



*The Burden of*  
**Heart Disease  
and Stroke**  
*in Tennessee*

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Tennessee Department of Health  
Office of Policy, Planning and Assessment  
Surveillance, Epidemiology and Evaluation

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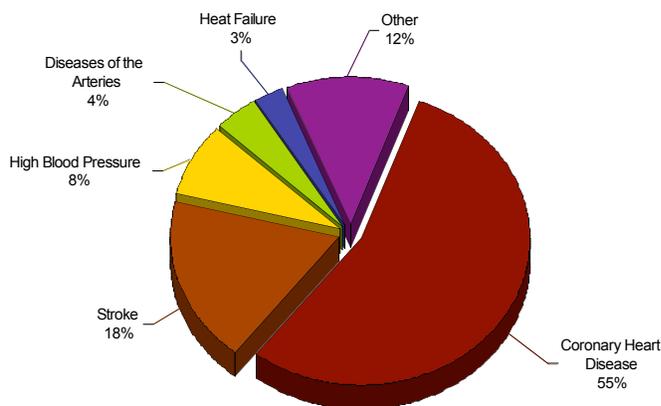
# INTRODUCTION

## PURPOSE

The purpose of this update is to supplement the report entitled *The Burden of Heart Disease and Stroke in Tennessee*, which was published by the Tennessee Department of Health (TDH) in 2006. The update includes the most recent data available on population demographics, risk factors for cardiovascular disease, and both hospitalizations and deaths due to diseases of the heart and stroke. Data sources used in the report include the Behavioral Risk Factor Surveillance System (BRFSS), the Hospital Discharge Data System (HDDS) and the Death Statistical Summary System (DSSS).

## BACKGROUND

- An estimated 79,400,000 American adults (one in every three) have one or more types of cardiovascular disease.<sup>1</sup>
- Nearly 2,400 Americans die of cardiovascular disease each day, an average of one death every 36 seconds.<sup>1</sup>
- The majority of cardiovascular disease deaths in the United States are due to coronary heart disease (52%), stroke (17%) and high blood pressure (7%).<sup>1</sup> A similar breakdown of deaths due to cardiovascular disease is observed in Tennessee (Figure 1).
- The cost of cardiovascular diseases in the United States for 2007 is estimated at \$431.8 billion. This figure includes direct health care costs, as well as lost productivity resulting from morbidity and mortality.<sup>1</sup>



**Figure 1. Percentage Breakdown of Deaths From Cardiovascular Disease, Tennessee, 2004 (DSSS)**

## What is cardiovascular disease?

Cardiovascular disease is a broad term used to describe a collection of diseases and conditions. It refers to any disorder involving the heart or any of the blood vessels throughout the body. Cardiovascular disease has two main components: diseases of the heart and diseases of the blood vessels.

### Diseases of the Heart

- cardiomyopathy
- congenital heart disease
- coronary artery disease
- coronary heart disease
- heart failure
- pericardial disease
- valvular heart disease

### Disease of the Blood Vessels

- aneurysm
- arteriosclerosis
- atherosclerosis
- high blood pressure
- lymphedema
- peripheral artery disease
- stroke
- varicose veins
- vasculitis
- venous incompetence
- venous thrombosis

Source: *The Mayo Clinic. Cardiovascular Disease 101: Know Your Heart and Blood Vessels.*  
[www.mayoclinic.com/health/cardiovascular-disease/HB00032](http://www.mayoclinic.com/health/cardiovascular-disease/HB00032)

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# INTRODUCTION *cont.*

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## DISEASES OF THE HEART

- Diseases of the heart include conditions affecting the heart muscle, the heart valves and the arteries supplying blood to the heart.<sup>2</sup>
- Twelve percent of adults in the United States have been told by a health care provider that they have some form of heart disease.<sup>3</sup>
- Diseases of the heart are the number one cause of death in Tennessee and the U.S. (Figure 2).<sup>4</sup>
- The majority of deaths due to diseases of the heart are the result of coronary heart disease. Coronary heart disease, which includes chest pain and heart attack, is caused by impaired blood flow through the coronary arteries.<sup>2</sup>
- The prevalence of coronary heart disease in the U.S. is highest among white males, followed by black females, black males and white females.<sup>1</sup>
- Although the prevalence of coronary heart disease is highest among white males, mortality is highest among black males, followed by white males, black females and white females.<sup>1</sup>

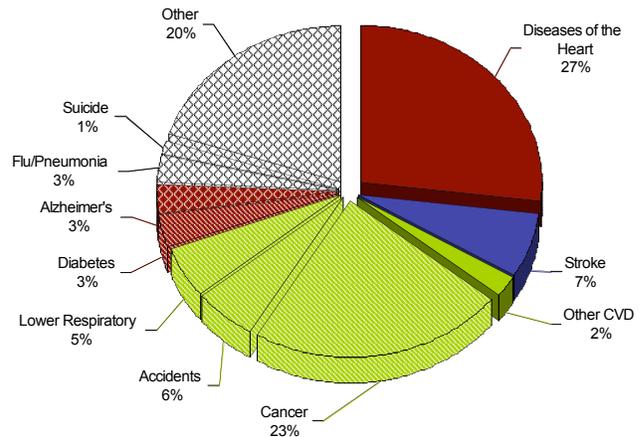


Figure 2. Causes of Death, Tennessee, 2004 (DSSS)

