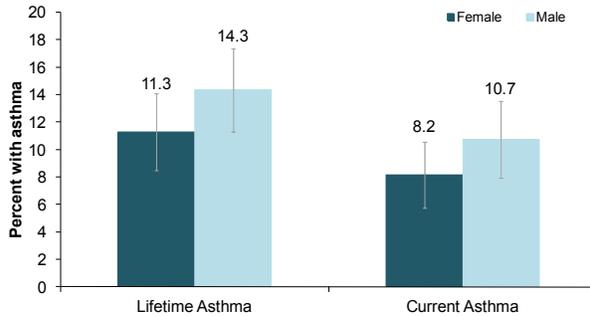


Current asthma prevalence in children, south east central states and the United States, 2007 (NSCH)

Prevalence

Childhood Asthma Prevalence

Figure 18



Lifetime and current asthma prevalence in children by gender, Tennessee, 2007 (NSCH)

Childhood asthma prevalence in Tennessee was higher among males than among females (Figure 18). As noted earlier, asthma prevalence in *adults* was higher in females than among males.

Lifetime prevalence was 14.3% for boys and 11.3% for girls.¹²

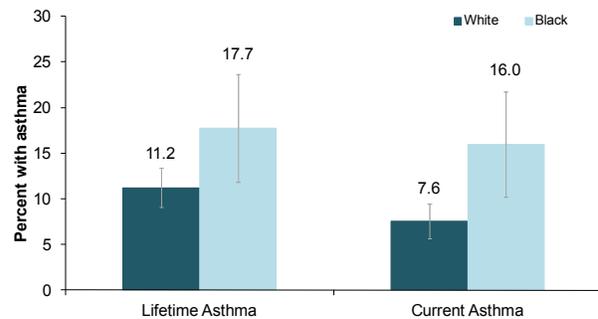
Current prevalence was 10.7% for boys and 8.2% for girls.¹²

Childhood asthma prevalence was higher among blacks than among whites (Figure 19).

Lifetime prevalence was 17.7% for black children and 11.2% for white children, but this difference was not statistically significant.

Current prevalence was 16.0% for black children and 7.6% among white children, and this difference was statistically significant.

Figure 19



Lifetime and current asthma prevalence in children by race, Tennessee, 2007 (NSCH)

Tobacco Exposure in Children

Exposure to second hand smoke is a common trigger for many people with asthma. According to the NSCH, 33.5% of Tennessee children were reported to live in households where someone smoked, 39.4% of whom were exposed to secondhand smoke inside their homes.

Children that lived in households where someone smokes had greater odds of being diagnosed with asthma than children that lived in smoke free households (odds ratio 1.67; 95% confidence interval: 1.14-2.24). Further, compared to children with no tobacco exposure, children exposed to secondhand smoke in their home had 110% higher odds of being ever diagnosed with asthma (OR: 2.1; 95% CI: 1.2-3.6).

Health Care Utilization and Cost

Hospitalizations and emergency department (ED) visits are a serious consequence of asthma and an indication of severe and/or poorly managed disease. They are costly both monetarily and in terms of personal suffering, but are largely preventable with appropriate treatment and disease management.^{6,13}

The following is a discussion of inpatient hospitalization rates and ED visit rates for a primary diagnosis of asthma. Hospital data were obtained from the Hospital Discharge Data System (HDDS), which is described in the Technical Notes.[§] Patient encounters in the HDDS are divided into inpatient and outpatient hospitalizations. Inpatient hospitalizations represent patients who were admitted to the hospital for treatment. Outpatient hospitalizations represent patients who were treated in a hospital setting without being admitted. Both in- and outpatients may have initially been treated in the emergency department, and there is therefore some overlap in inpatient hospitalizations and ED visits. Rates were calculated as the number of inpatient hospitalizations or emergency department visits per 100,000 Tennessee population (i.e. discharge-level analyses) and were age-adjusted to the 2000 U.S. standard population. This is not the same as the number of unique people hospitalized for asthma, because some individuals may have been hospitalized or visited an emergency department more than once in a given year. The rates presented are a reflection of the burden that asthma places on the health care system in Tennessee.

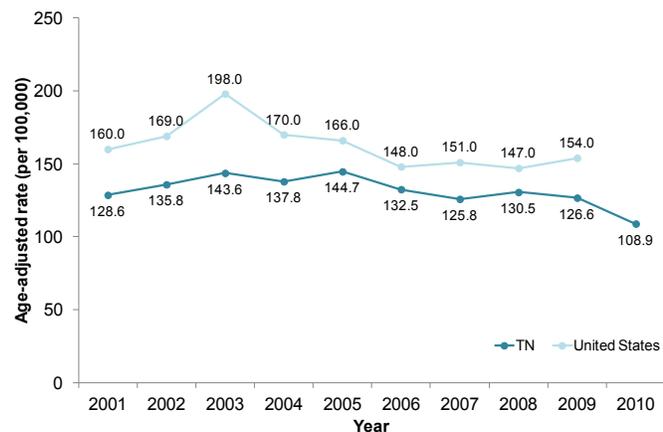
Inpatient Hospitalizations for Asthma

In 2010, there were 7,059 inpatient hospitalizations in Tennessee for a primary diagnosis of asthma, and the rate of asthma hospitalizations was 108.9/100,000.

Between 2001 and 2010, there was no statistically significant increase or decrease in the overall asthma hospitalization rate in Tennessee (Figure 20).

Between 2001 and 2009, the asthma hospitalization rate in Tennessee was consistently lower than that for the entire United States (Figure 20).¹⁴

Figure 20



Age-adjusted inpatient hospitalization rate for primary asthma, Tennessee and the United States, 2001-2010 (HDDS, NHDS)

In 2010, there were 7,059 inpatient hospitalizations in Tennessee for a primary diagnosis of asthma.

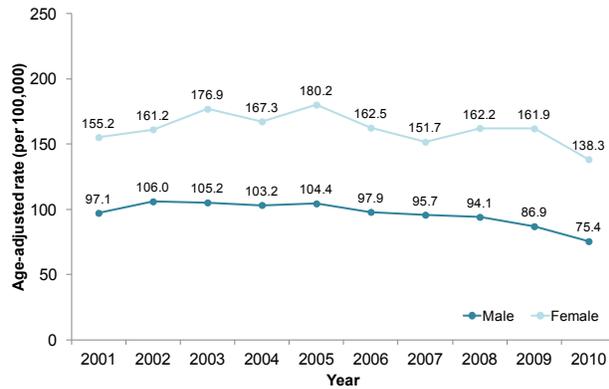
[§] All 2010 hospital data are provisional.

Inpatient Hospitalizations for Asthma

Between 2001 and 2010, there was a statistically significant decrease in the asthma hospitalization rate among males (22.3% decrease) (Figure 21).

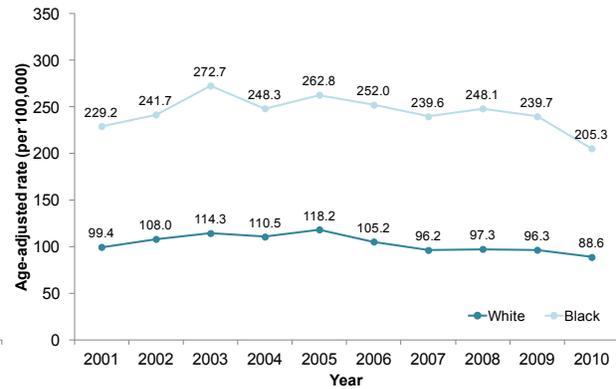
There were no statistically significant increases or decreases in the asthma hospitalization rate among females, blacks or whites.

Figure 21



Age-adjusted inpatient hospitalization rate for primary asthma by gender, Tennessee, 2001-2010 (HDDS)

Figure 22

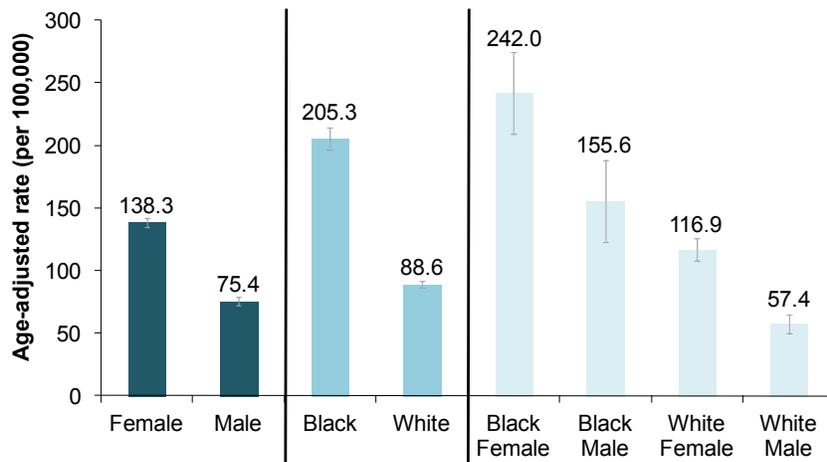


Age-adjusted inpatient hospitalization rate for primary asthma by race, Tennessee, 2001-2010 (HDDS)

In 2010, the asthma hospitalization rate was higher among females than males (138.3 vs. 75.4/100,000, respectively) and higher among blacks than whites (205.3 vs. 88.6/100,000, respectively) (Figure 23).

