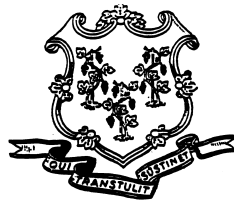# The Burden of Diabetes in Connecticut

2010 Surveillance Report

March 2011

State of Connecticut
Department of Public Health
410 Capitol Avenue
P.O. Box 340308
Hartford, CT 06134-0308

## CREDITS AND ACKNOWLEDGMENTS

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**EXECUTIVE SUMMARY**

- Diabetes is a major public health problem.  The prevalence of diabetes in Connecticut has increased significantly since the late-1990s.  About 186,000 adults in Connecticut have diagnosed diabetes (6.9%) [2007-2009 data].  An additional 93,000 adults are estimated to have undiagnosed diabetes.  Older adults, low-income adults, and racial and ethnic minorities have the highest rates of diagnosed diabetes.

- Diabetes is the eighth leading cause of death in Connecticut (2008 data).  Age-adjusted diabetes and *diabetes-related* mortality rates are higher among Black and Hispanic Connecticut residents compared with White residents (2006-2008 data).  Also, Connecticut males have significantly higher diabetes mortality rates than females.

- Premature mortality (to age 75) due to diabetes is significantly higher among Black and Hispanic Connecticut residents compared with White residents (2006-2008 data).

- Black and Hispanic Connecticut residents have higher age-adjusted hospitalization rates for diabetes and *diabetes-related* lower-extremity amputations than White residents (2008 data).  Also, males have higher age-adjusted rates of diabetes hospitalizations and *diabetes-related* hospitalizations with lower-extremity amputations than females.

- Approximately $128 million was billed for hospitalizations in Connecticut due to diabetes as a principal diagnosis while almost $46 million was billed for *diabetes-related* hospitalizations with a lower extremity amputation in 2008.  Diabetes also incurs enormous indirect costs due to illness, lost productivity, and premature death.

- Risk factors for diabetes may be modifiable or non-modifiable.  The chief modifiable risk factor for diabetes is obesity.  Examples of non-modifiable risk factors are increasing age, family history of diabetes, and having had gestational diabetes.

- An estimated 10.4% of high school students in Connecticut are obese (2009 data).  Of these, males are more likely to be obese than females and Hispanic students are more likely to be obese than White and Black students.

- Approximately 21% of adults in Connecticut are obese (2007-2009 data).  Males, Black adults, older adults, and low-income adults are more likely to be obese.  An estimated 82% of adults with diabetes in Connecticut are overweight or obese (2007-2009 data).

- Access to health care is crucial to the prevention, treatment, and management of diabetes. About 9% of adults in Connecticut do not have health insurance (2007-2009 data). Approximately 30% of Hispanic, 21% of Black, and 6% of White adults in Connecticut do not have health insurance.

- Targeted public health interventions that address risk factors for the development of diabetes, timely diagnosis of the disease, as well as appropriate preventive care for those diagnosed with diabetes are warranted for the Black, Hispanic, and low-income populations in Connecticut.

**THE BURDEN OF DIABETES IN CONNECTICUT**

**INTRODUCTION**

Diabetes is a group of diseases characterized by the abnormal metabolism of glucose resulting in elevated blood glucose levels.  There are two main classifications of diabetes- type 1 diabetes, formerly called insulin dependent diabetes mellitus or juvenile-onset diabetes, and type 2 diabetes, formerly called non-insulin-dependent diabetes mellitus.  Type 1 diabetes is caused by the destruction of pancreatic beta cells by the body's immune system, leading to insulin deficiency and making insulin treatment necessary.  Currently, there is no effective means of preventing type 1 diabetes.  Type 1 diabetes accounts for 5%-10% of all diabetes cases in adults. Type 2 diabetes is characterized by insulin resistance, a disorder in which the cells do not use insulin properly.  There are both lifestyle and pharmacological interventions to prevent or delay the onset of type 2 diabetes in adults.  Type 2 diabetes accounts for 90%-95% of all diabetes cases in adults.[1, 2]

Diabetes is a major public health problem in Connecticut and the United States.  Diabetes is a leading cause of death.  Also, individuals with diabetes are at increased risk of developing cardiovascular disease, blindness, kidney failure, and lower-extremity amputation.[1]  This report describes the burden of diabetes in Connecticut through data on diabetes prevalence, mortality, hospitalizations, and risk factors.