## STROKE

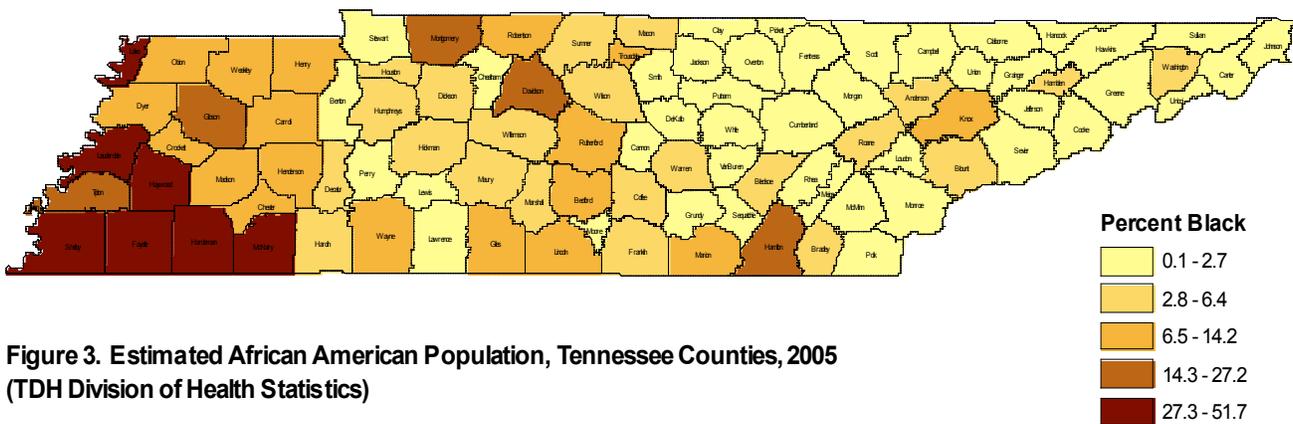
- Stroke occurs when blood flow to the brain is interrupted (ischemic stroke) or when a blood vessel in the brain ruptures (hemorrhagic stroke). This in turn causes death of brain cells in the affected area and loss of brain function.<sup>2</sup>
- Of all strokes in the United States, 87% are ischemic and the rest are hemorrhagic.<sup>1</sup>
- Each year in the U.S., approximately 500,000 people have a stroke for the first time, and 200,000 have a recurrent stroke. That means that someone has a stroke every 45 seconds.<sup>1</sup>
- Stroke is the third leading cause of death in Tennessee and in the United States (Figure 2).<sup>4</sup>
- In the United States, both stroke incidence and stroke mortality are highest among black males, followed by black females, white males and white females.<sup>1</sup>

## HIGH BLOOD PRESSURE

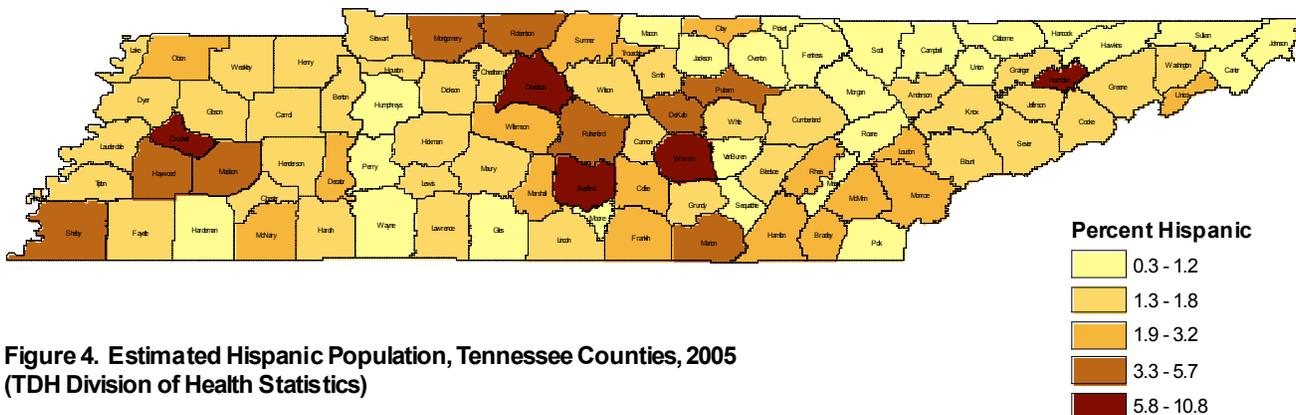
- High blood pressure (also called hypertension) is the excessive force of blood pumping through the blood vessels. It is the most common form of cardiovascular disease, as well as a risk factor for other types of cardiovascular disease, such as stroke and heart failure.<sup>2</sup>
- The prevalence of high blood pressure in blacks in the United States is among the highest in the world and is increasing.<sup>1</sup>
- In the United States the prevalence of high blood pressure is highest among black females, followed by black males, white males and white females.<sup>1</sup>
- Compared with whites, blacks develop high blood pressure earlier in life and their average blood pressures are much higher. As a result, compared with whites, blacks have a 1.3-times greater rate of non-fatal stroke, a 1.8-times greater rate of fatal stroke, and a 1.5-times greater rate of heart disease death.<sup>1</sup>

# POPULATION

- In 2005, the population of Tennessee was estimated to be approximately 6 million.
- Approximately 17 percent of the population was African American. Within each county, the percentage of African Americans ranged from 0.1 percent to 52 percent (Figure 3). The ten counties with the highest percentage of African Americans were: Haywood (52%), Shelby (51%), Hardeman (43%), Lauderdale (35%), McNairy (33%), Fayette (33%), Lake (32%), Davidson (27%), Hamilton (21%), and Montgomery (20%).
- Approximately 3 percent of the population was Hispanic. Within each county, the percentage of Hispanics ranged from 0.3 percent to 11 percent (Figure 4). The ten counties with the highest percentage of Hispanics were: Bedford (11%), Hamblen (8%), Crockett (8%) Warren (7%), Davidson (6%), Montgomery (6%), Dekalb (5%), Marion (5%), Putnam (4%) and Madison (4%).