Black females had the highest asthma hospitalization rate (242.0/100,000), followed by black males (155.6), white females (116.9) and white males (57.4) (Figure 23).

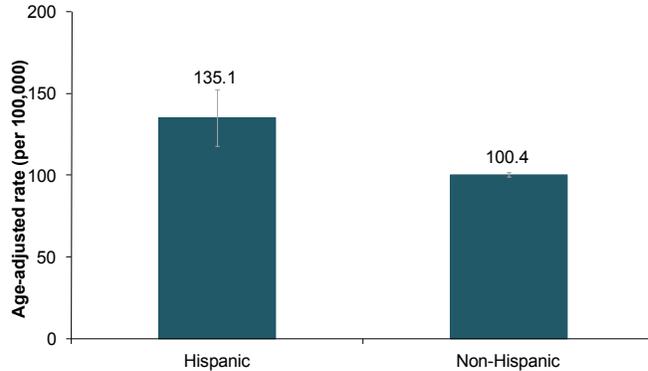
Figure 23



Age-adjusted inpatient hospitalization rate for primary asthma by gender and/or race, Tennessee, 2010 (HDDS)

Inpatient Hospitalizations for Asthma

Figure 24



Age-adjusted inpatient hospitalization rate for primary asthma by ethnicity, Tennessee, 2008-2010 average (HDDS)

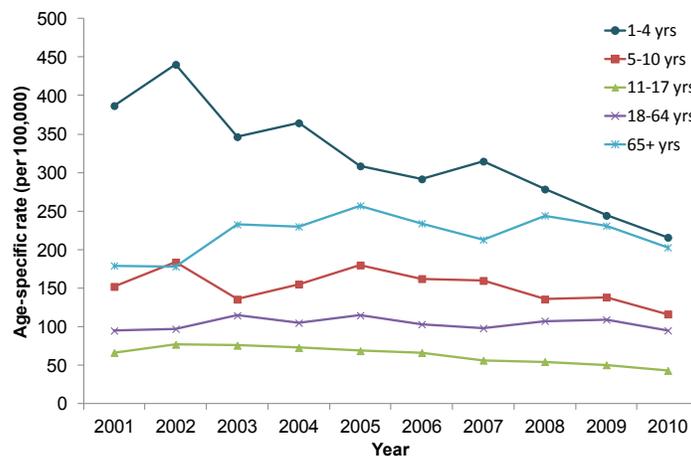
Between 2008 and 2010, there were 517 inpatient hospitalizations for primary asthma among Hispanics.

During this same time, the average, annual hospitalization rate was 135.1/100,000 among Hispanics and 100.4/100,000 among non-Hispanics (Figure 24).

Between 2001 and 2010, children 1 to 4 years of age had the highest inpatient hospitalization rate for primary asthma. Since 2003, adults age 65 and older have had the second highest inpatient hospitalization rate (Figure 25).

Between 2001 and 2010, there were statistically significant decreases in asthma inpatient hospitalizations in children ages 1-4, 5-10 and 11-17 years. There was a 44% decrease for children aged 1-4 (from 386.6 to 215.9/100,000), a 23% decrease for children aged 5-10 (from 152.1 to 116.4/100,000), and a 35% decrease for children aged 11-17 (from 66.4/100,000 to 43.1/100,000). There were no statistically significant increases or decreases in the hospitalization rate for adults aged 18-64 or 65 and older, and the rates for these age groups in 2010 were 95.1/100,000 and 202.9/100,000, respectively (Figure 25).

Figure 25

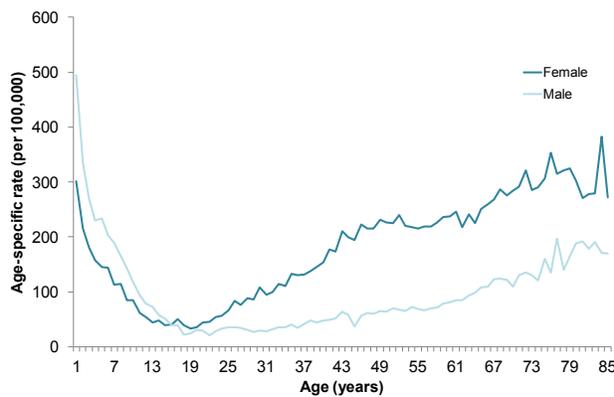


Age-specific inpatient hospitalization rate for primary asthma, Tennessee, 2001-2010 (HDDS)

Inpatient Hospitalizations for Asthma

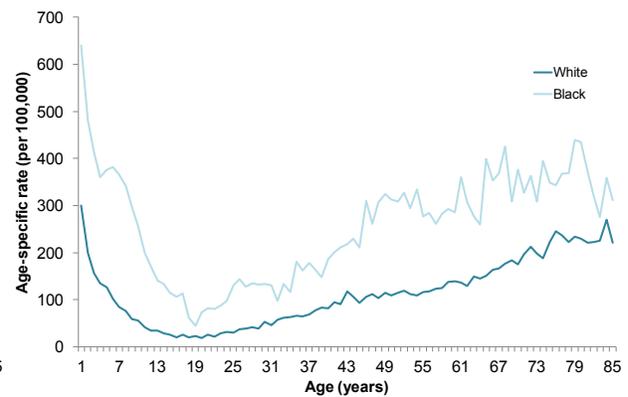
Inpatient hospitalization rates for asthma were highest among very young children. As age increased, hospitalization rates decreased sharply until the mid to late teens, and then gradually increased again as age increased. This pattern held true for all gender and race groups. However, asthma hospitalization rates among children were higher for males than females, while among adults they were higher for females (Figure 26). Asthma hospitalizations were higher among blacks than whites at all ages (Figure 27).

Figure 26



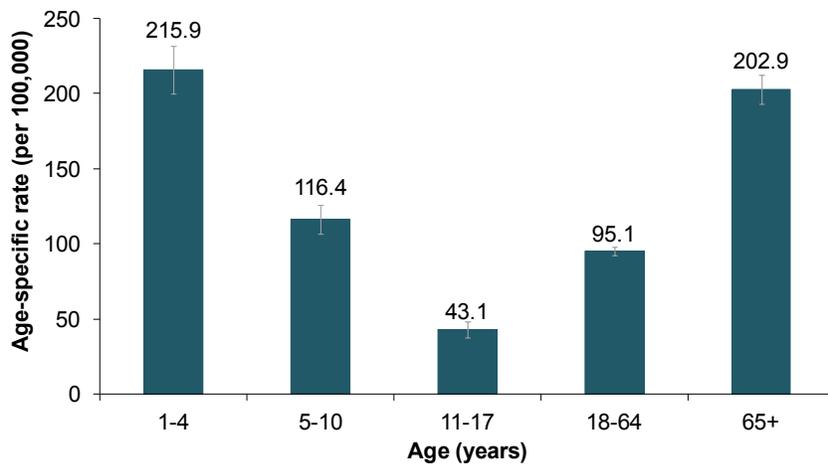
Age-specific inpatient hospitalization rate for primary asthma, by gender, Tennessee, 2006-2010 average (HDDS)

Figure 27



Age-specific inpatient hospitalization rate for primary asthma by race, Tennessee, 2006-2010 average (HDDS)

Figure 28

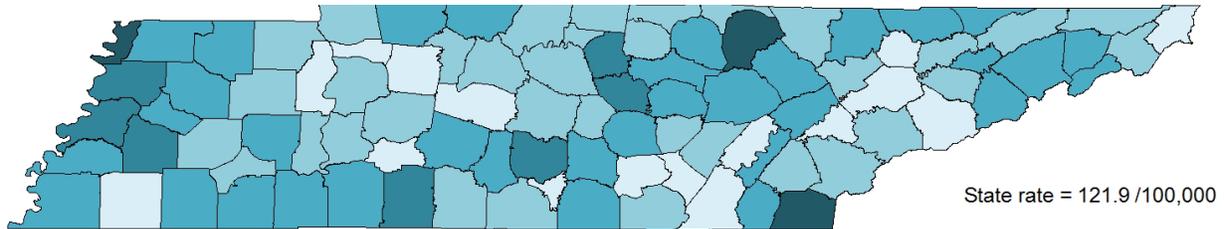


Age-specific inpatient hospitalization rate for primary asthma, Tennessee, 2010 (HDDS)

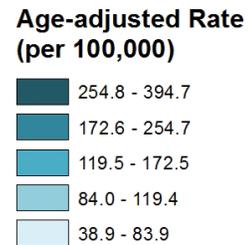
In 2010, the inpatient hospitalization rate for primary asthma was highest among children aged 1-4 years (215.9/100,000) and adults 65 years and older (202.9). The rate was lowest among children 11-17 years old (43.1) (Figure 28).