**PREVALENCE**

In Connecticut, an estimated 6.9% of the adult population, or approximately 186,000 adults 18 years and older, have diagnosed diabetes (2007-2009 data) compared with about 8.2% of the U.S. population.[3, 4]  An additional 93,000 adults (approximately one-third of adults with diabetes) are estimated to have undiagnosed diabetes.  Factors contributing to the prevalence of undiagnosed diabetes include the gradual development of symptoms and the absence of severe symptoms until several years after disease onset.[1, 5]  Overall, approximately 279,000 Connecticut residents 18 years and older are estimated to have either diagnosed or undiagnosed diabetes.  Prevalence estimates in this report refer to diagnosed cases of diabetes.

National survey data suggest that the prevalence of diabetes has continuously increased since the mid-1990s. Based on responses to the Behavioral Risk Factor Surveillance System (BRFSS) surveys, the prevalence of diabetes among adults in the United States was estimated to be 5.6% in 1999, 7.0% in 2004, and 8.3% in 2009.[6] The prevalence of diabetes among adults in Connecticut has also increased since 1999, from 4.8% in 1998-2000 to 6.9% in 2007-2009 (p<0.001).[3] The U.S. *Healthy People 2010* target for diabetes prevalence is 2.5% (Figure 1).[7]

**Figure 1. Prevalence of Diagnosed Diabetes among Adults in Connecticut and the United States (1999-2009, 3-Year Moving Average), and the Healthy People 2010 Target**
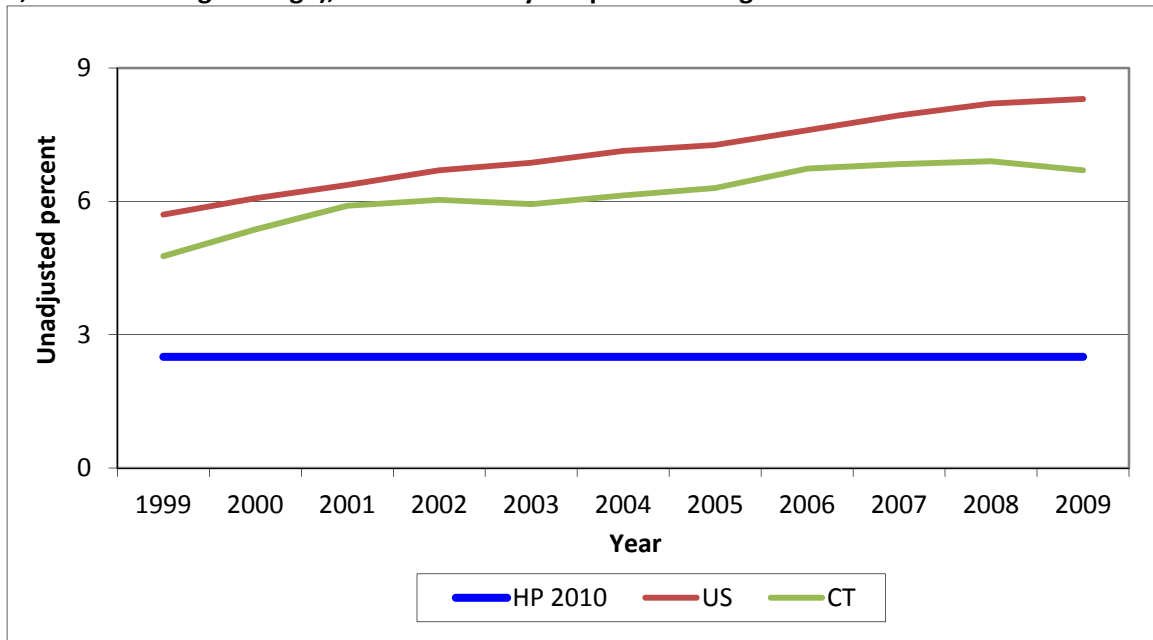