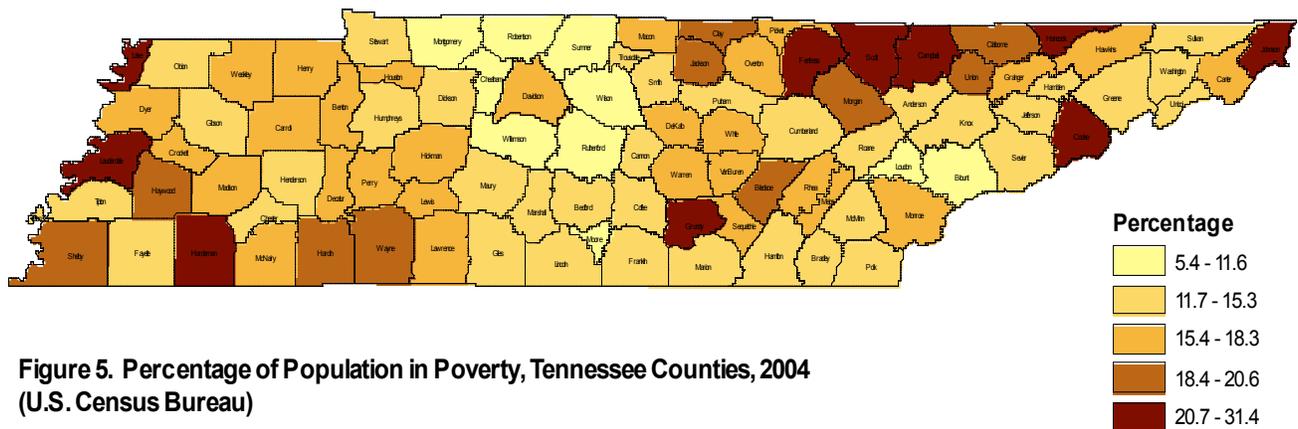
**Figure 3. Estimated African American Population, Tennessee Counties, 2005**  
(TDH Division of Health Statistics)



**Figure 4. Estimated Hispanic Population, Tennessee Counties, 2005**  
(TDH Division of Health Statistics)

# POPULATION *cont.*

- In 2004, fifteen percent of the population of Tennessee (approximately 900,000 people) was living in poverty. Within each county, the percentage of persons in poverty ranged from 5 percent to 31 percent (Figure 5). The ten counties with the highest percentage of persons living in poverty were: Lake (31%), Hancock (29%), Grundy (22%), Fentress (22%), Johnson (22%), Campbell (22%), Cocke (21%), Scott (21%) Hardeman (21%) and Lauderdale (21%).<sup>5</sup>



**Figure 5. Percentage of Population in Poverty, Tennessee Counties, 2004**  
(U.S. Census Bureau)

# MODIFIABLE RISK FACTORS

- This section discusses the prevalence of several major risk factors for cardiovascular disease that can be modified through behavior change and/or treatment.
- Based on the 2005 Tennessee Behavioral Risk Factor Surveillance System, the most common risk factor among Tennessee adults aged 18 and older was consumption of fewer than five daily servings of fruits and vegetables (74%), followed by sedentary lifestyle (33%), high cholesterol (33%), high blood pressure (30%), obesity (27%), cigarette smoking (27%), and diabetes (9%).

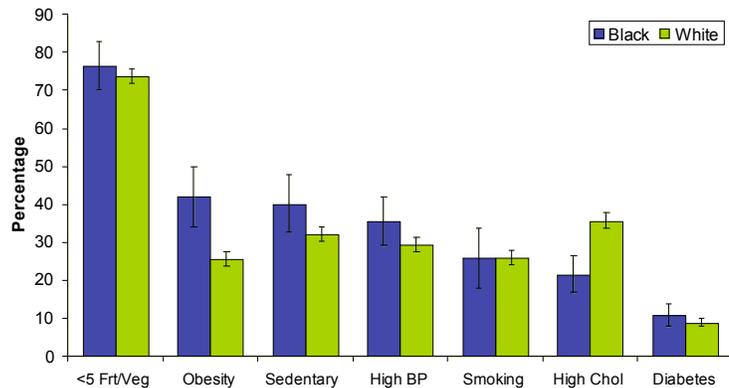


Figure 6. Prevalence of Modifiable Risk Factors by Race, Tennessee, 2005 (Behavioral Risk Factor Surveillance System)

- Obesity and sedentary lifestyle were more common among African Americans than whites (42% vs. 26% and 40% vs. 32%, respectively;  $p < 0.05$  for both). High cholesterol was more common among whites than African Americans (36% vs. 22%;  $p < 0.05$ ) (Figure 6).
- Approximately 90% of both African Americans and whites had at least one of the risk factors for cardiovascular disease listed above. A higher percentage of blacks (26%) had four or more of these risk factors than did whites (18%) ( $p < 0.05$ ) (Figure 7).

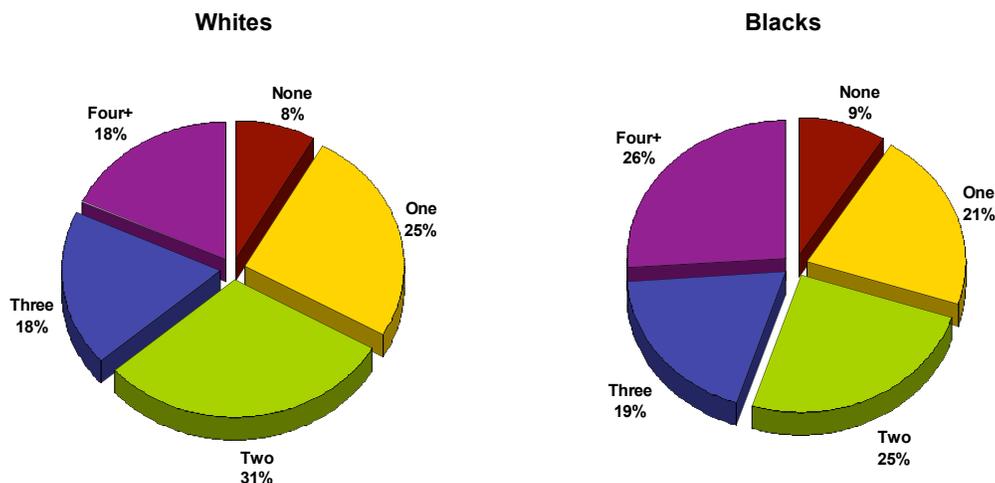


Figure 7. Distribution of Modifiable Risk Factors among Whites and Blacks, Tennessee, 2005 (BRFSS)