Inpatient Hospitalizations for Asthma

Figure 29



Age-adjusted inpatient hospitalization rate for primary asthma by county, Tennessee 2008-2010 average (HDDS)



Between 2008 and 2010, the average age-adjusted inpatient hospitalization rate for primary asthma within individual Tennessee counties ranged from 38.9/100,000 in Moore County to 394.7/100,000 in Fentress County (Figure 29). More detailed county and regional level hospitalization rates are located in the Appendix.

The ten counties with the *lowest* asthma inpatient hospitalization rates were: Moore, Union, Williamson, Sequatchie, Benton, Dickson, Lewis, Loudon, Sevier and Houston.

The ten counties with the *highest* asthma hospitalization rates were: Fentress, Polk, Lake, Haywood, Dyer, Lawrence, Bedford, Smith, Lauderdale and DeKalb.

Asthma Action Plans

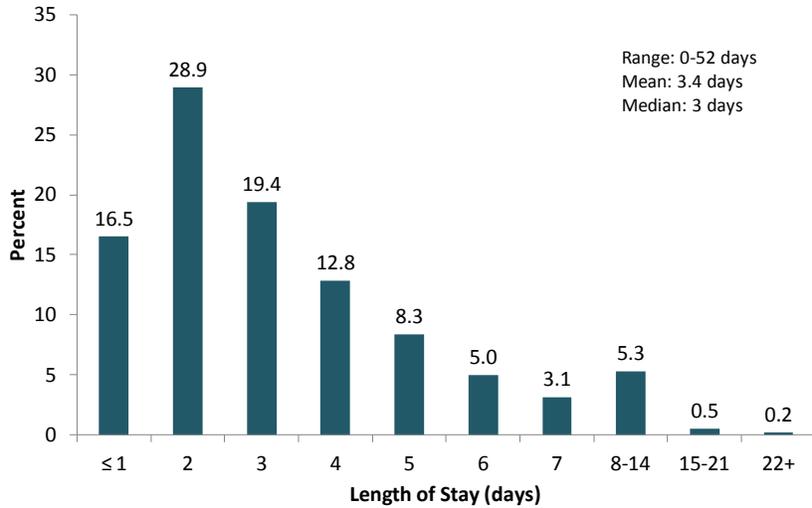
An asthma action plan is a written, customized plan developed by a doctor or asthma specialist to help someone with asthma manage their disease. Asthma action plans can be organized in a number of ways, but may include any of the following: a list of asthma triggers, a list of routine asthma symptoms and what to do if these symptoms occur, the name and dose of daily asthma medication(s), the name and dose of rescue medication(s) to be taken during an attack, emergency telephone numbers, and instructions about when to contact a doctor or seek emergency care. Plans should be reviewed with a healthcare provider at least once a year and updated as necessary. Asthma action plans are collaborative efforts between patients and health care providers, and there is evidence that written plans not only facilitate communication between the two, but also play a key role in successful self-management of the disease.

Sources:
 WebMD. Asthma Guide: Developing an Asthma Action Plan. Accessed 11 July 2010 at www.webmd.com/asthma/guide/developing-an-asthma-action-plan
 Hodder R. The paradox of adult asthma control: "Who's in control anyway?" *Canadian Respiratory Journal* 2007; 14(4):229-234.

Inpatient Hospitalizations for Asthma

In 2010, the length of stay for inpatient asthma hospitalizations ranged from 0-52 days. The mean (i.e. average) length of stay was 3.4 days and the median was 3 days (Figure 30).

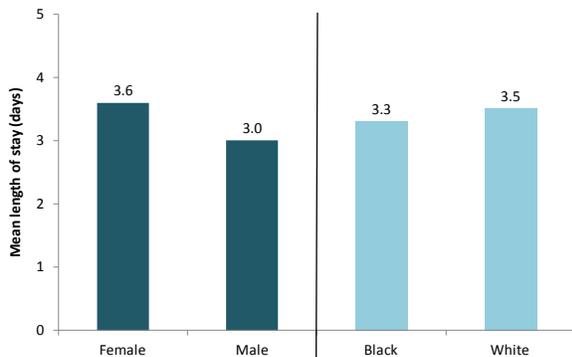
Figure 30



Distribution of length of stay among inpatient hospitalizations for primary asthma, Tennessee, 2010 (HDDS)

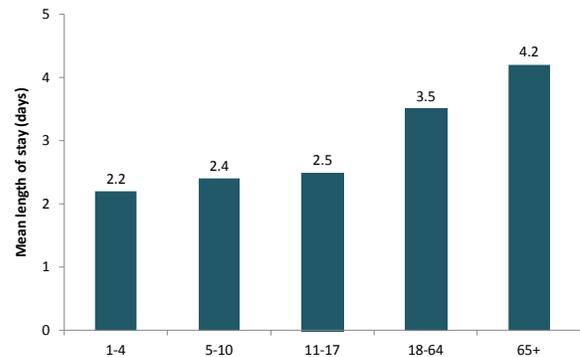
Mean length of stay was 3.6 days among females and 3.0 days for males (Figure 31). Mean length of stay was 3.3 days among blacks and 3.5 days for whites (Figure 31). Elderly adults aged 65 years and older had the longest mean length of stay (4.2 days), while children had the shortest stays (≤ 2.5 days) (Figure 32).

Figure 31



Mean length of stay among inpatient hospitalizations for primary asthma by gender and race, Tennessee, 2010 (HDDS)

Figure 32

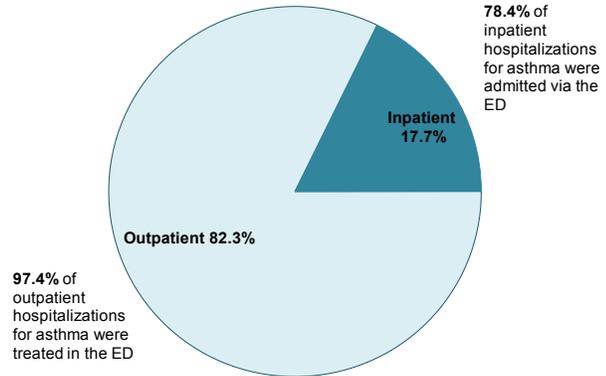


Mean length of stay among inpatient hospitalizations for primary asthma by age, Tennessee, 2010 (HDDS)

Emergency Department Visits for Asthma

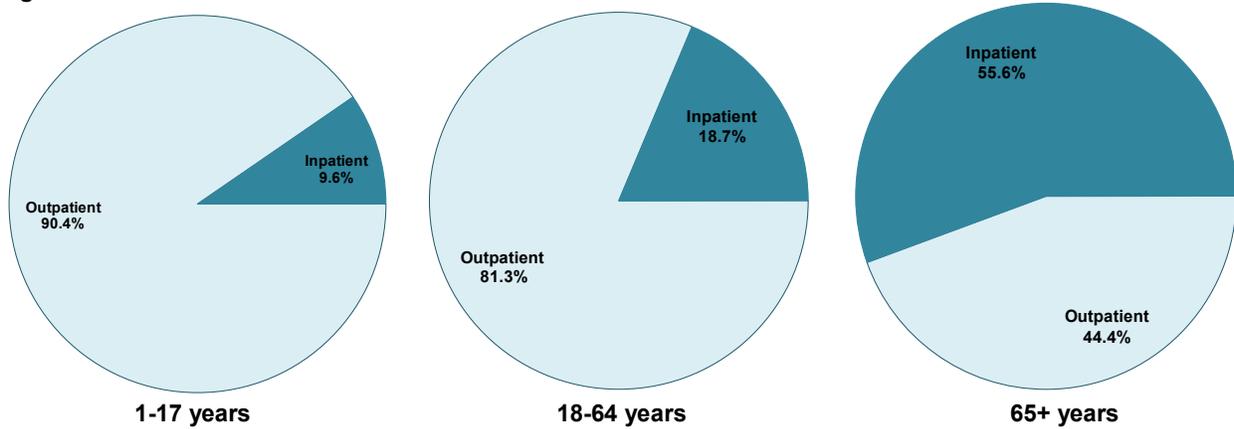
In 2010, the majority of hospital encounters for primary asthma were *outpatient* visits (82.3%) and among these outpatient visits, the vast majority (97.4%) were treated in the emergency department (ED) (Figure 33). Elderly adults were less likely to be treated as outpatients than were children and younger adults. Less than one-half of asthma hospital encounters among the elderly were outpatient visits (Figure 34).