**Sources:** Centers for Disease Control and Prevention (CDC), 2010; Connecticut Department of Public Health, 2010.

**Prevalence by Age, Race and Ethnicity, and Household Income**

Diabetes prevalence rates vary by age, race and ethnicity[*], and annual household income (2007-2009 data). The prevalence of diabetes increases with age. For example, Connecticut adults aged 65 years and older are over eight times more likely to have diabetes than adults aged 18 to 44 years (p<0.001) [Figure 2].[3] The prevalence of diabetes is also higher among racial and ethnic minorities. The age-adjusted diabetes prevalence rates among Black and Hispanic adults in Connecticut are significantly higher than the prevalence among White Connecticut adults (p<0.001 for both comparisons) [Figure 3].[3] Similarly, lower socioeconomic position has been consistently linked to higher prevalence of type 2 diabetes.[1, 8, 9] In fact, Connecticut adults with lower annual household incomes are significantly more likely to have diabetes compared to adults with higher annual household incomes (p<0.001).[3] For example, 12.3% of Connecticut adults with annual household incomes of less than $25,000 have diabetes compared to 4.7% of Connecticut adults with annual household incomes of $75,000 or greater (Figure 4).[3] The increased prevalence of diabetes among low-income persons is attributed to the decreased likelihood of low-income persons having adequate diets, sufficient physical activity, and access to medical care – all factors known to affect the progression of pre-diabetes to diabetes.[10]

**Figure 2. Prevalence of Diabetes among Connecticut Adults by Age, 2007-2009, with 95% Confidence Intervals**
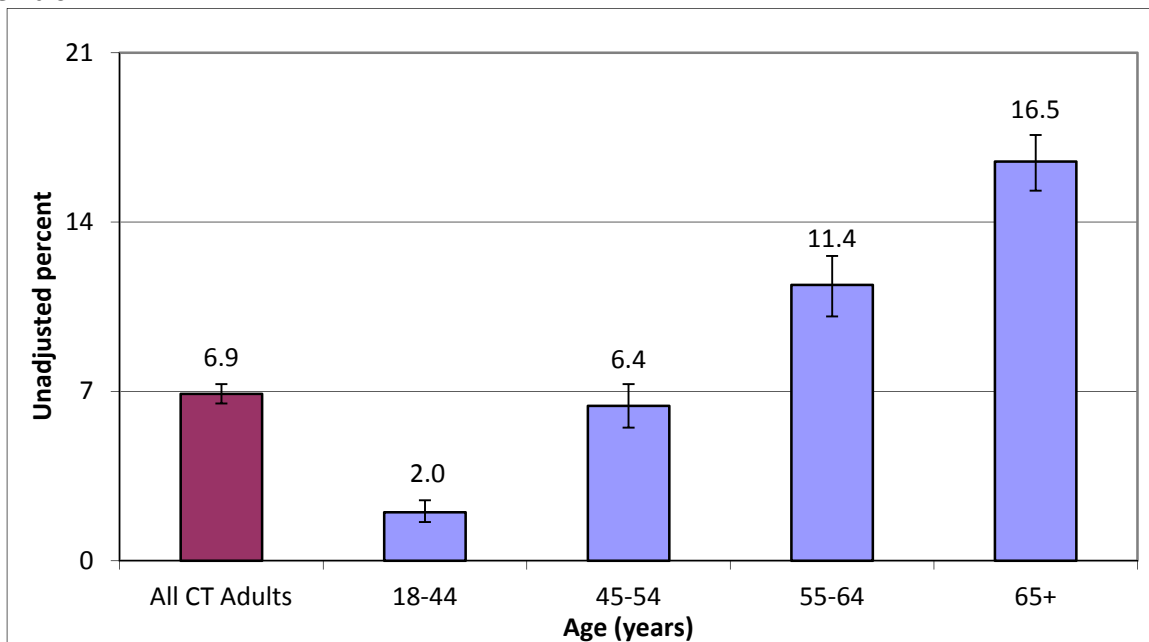