# DISEASES OF THE HEART

- Between 1996 and 2005, approximately 16,000 Tennesseans died from diseases of the heart annually. Approximately three-quarters of these deaths occurred in persons 65 years and older.
- The age-adjusted mortality rate from diseases of the heart decreased 21% between 1996 and 2005, from 314 to 248 deaths per 100,000.
- Between 1996 and 2005, the age-adjusted mortality rate from diseases of the heart decreased for all gender/race groups. The decrease was greatest among black females (26%). Decreases among other gender/race groups were as follows: white males (21%), white females (20%), and black males (19%).
- Racial/gender differences in diseases of the heart mortality rates persisted throughout 1996-2005. Each year, black males had the highest mortality rates, followed by white males, black females and white females (Figure 8).
- The average age-adjusted mortality rate from diseases of the heart for the 6 years between 2000 and 2005 was higher among blacks than among whites (349 vs. 262/100,000), and higher among non-Hispanics than among Hispanics (273 vs. 83/100,000). Mortality was higher for males than for females for all ethnic/racial groups (Figure 9).
- For the time period 2000-2004, diseases of the heart were the number one leading cause of death among whites and blacks, and the third leading cause of death among Hispanics.<sup>6</sup>
- Among blacks, diseases of the heart were the leading cause of death among persons as young as 35-44 years of age. Among whites, diseases of the heart did not become the leading cause of death until 65 years of age (Table 1).

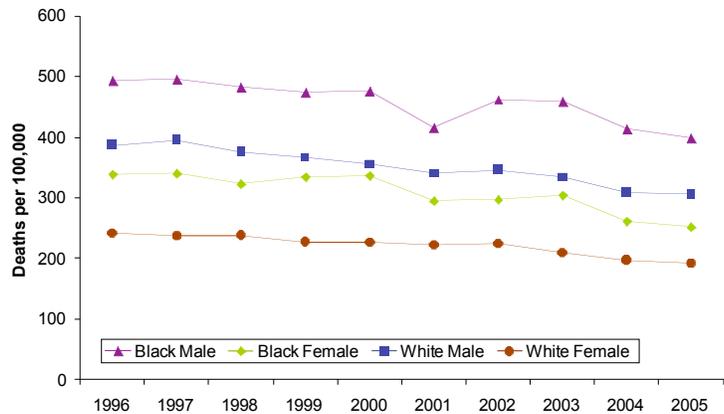


Figure 8. Age-Adjusted Mortality Rate from Diseases of the Heart by Gender and Race, Tennessee, 1996-2005 (DSSS)

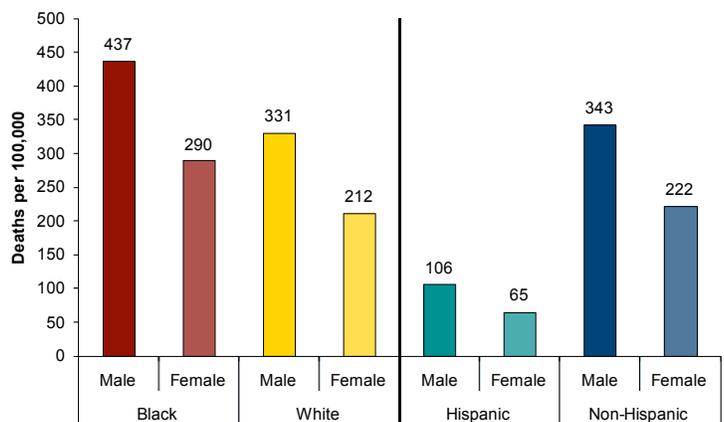


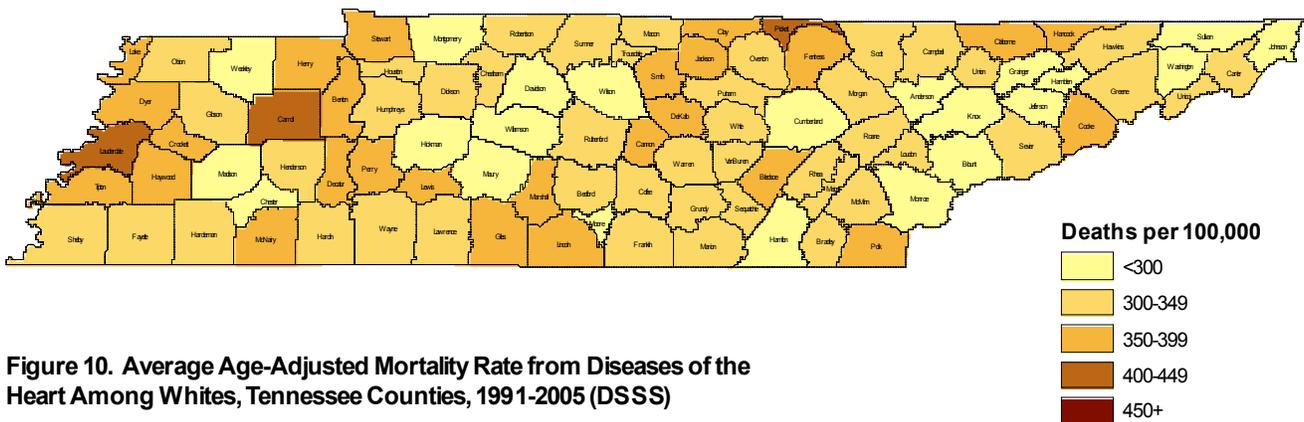
Figure 9. Average Age-Adjusted Mortality Rate from Diseases of the Heart by Race/Ethnicity and Gender, Tennessee, 2000-2005 (DSSS)