Figure 33



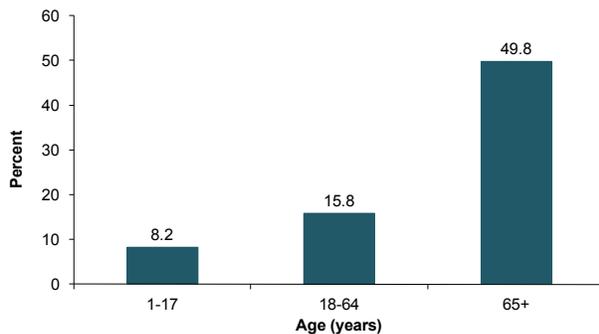
Percentage of inpatient vs. outpatient hospitalizations for primary asthma, Tennessee, 2010 (HDDS)

Figure 34



Percentage of inpatient vs. outpatient hospitalizations for primary asthma by age, Tennessee, 2010 (HDDS)

Figure 35



Percentage of emergency department asthma patients admitted to hospital by age, Tennessee, 2010 (HDDS)

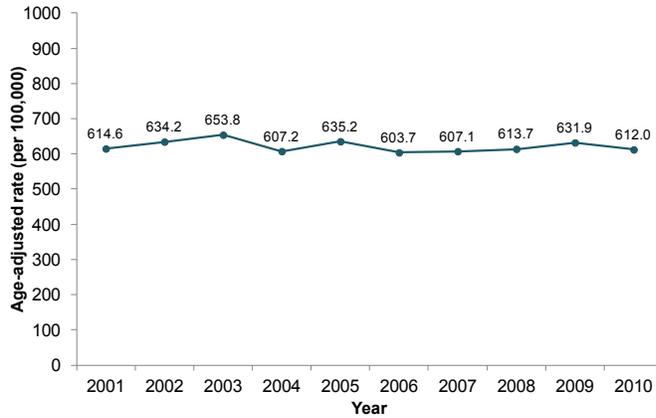
The majority of ED visits for primary asthma were treated as outpatients, but 14.8% were subsequently admitted to the hospital. The elderly were much more likely than children or younger adults to be admitted following an ED visit for asthma (Figure 35).

Health Care Utilization and Cost

Emergency Department Visits for Asthma

In 2010, there were 37,462 emergency department visits for a primary diagnosis of asthma in Tennessee, and the rate of ED visits was 612.0/100,000.

Figure 36



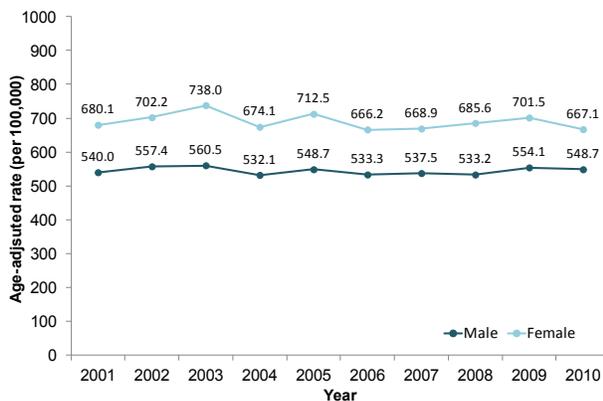
Age-adjusted ED visit rate for primary asthma, Tennessee, 2001-2010 (HDDS)

In 2010, there were 37,462 emergency department visits in Tennessee for a primary diagnosis of asthma.

There were no statistically significant increases or decreases in the ED visit rate for primary asthma in Tennessee from 2001 to 2010 among the total population or by gender group (Figure 36 and Figure 37).

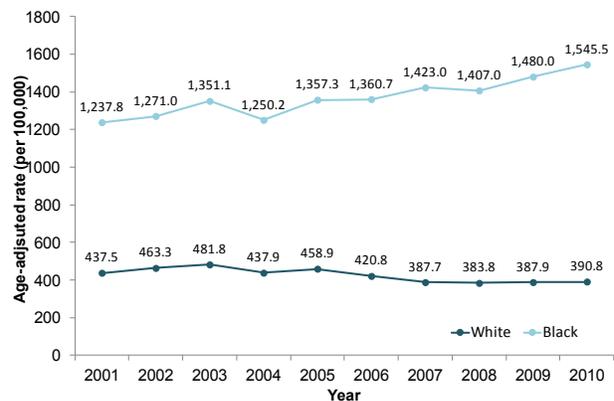
Between 2001 and 2010 there was a statistically significant increase in the ED visit rate among blacks (25% increase) and a statistically significant decrease in the ED visit rate among whites (11% decrease) (Figure 38).

Figure 37



Age-adjusted ED visit rate for primary asthma by gender, Tennessee, 2001-2010 (HDDS)

Figure 38



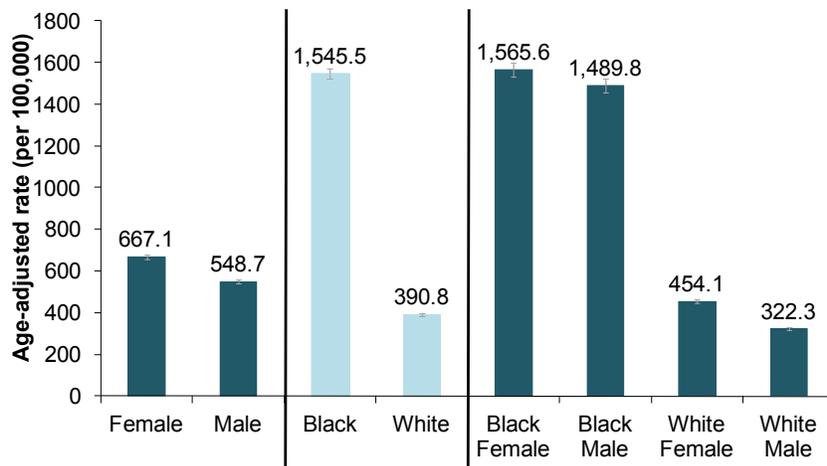
Age-adjusted ED visit rate for primary asthma by race, Tennessee, 2001-2010 (HDDS)

Emergency Department Visits for Asthma

In 2010, the primary asthma ED visit rate was higher among females (667.1/100,000) than males (548.7/100,000) and higher among blacks (1,545.5/100,000) than whites (390.8/100,000) (Figure 39).

Black females and black males had the highest primary asthma ED visit rates (1,565.6/100,000 and 1,489.8/100,000, respectively), followed by white females (454.1/100,000) and white males (322.3/100,000) (Figure 39).

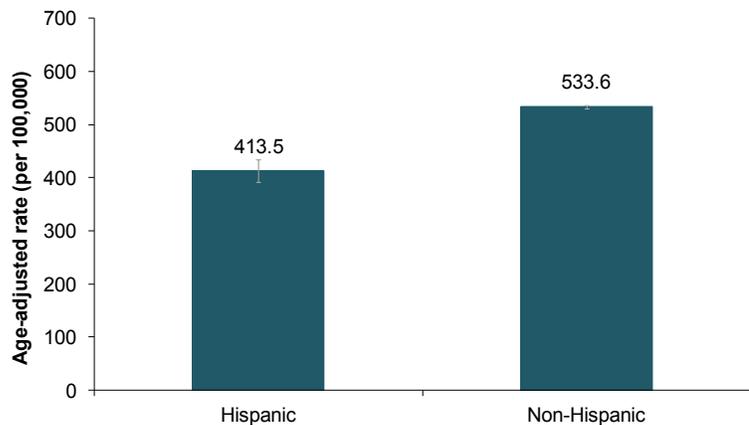
Figure 39



Age-adjusted ED visit rate for primary asthma by gender and/or race, Tennessee, 2010 (HDDS)

Between 2008 and 2010, there were 2,935 ED visits for a primary diagnosis of asthma among Hispanics. During this same time, the average, annual asthma ED visit rate was 413.5/100,000 among Hispanics and 533.6/100,000 among non-Hispanics (Figure 40).

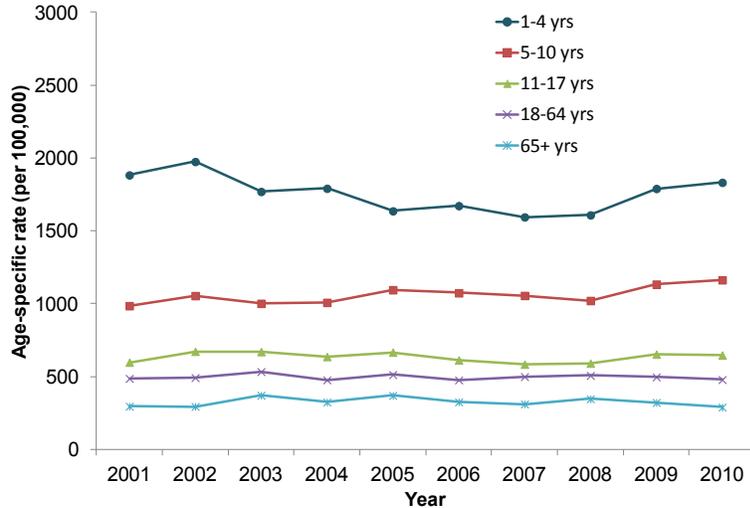
Figure 40



Age-adjusted ED visit rate for primary asthma by ethnicity, Tennessee, 2008-2010 average (HDDS)

Emergency Department Visits for Asthma

Figure 41



Between 2001 and 2010, the only statistically significant change in primary asthma ED visit rates by age group was seen in children aged 5-10 years, with an 18% increase (Figure 41). The rate increased from 985.6/100,000 in 2001 to 1,163.0/100,000 in 2010.

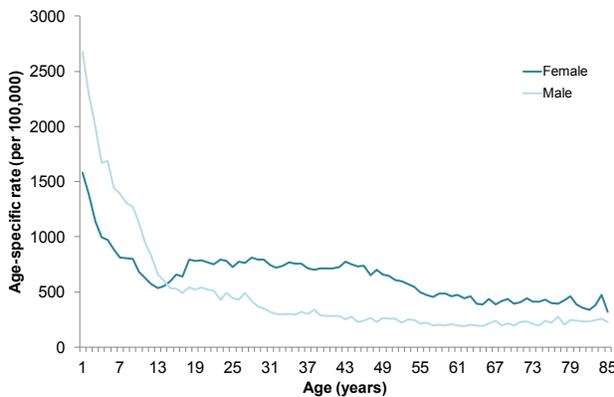
Age-specific ED visit rate for primary asthma, Tennessee, 2001-2010 (HDSS)

ED visit rates for asthma were highest among very young children and decreased with increasing age. This pattern was similar for all gender/race groups.

ED visit rates among children were higher for males than females, while among adults they were higher for females (Figure 42).

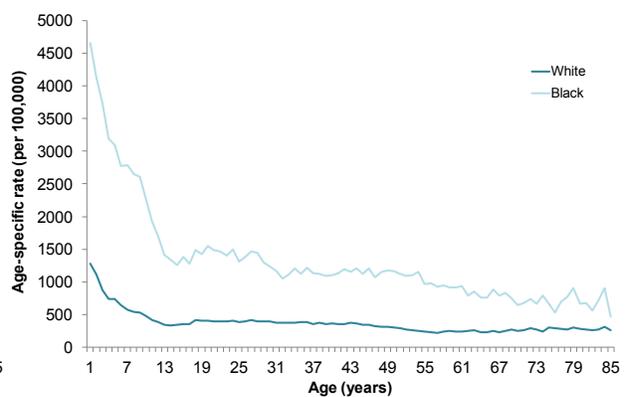
ED visits for asthma were higher among blacks than whites at all ages. The gap between blacks and whites decreased as age increased (Figure 43).

Figure 42



Age-specific ED visit rate for primary asthma, by gender, Tennessee, 2006-2010 average (HDSS)

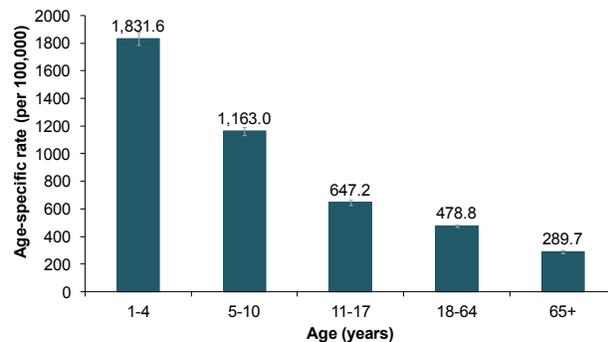
Figure 43



Age-specific ED visit rate for primary asthma, by race, Tennessee, 2006-2010 average (HDSS)

Emergency Department Visits for Asthma

Figure 44



Age-specific ED visit rate for primary asthma, Tennessee, 2010 (HDDS)

In 2010, the ED visit rate for asthma decreased as age increased. The rate was highest among children aged 1-4 years (1,831.6/100,000) and lowest among adults aged 65 years and older (289.7/100,000) (Figure 44).

Barriers to Asthma Control

Controlled asthma is characterized by minimal to no symptoms during the day and at night, no asthma attacks, no emergency visits to physicians or hospitals, minimal need for rescue medications, no limitations on physical activities and exercise, nearly normal lung function and minimal or no side-effects from medication. With the medical treatments currently available it is theoretically possible to achieve control in the majority of patients. Yet a substantial number of patients appear to tolerate suboptimal treatment. In addition, patient perceptions of asthma control and prevalence of symptoms are often mismatched, with patients who consider their asthma well controlled still reporting daily symptoms.

There are a number of possible reasons for poor asthma control:

- Co-morbidities (e.g. rhinitis, COPD)
- Severe therapy-resistant disease
- Ongoing exposure to triggers
- Inadequate assessment
- Inadequate treatment
- Limited treatment effectiveness
- Ineffective delivery of treatment (e.g. poor inhaler technique)
- Over-reliance on complimentary/alternative treatments
- Inadequate use of action plans
- Low patient and physician expectations
- Low adherence to agreed asthma therapy
- Functional and psychological problems affecting willingness to use therapy
- Not attending medical consultations
- Patients do not perceive symptoms as indicative of poor control
- Misdiagnosis

The level of asthma control achieved reflects the behavior of both health care professionals and patients. Understanding reasons for poor control in individual patients requires health care professionals to identify both the clinical and behavioral factors involved, and good communication between providers and patients is key to setting *and achieving* realistic goals for asthma control.

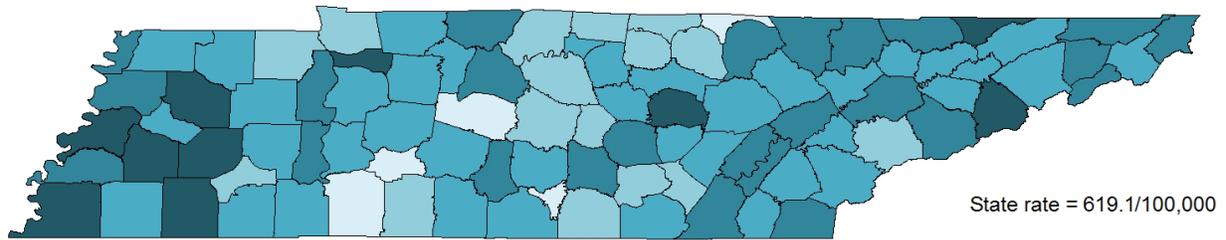
Sources:

Holgate ST, Price D, Valovirta E. Asthma out of control? A structured review of recent patient surveys. *BMC Pulmonary Medicine* 2006; 6(S1).

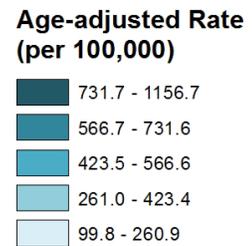
Horne R, Price D, Cleland J, *et al.* Can asthma control be improved by understanding the patient's perspective? *BMC Pulmonary Medicine* 2007; 7(8).

Emergency Department Visits for Asthma

Figure 45



Age-adjusted ED visit rate for primary asthma by county, Tennessee 2008-2010 average (HDDS)



Between 2008 and 2010, the average age-adjusted ED visit rate for primary asthma within individual Tennessee counties ranged from 99.8/100,000 in Moore County to 1,156.7/100,000 in Hardeman County (Figure 45). More detailed county and regional level ED visit rates are located in the Appendix.

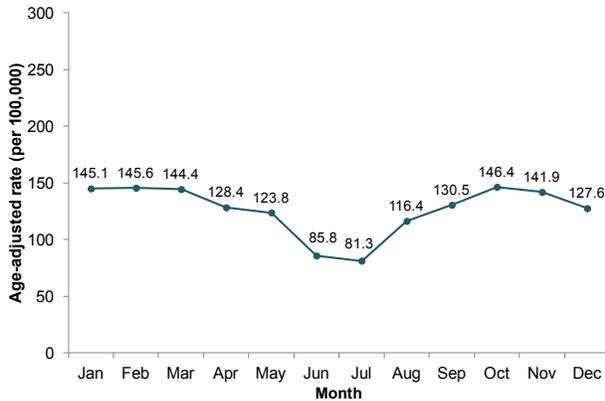
The ten counties with the *lowest* ED visit rates for primary asthma were: Moore, Pickett, Lewis, Williamson, Wayne, Stewart, Wilson, Henry, Macon and Grundy.

The ten counties with the *highest* ED visit rates for primary asthma were: Hardeman, Shelby, Lauderdale, Cocke, Haywood, Madison, Houston, White, Hancock, and Gibson.