Table 1. Leading Causes of Death by Age Group and Race, Tennessee, 2000-2004<sup>6</sup>

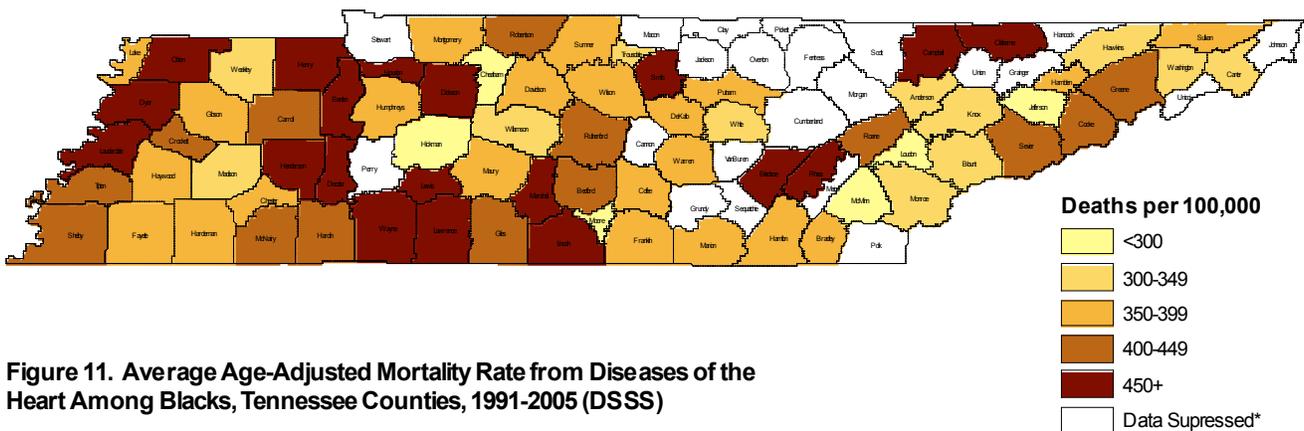
Age	Race	
	Black	White
25-34	Homicide	Accidents
35-44	<i>Diseases of the Heart</i>	Accidents
45-54	<i>Diseases of the Heart</i>	Cancer
55-64	<i>Diseases of the Heart</i>	Cancer
65+	<i>Diseases of the Heart</i>	<i>Diseases of the Heart</i>
All Ages	<i>Diseases of the Heart</i>	<i>Diseases of the Heart</i>

# DISEASES OF THE HEART *cont.*

- Between 1991 and 2005, the average age-adjusted mortality rate from diseases of the heart in Tennessee was 317 deaths per 100,000. Within individual counties the mortality rate ranged from 225/100,000 to 428/100,000.
  - The mortality rate from diseases of the heart among whites ranged from 224 to 413 deaths per 100,000. There were no counties in which the mortality rate among whites was greater than 450 deaths per 100,000 (Figure 10).
  - The mortality rate from diseases of the heart among blacks ranged from 241 to 798 deaths per 100,000. There were 19 counties in which the mortality rate among blacks was greater than 450 deaths per 100,000 (Figure 11).<sup>1</sup>



**Figure 10. Average Age-Adjusted Mortality Rate from Diseases of the Heart Among Whites, Tennessee Counties, 1991-2005 (DSSS)**



**Figure 11. Average Age-Adjusted Mortality Rate from Diseases of the Heart Among Blacks, Tennessee Counties, 1991-2005 (DSSS)**

<sup>1</sup>Data suppressed when the total number of deaths between 1991-2005 was less than 10 in a given county.

# DISEASES OF THE HEART *cont.*

- Between 1997 and 2004, there was an average of approximately 68,000 hospital inpatients with a principle diagnosis of diseases of the heart in Tennessee each year. Approximately two-thirds of these hospitalizations occurred in persons 65 years and older.
- In 2004, the age-adjusted inpatient hospitalization rate for diseases of the heart in Tennessee was 1,165 per 100,000. There were no statistically significant increases or decreases in diseases of the heart inpatient hospitalizations between 1997 and 2004 (Figure 12).

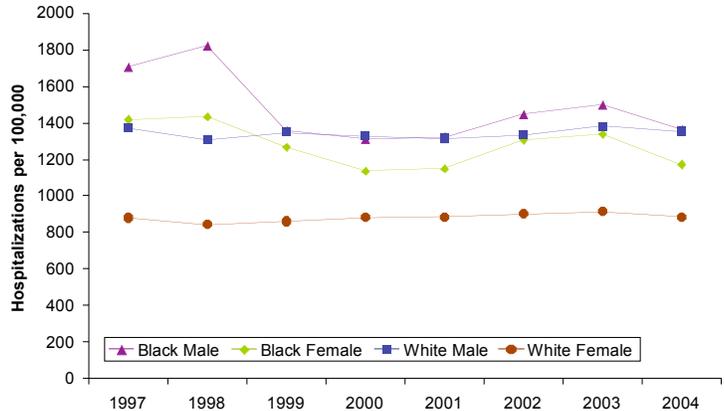


Figure 12. Age-Adjusted Inpatient Hospitalization Rate for Diseases of the Heart by Gender and Race, Tennessee, 1997-2004 (HDDS)

- The average age-adjusted inpatient hospitalization rate for diseases of the heart between 2002 and 2004 was highest among black males (1,438/100,000), followed by white males (1,357/100,000), black females (1,274/100,000), and white females (899/100,000).

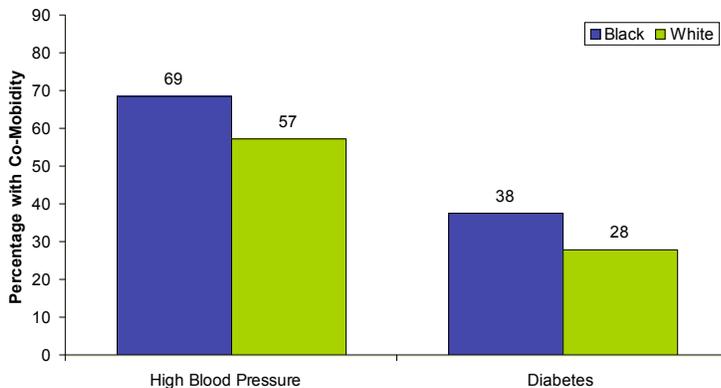


Figure 13. Prevalence of Co-Morbidities among Hospital Inpatients with Diseases of the Heart by Race, Tennessee, 2004 (HDDS)

- In 2004, 59% of hospital inpatients with a principle diagnosis of diseases of the heart also had a diagnosis of high blood pressure (i.e. co-morbid high blood pressure). The prevalence of co-morbid diabetes was 29%.
- Black inpatients with diseases of the heart were more likely than whites to have co-morbid high blood pressure (69% vs. 57%, respectively) and diabetes (38% vs. 28%) (Figure 13).

# STROKE

- Between 1996 and 2005, approximately 4,000 Tennesseans died from stroke annually. Approximately nine out of every ten of these deaths occurred in persons 65 years and older.
- The age-adjusted mortality rate from stroke decreased 23% between 1996 and 2005, from 80 to 62 deaths per 100,000.
- Between 1996 and 2005, the age-adjusted mortality rate from stroke decreased for all gender/race groups. The decrease was greatest among black females (34%). Decreases among other gender/race groups were as follows: white males (25%), black males (22%), and white females (19%).
- Racial/gender differences in stroke mortality rates persisted throughout 1996-2005. Each year, black males had the highest mortality rates, followed by black females, and white males/females (Figure 14).
- The average age-adjusted mortality rate from stroke for the 6 years between 2000 and 2005 was higher among blacks than among whites (93 vs. 66/100,000), and higher among non-Hispanics than Hispanics (69 vs. 18/100,000). Mortality was higher for black males than black females. Stroke mortality rates for males and females were similar for other racial/ethnic groups (Figure 15).
- For the time period 2000-2004, stroke was the third leading cause of death among whites and blacks, and the seventh leading cause of death among Hispanics.<sup>6</sup>

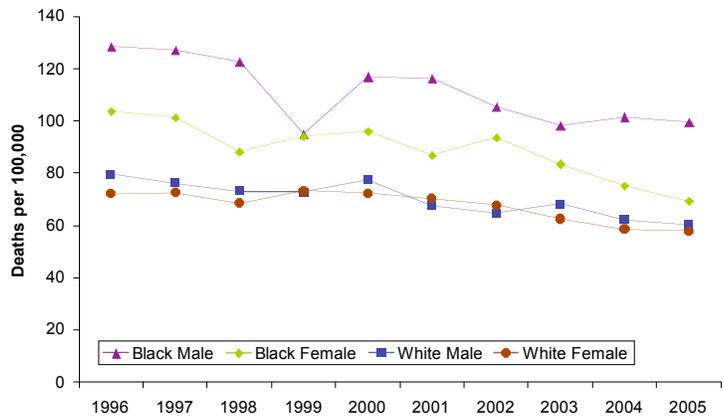


Figure 14. Age-Adjusted Mortality Rate from Stroke by Gender and Race, Tennessee, 1996-2005 (DSSS)

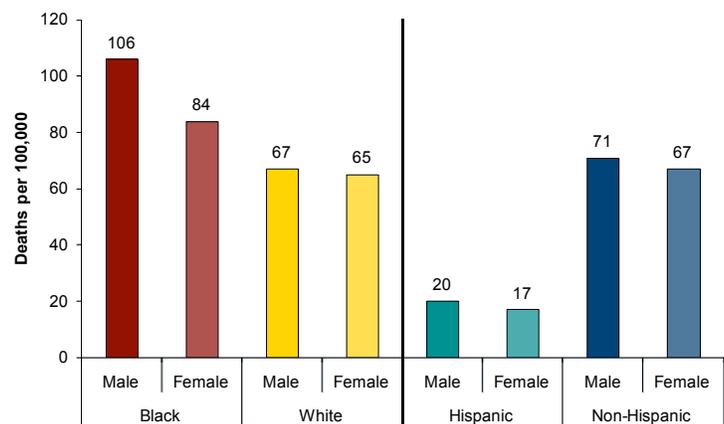
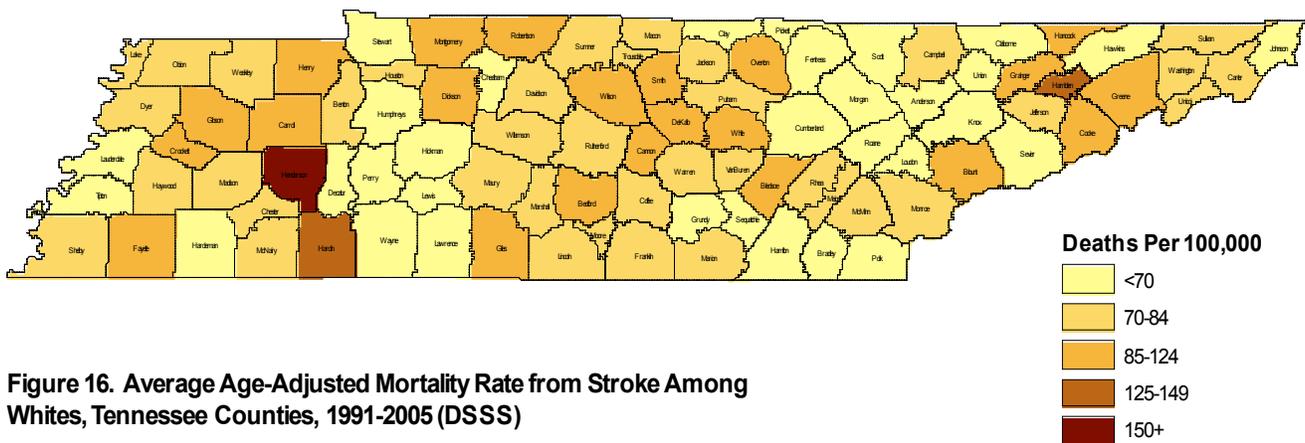