Seasonal Asthma Trends

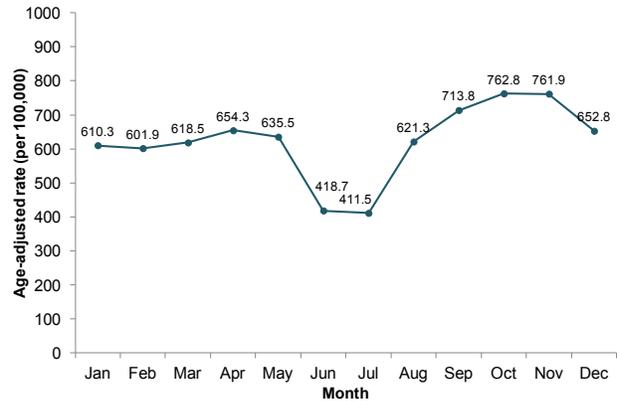
As seasons change, different asthma triggers are present in the air (e.g. pollens in the spring and outdoor molds in the fall). As a result, asthma symptoms often vary over time due to these changing environmental triggers. The following is a discussion of seasonal trends in inpatient hospitalizations and ED visits for a primary diagnosis of asthma.

Figure 46



Age-adjusted inpatient hospitalization rate for primary asthma by month, Tennessee, 2006-2010 average (HDDS)

Figure 47



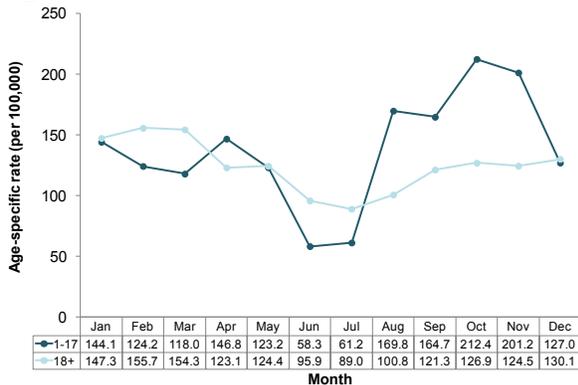
Age-adjusted ED visit rate for primary asthma by month, Tennessee, 2006-2010 average (HDDS)

Between 2006 and 2010, average monthly rates for inpatient hospitalizations and ED visits peaked in October and November and were lowest in June and July (Figure 46 and Figure 47).

Monthly inpatient hospitalization and ED visit rates were at their lowest in June and July among both children (1-17 years) and adults (18 years and older). However, the timing of peaks was different among the two groups (Figure 48 and Figure 49).

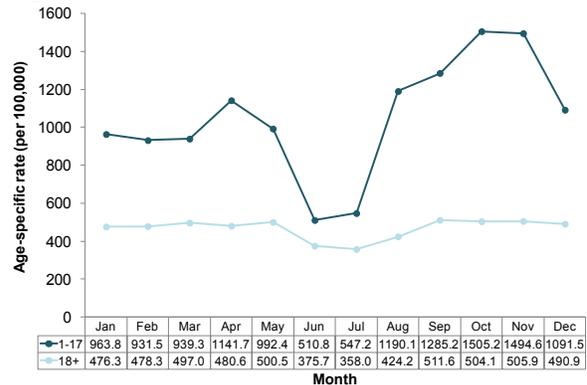
Among children, inpatient hospitalizations and ED visits peaked in October and November. Among adults these peaks occurred in the winter months (November-March). In general, “peak” rates were less pronounced among adults than among children.

Figure 48



Age-specific inpatient hospitalization rate for primary asthma by month, Tennessee, 2006-2010 average (HDDS)

Figure 49



Age-specific ED visit rate for primary asthma by month, Tennessee, 2006-2010 average (HDDS)

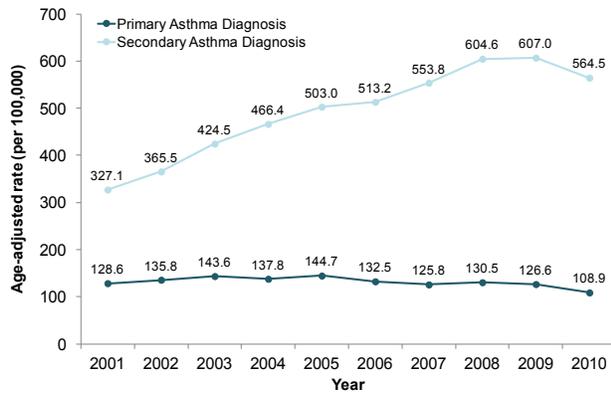
Secondary Diagnosis of Asthma

The previous discussion of inpatient hospitalizations and ED visits was based on a primary diagnosis of asthma.

Among inpatient hospitalizations for a primary diagnosis other than asthma, the rate of hospitalizations for which there was a secondary diagnosis of asthma increased approximately 72% between 2001 and 2010 from 327.1 to 564.5/100,000 (Figure 50).

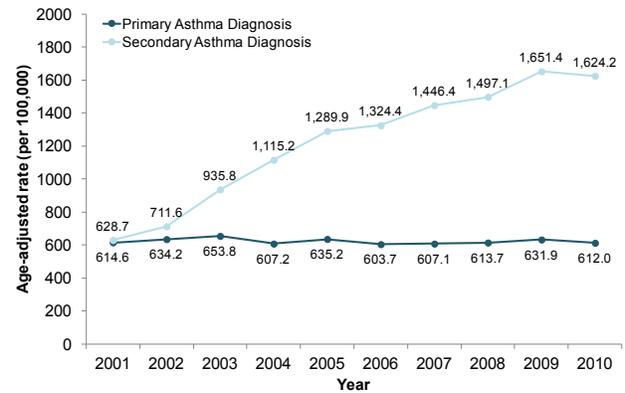
Among ED visits for a primary diagnosis other than asthma, the rate of ED visits for which there was a secondary diagnosis of asthma increased approximately 158% between 2001 and 2010, from 628.7 to 1,624.2/100,000 (Figure 51).

Figure 50



Age-adjusted inpatient hospitalization rate for primary or secondary asthma, Tennessee, 2001-2010 (HDDS)

Figure 51



Age-adjusted ED visit rate for primary or secondary asthma, Tennessee, 2001-2010 (HDDS)

Health Care Utilization and Cost

Billed Charges for Asthma Hospitalizations

The Hospital Discharge Data System collects information on hospital charges billed to insurance companies and to patients. Actual payments paid to hospitals were likely less than the amounts billed. However, examining billed charges provides insight into the hospital costs associated with asthma.

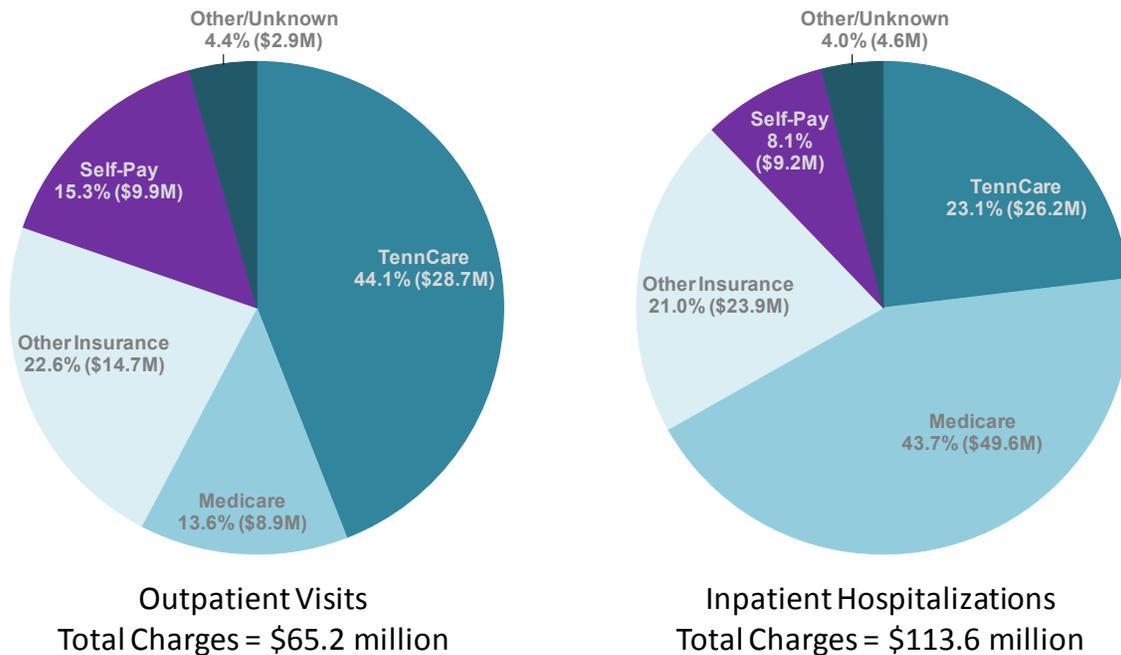
In 2010, hospital charges for a primary asthma diagnosis totaled \$178.8 million in Tennessee. This represented 0.5% of the \$35.7 billion charged for all hospital visits that year.

Approximately 64% of asthma charges (\$113.6 million) were for inpatient hospitalizations and 37% (\$65.2 million) were for outpatient hospitalizations.