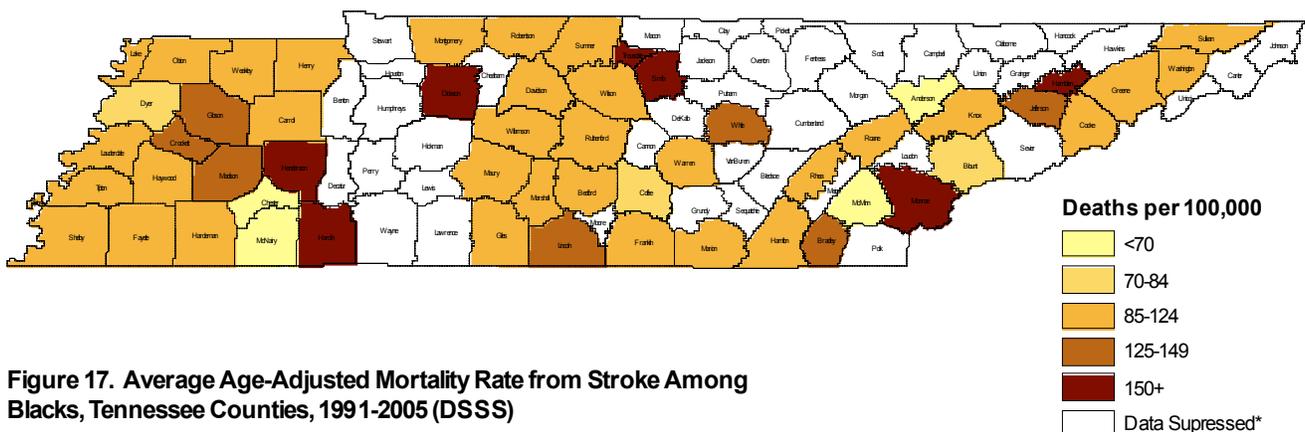
Figure 15. Average Age-Adjusted Mortality Rate from Stroke by Race/Ethnicity and Gender, Tennessee, 2000-2005 (DSSS)

# STROKE *cont.*

- Between 1991 and 2005, the average age-adjusted mortality rate from stroke in Tennessee was 80 deaths per 100,000. Within individual counties the mortality rate ranged from 47/100,000 to 170/100,000.
  - The mortality rate from stroke among whites ranged from 47 to 164 deaths per 100,000. There were 3 counties in which the mortality rate among whites was greater than 124 deaths per 100,000 (Figure 16).
  - The mortality rate from stroke among blacks ranged from 57 to 251 deaths per 100,000. There were 14 counties in which the mortality rate among blacks was greater than 124 deaths per 100,000 (Figure 17).<sup>2</sup>



**Figure 16. Average Age-Adjusted Mortality Rate from Stroke Among Whites, Tennessee Counties, 1991-2005 (DSSS)**



**Figure 17. Average Age-Adjusted Mortality Rate from Stroke Among Blacks, Tennessee Counties, 1991-2005 (DSSS)**

<sup>2</sup>Data suppressed when the total number of deaths between 1991-2005 was less than 10 in a given county.

# STROKE *cont.*

- Between 1997 and 2004, there was an average of approximately 20,000 hospital inpatients with a principle diagnosis of stroke in Tennessee each year. Approximately seven out of every ten of these hospitalizations occurred in persons 65 years and older.
- The age-adjusted inpatient hospitalization rate for stroke decreased 14% between 1997 and 2004, from 373 to 320 hospitalizations per 100,000.

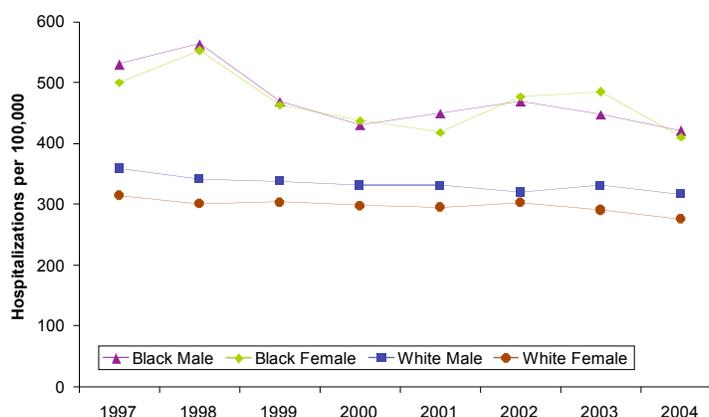


Figure 18. Age-Adjusted Inpatient Hospitalization Rate for Stroke by Gender and Race, Tennessee, 1997-2004 (HDDS)

- Between 1996 and 2005, the age-adjusted inpatient hospitalization rate for stroke decreased for all gender/race groups, although the decrease among black females was not statistically significant. The decrease was greatest among black males 21%, followed by black females 18%, white males 12%, and white females 12% (Figure 18).
- The average age-adjusted inpatient hospitalization rate for stroke between 2002 and 2004 was highest among black females (458/100,000), followed by black males (446/100,000), white males (323/100,000), and white females (290/100,000).