TennCare was charged for the greatest percentage of outpatient asthma charges (44.1%), followed by other insurance (22.6%), self-pay (15.3%), Medicare (13.6%) and other or unknown payer (4.4%) (Figure 52).

Medicare was charged for the greatest percentage of inpatient asthma charges (43.7%), followed by TennCare (23.1%), other insurance (21.0%), self-pay (8.1%) and other or unknown payer (4.0%) (Figure 52).

Figure 52



Total outpatient or inpatient hospital charges for primary asthma by payer, Tennessee, 2010 (HDDS)

Mortality

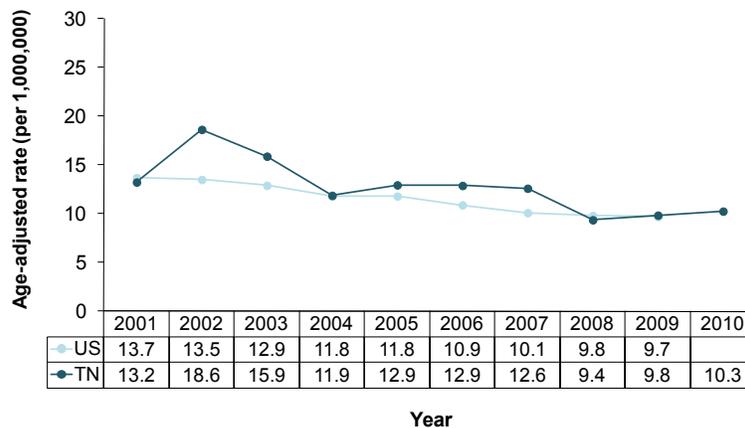
Deaths due to asthma are largely preventable and represent a breakdown in effective disease management. The following is a discussion of mortality due to asthma, both as the underlying (or primary) cause of death and as a contributing (or secondary) cause of death. Death data were derived from the Death Statistical System (DSS), which is described in the Technical Notes.

Deaths due to an Underlying Cause of Asthma

In 2010, there were 66 deaths due to an underlying diagnosis of asthma in Tennessee, and the asthma mortality rate was 10.3/1,000,000.

Between 2001 and 2010, there was a statistically significant decrease in the asthma mortality rate in Tennessee (Figure 53).

Figure 53



Age-adjusted mortality rate for underlying asthma, Tennessee and the United States, 2001-2010 (DSS, NVSS)

In 2010, Tennessee ranked 11th lowest nationwide for asthma mortality.¹⁵ The asthma mortality rate in Tennessee was higher than the national rate in some years, and was lower than the national rate in other years. By comparing the rates and confidence intervals for all years, there were no statistically significant differences between Tennessee and the U.S. except for in 2002 when the Tennessee mortality rate for asthma was higher than the U.S. Both had similar decreases in asthma mortality between 2001 and 2009 (Figure 53).¹⁵

Mortality

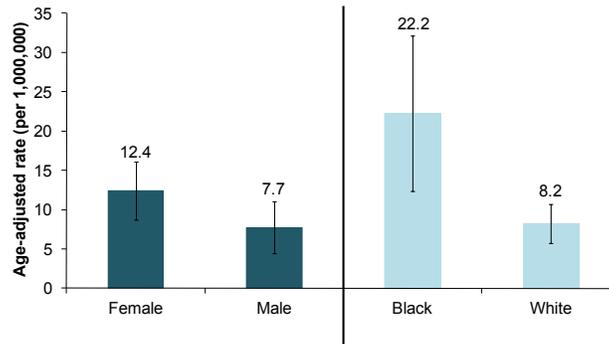
Deaths due to an Underlying Cause of Asthma

In 2010, there were no statistically significant differences in the asthma mortality rate for females (12.4/1,000,000) compared to males (7.7/1,000,000) (Figure 54).

The asthma mortality rate was statistically significantly higher among blacks (22.2/1,000,000) than among whites (8.2/1,000,000) (Figure 54).

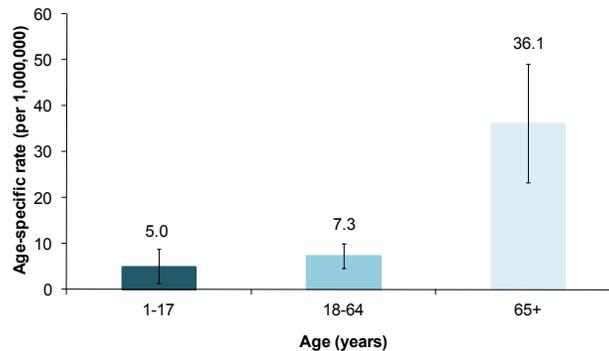
The asthma mortality rate was lowest among children 1-17 years of age (5.0/1,000,000) and highest among adults ages 65 years and older (36.1/1,000,000) (Figure 55).

Figure 54



Age-adjusted mortality rate for underlying asthma by gender or race, Tennessee, 2010 (DSS)

Figure 55



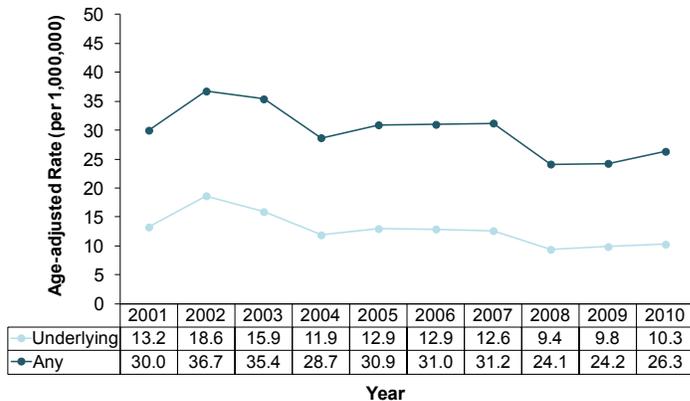
Age-specific mortality rate for underlying asthma, Tennessee, 2010 (DSS)

Mortality

Deaths due to Any Diagnosis of Asthma

Studies have found that persons with asthma have an increased risk of death from causes other than asthma. For example, patients who had a hospitalization for treatment of asthma were found to have increased risk of death from other lung diseases and from cardiovascular diseases compared with the general population.¹⁶ Indeed, examining asthma mortality based solely on primary cause of death may underestimate the magnitude of asthma-related mortality.¹⁷ The following is a discussion of asthma mortality trends in Tennessee where asthma was listed as an underlying and/or a contributing cause of death (i.e. any asthma diagnosis).

Figure 56



In 2010, there were 174 deaths for which asthma was listed as any cause of death, and the mortality rate for any asthma diagnosis was 26.3/1,000,000.

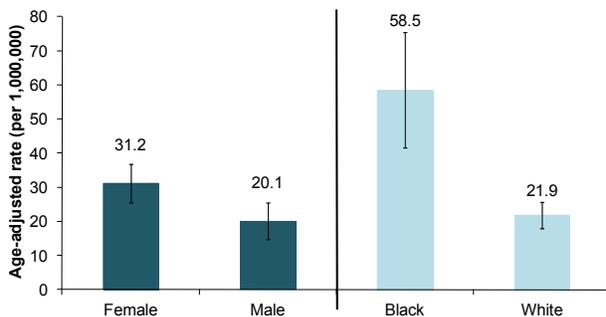
Between 2001 and 2010, the annual mortality rates for any asthma diagnosis were approximately 2-2.5 times those for an underlying asthma diagnosis alone (Figure 56).

Age-adjusted mortality rate for underlying and any asthma diagnosis, Tennessee, 2001-2010 (DSS)

In 2010, the mortality rate for any asthma diagnosis was slightly higher among females (31.2/1,000,000) than among males (20.1/1,000,000) (Figure 57), and was higher among blacks (58.5/1,000,000) than among whites (21.9/1,000,000) (Figure 57).

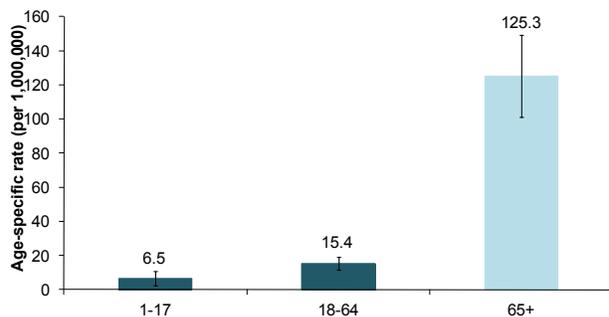
The mortality rate for any asthma was lowest among children 1-17 years of age (6.5/1,000,000) and highest among adults 65 years of age and older (125.3/1,000,000) (Figure 58).