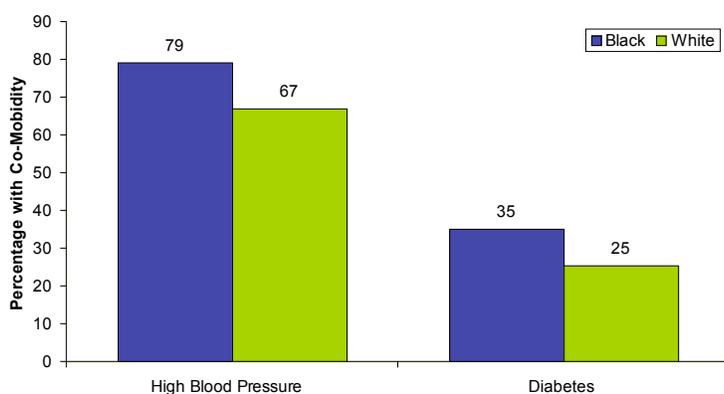


Figure 19. Prevalence of Co-Morbidities among Hospital Inpatients with Stroke by Race, Tennessee, 2004 (HDDS)

- In 2004, 69% of hospital inpatients with a principle diagnosis of stroke also had a diagnosis of high blood pressure (i.e. co-morbid high blood pressure). The prevalence of co-morbid diabetes was 27%.
- Black inpatients with stroke were more likely than whites to have co-morbid high blood pressure (79% vs. 67%, respectively) and diabetes (35% vs. 25%) (Figure 19).

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# SUMMARY

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Heart disease and stroke are the first and third leading causes of death in Tennessee, and together with other types of cardiovascular disease are responsible for approximately a third of all deaths in the state. Although both hospitalizations and deaths due to these diseases have been declining, gender and racial disparities continue to persist. This update, together with the original report entitled *The Burden of Heart Disease and Stroke in Tennessee*, offers the most current picture possible of cardiovascular disease in the state. Key findings include the following:

## MODIFIABLE RISK FACTORS

- Approximately nine out of every ten adult Tennesseans reported at least one modifiable risk factor for cardiovascular disease in 2005.
- A higher percentage of blacks than whites reported having four or more such risk factors.
- Obesity and sedentary lifestyle were more common among blacks, while high cholesterol was more common among whites.

## DISEASES OF THE HEART

- Between 1996 and 2005, age-adjusted mortality rates for diseases of the heart decreased for all gender/race groups. However, gender and racial disparities persisted.
- Black males had the highest diseases of the heart mortality rates, followed by white males, black females and white females.
- Between 1997 and 2004, inpatient hospitalization rates for diseases of the heart did not change significantly. Black males had the highest inpatient hospitalization rates, followed by white males, black females and white females.
- 59% of inpatients with diseases of the heart also had a diagnosis of high blood pressure and 38% also had diabetes. Co-morbid high blood pressure and diabetes were more common in black inpatients with diseases of the heart than in white inpatients.

## STROKE

- Between 1996 and 2005, age-adjusted mortality rates for stroke decreased for all gender/race groups. However, gender and racial disparities persisted.
- Blacks had higher stroke mortality rates than whites. Black males had higher stroke mortality rates than black females. Among whites, stroke mortality rates were similar among males and females.
- Between 1997 and 2004, inpatient hospitalization rates for stroke decreased for all gender/race groups. Black females had the highest inpatient hospitalization rates, followed by black males, white males and white females.
- 69% of inpatients with stroke also had a diagnosis of high blood pressure and 35% also had diabetes. Co-morbid high blood pressure and diabetes were more common in black inpatients with stroke than in white inpatients.

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# TECHNICAL NOTES

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## 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.

**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.) and facilities licensed by the Tennessee Department of Mental Health and Developmental Disabilities. The analyses are limited to the records of Tennessee residents.

**Death Statistical Summary System (DSSS):** The DSSS is an annual state-based compilation of mortality data. For 1996 through 1998, the data set has the cause of death coded in ICD-9 format. From 1999 to 2005, the cause of death is coded in ICD-10 format, which lists secondary causes of death. However, in this report only the underlying cause of death is analyzed. The analyses are limited to the records of Tennessee resident decedents.

## MEASURES

**Behavioral Risk Factor Surveillance System:** The modifiable risk factors for cardiovascular disease examined in this report were defined as follows:

**Fruit and vegetable consumption:** Consumed fruits and vegetable less than five times a day.

**Obesity:** Body mass index (BMI) greater than or equal to 30.

**Sedentary lifestyle:** No physical activity during the past 30 days other than a regular job.

**Diabetes mellitus:** Have been told by a doctor that they have diabetes mellitus.

**High blood pressure:** Have been told by a doctor that they have high blood pressure.

**High blood cholesterol:** Have been told by a doctor that they have high blood cholesterol.

**Smoking:** Have smoked at least 100 cigarettes in their lifetime and currently smoke everyday or some days of the week.

**Diagnoses:** The diagnosis codes used in this report are in accordance with the ICD-9-CM (HDDS) and ICD-10 (DSSS) coding systems. They are as follows:

**Diseases of the heart:** 390 - 398, 402, 404 - 429 (ICD-9-CM); I00 - I09, I11, I13, I20 - I51 (ICD-10)

**Stroke:** 430 - 438 (ICD-9-CM); I60 - I69 (ICD-10)

**Hypertension:** 401 - 404 (ICD-9-CM); I10 - I13 (ICD-10)

**Diabetes mellitus:** 250 (ICD-9-CM)

**Classification of Race and Ethnicity:** For BRFSS data, the terms “white” and “black” or “African American” refer to persons of non-Hispanic origin only. For HDDS and DSSS data, these terms refer to persons of both Hispanic and non-Hispanic origin. The term “Hispanic” refers to persons of Hispanic origin regardless of race.

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