Figure 57



Age-adjusted mortality rate for any asthma by gender or race, Tennessee, 2010 (DSS)

Figure 58



Age-specific mortality rate for any asthma, Tennessee, 2010 (DSS)

Data Sources

Behavioral Risk Factor Surveillance System (BRFSS): The BRFSS is an annual, CDC-funded, state-administered, random-digit-dialed telephone survey of the U.S. non-institutionalized population, 18 years of age and older, which gathers self-reported data on certain health conditions and behavioral risk factors. For BRFSS data, the terms “white” and “black” refer to persons of non-Hispanic origin only, and the terms “Hispanic” and “non-Hispanic” refer to ethnicity regardless of race. BRFSS data for the U.S. and for states other than Tennessee were derived from the BRFSS website as referenced in the text. As such, no statistical tests were performed due to lack of necessary data. For Tennessee data, time trends were analyzed using linear regression and two way comparisons of prevalence rates (e.g. male vs. female) were tested for significance using a chi-square test. *P*-values of less than 0.05 were considered significant. Unless otherwise indicated, trends and differences noted in the text were statistically significant. Ninety-five percent confidence intervals are provided in the graphs.

Death Statistical System (DSS): The DSS is an annual state-based compilation of mortality data. The analyses were limited to the records of Tennessee residents. For DSS data, the terms “white” and “black” refer to persons of any ethnicity. Trends were analyzed using linear regression and were statistically significant (*p*-value < 0.05) unless otherwise indicated in the text. Ninety-five percent confidence intervals for mortality rates by gender, race, and age group are provided in the graphs. Comparisons between groups (e.g. male vs. female) were considered significant if confidence intervals did not overlap.

Hospital Discharge Data System (HDDS): The HDDS is an annual state-based compilation of data on patients discharged from all acute care hospitals licensed by the Tennessee Department of Health. The HDDS does not include federal facilities (i.e., VA hospitals, etc.) or facilities licensed by the Tennessee Department of Mental Health and Developmental Disabilities. The analyses were limited to the records of Tennessee residents. For HDDS data, the terms “white” and “black” refer to persons of any ethnicity and the terms “Hispanic” and “non-Hispanic” refer to ethnicity regardless of race. Hospitalization rates by Hispanic status excluded three hospitals due to questionable ethnicity designations. Trends were analyzed using linear regression and were statistically significant (*p*-value < 0.05) unless otherwise indicated in the text. Ninety-five percent confidence intervals for hospitalization rates by gender, race, gender/race combined, ethnicity, and age group are provided in the graphs. Comparisons between groups (e.g. male vs. female) were considered significant if confidence intervals did not overlap. No statistical testing was performed on billed hospital charges. All 2010 HDDS data are provisional.

National Survey of Children’s Health (NSCH): The NSCH is a module of the State and Local Area Integrated Telephone Survey, conducted by the National Center for Health Statistics. The survey was administered to a random-digit-dialed sample of households with children less than 18 years of age – one child was randomly selected from all children in each identified household to be the subject of the survey. The respondent was the parent or guardian who knew the most about the child’s health and health care. NSCH data were derived from NSCH websites and published reports as referenced in the text. As such, no statistical tests were performed due to lack of necessary data.

National Hospital Discharge Survey (NHDS): The NHDS is a national probability survey that collects information on inpatients discharged from non-Federal short-stay hospitals in the U.S. Data from the NHDS was derived from previously published reports as referenced in the text.

Data Analysis

Hospitalization and mortality rates were age-adjusted to the 2000 standard United States population with a 10 year age interval (i.e. 11 age groups) using the direct method of standardization. Both age-specific and age-adjusted rates were calculated using the 2008 Revision of the 2003 Population Estimates and Projections from the Tennessee Department of Health's Office of Health Statistics (2001-2009) and U.S. Census data (2010)

Disease Classification

The diagnosis codes used for disease classification in the HDDS data were International Classification of Diseases, 9th Revision, Clinical Modification (ICD-9-CM). Asthma was defined using all ICD9-CM codes beginning with 493. The diagnosis codes used to define asthma in the DSS were all International Classification of Diseases, 10th Revision (ICD-10) codes beginning with J45 and J46.

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Appendix

County & Regional Inpatient and Emergency Department Visit Rates

The following tables present detailed asthma data for individual health department regions and counties in Tennessee. Included are inpatient hospitalization and emergency department visit rates from the hospital discharge data system. Data presented are 2008-2010 annual averages for primary asthma. All rates presented are age-adjusted and are per 100,000 persons in the population.

Metropolitan Regions

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Davidson	2,034	113.0	10,624	591.1
Hamilton	803	77.8	6,255	676.8
Knox	1,047	83.9	7,028	595.2
Madison	352	119.4	2,468	855.0
Shelby	4,693	168.3	29,541	1039.5
Sullivan	513	108.6	2,557	612.0

East Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Anderson	216	94.7	921	458.1
Blount	322	87.0	1,262	384.5
Campbell	233	171.4	773	664.1
Claiborne	129	128.8	584	648.3
Cocke	172	144.7	935	939.4
Grainger	74	100.2	306	475.1
Hamblen	278	142.7	951	521.6
Jefferson	160	100.1	777	538.4
Loudon	113	77.7	631	516.0
Monroe	139	102.7	618	486.5
Morgan	95	153.2	307	533.2
Roane	237	138.0	827	580.9
Scott	82	114.8	404	604.2
Sevier	205	78.1	1,459	621.0
Union	29	48.7	270	473.9
Region Total	2,484	107.3	11,025	538.6

Appendix

Mid-Cumberland Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Cheatham	134	105.6	547	469.1
Dickson	109	71.7	732	513.8
Houston	21	78.6	193	854.5
Humphreys	60	99.5	233	446.6
Montgomery	694	168.8	2,369	494.7
Robertson	257	131.2	1,258	648.6
Rutherford	679	97.7	3,186	421.2
Stewart	44	98.3	113	286.3
Sumner	443	93.7	1,844	400.8
Trousdale	25	102.9	108	474.0
Williamson	239	49.8	971	193.0
Wilson	304	91.1	1,051	327.8
Region Total	3,009	98.8	12,605	403.1

Northeast Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Carter	165	92.5	712	441.6
Greene	279	129.1	1,059	554.6
Hancock	35	150.3	163	827.7
Hawkins	197	107.9	827	492.3
Johnson	43	83.8	298	619.6
Unicoi	73	137.9	329	703.5
Washington	476	132.5	1,978	602.0
Region Total	1,268	118.5	5,366	556.3

Appendix

Northwest Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Benton	38	65.8	253	590.6
Carroll	94	99.6	418	492.6
Crockett	70	151.3	224	539.7
Dyer	278	232.5	746	655.5
Gibson	218	141.4	1,092	789.3
Henry	91	87.4	287	332.2
Lake	68	300.1	139	656.7
Obion	146	143.9	500	557.5
Weakley	152	152.9	423	449.2
Region Total	1,155	144.3	4,082	567.4

South Central Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Bedford	275	202.5	664	490.3
Coffee	251	154.3	922	614.2
Giles	112	115.6	364	444.8
Hickman	67	87.9	369	519.5
Lawrence	288	210.2	445	359.0
Lewis	27	73.5	65	191.4
Lincoln	96	90.1	535	566.4
Marshall	130	143.1	594	678.3
Maury	333	138.3	1,180	502.3
Moore	7	38.9	17	99.8
Perry	29	106.1	100	462.4
Wayne	85	166.1	120	260.9
Region Total	1,700	144.4	5,375	487.9

Appendix

Southeast Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Bledsoe	47	108.2	185	484.4
Bradley	469	156.2	1,487	519.7
Franklin	168	126.1	417	356.5
Grundy	37	78.9	147	352.3
McMinn	173	107.0	781	517.1
Marion	84	86.8	371	469.4
Meigs	64	172.5	250	731.6
Polk	203	339.0	311	653.4
Rhea	78	79.1	557	618.0
Sequatchie	21	51.1	145	372.0
Region Total	1,344	130.4	4,651	500.8

Southwest Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Chester	49	106.7	185	403.3
Decatur	36	95.1	216	701.7
Fayette	91	82.6	583	548.0
Hardeman	122	146.8	933	1156.7
Hardin	92	128.2	332	484.7
Haywood	148	254.7	514	907.5
Henderson	123	140.7	428	543.6
Lauderdale	163	190.4	839	1028.8
McNairy	107	126.4	357	482.2
Tipton	247	139.7	1,115	623.3
Region Total	1,178	137.9	5,502	682.2

Appendix

Upper Cumberland Region

County	Inpatient Hospitalizations		Emergency Department Visits	
	Number	Rate	Number	Rate
Cannon	52	111.1	171	423.4
Clay	31	111.0	84	369.3
Cumberland	256	142.8	696	474.2
Dekalb	117	185.1	271	495.5
Fentress	220	394.7	314	627.8
Jackson	44	113.5	130	393.9
Macon	65	98.2	225	348.6
Overton	109	150.9	248	390.6
Pickett	14	97.0	20	125.4
Putnam	295	137.0	1,140	549.4
Smith	116	192.4	320	566.6
Van Buren	19	98.1	82	504.6
Warren	185	145.0	749	634.0
White	141	170.8	607	845.6
Region Total	1,664	154.6	5,057	523.6