**Source:** Connecticut Department of Public Health, 2010. Behavioral Risk Factor Surveillance System Survey (BRFSS).

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[*] Throughout this report racial groupings (e.g., "Black, "White") exclude persons of Hispanic ethnicity. A Hispanic ethnicity category is included in figures and tables reflecting data separate from race categories. Therefore, the modifier "non-Hispanic" is assumed.

**Figure 3. Age-adjusted Prevalence of Diabetes among Connecticut Adults by Race and Ethnicity, 2007-2009, with 95% Confidence Intervals**
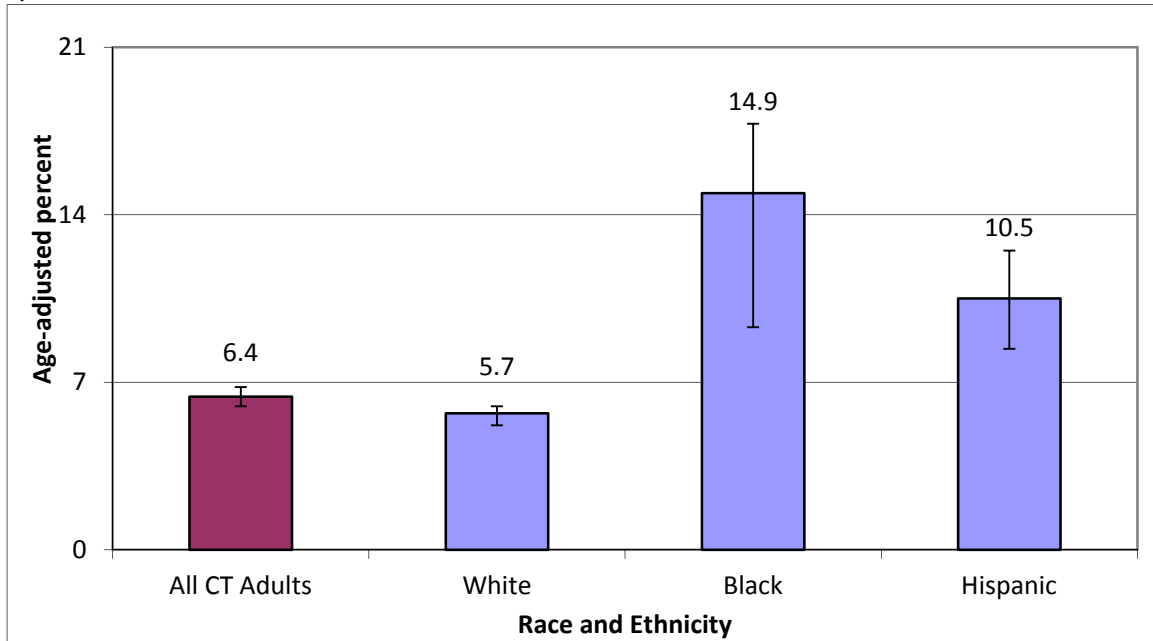


**Source:** Connecticut Department of Public Health, 2010.  BRFSS.

**Figure 4. Age-adjusted Prevalence of Diabetes among Connecticut Adults by Annual Household Income, 2007-2009, with 95% Confidence Intervals**
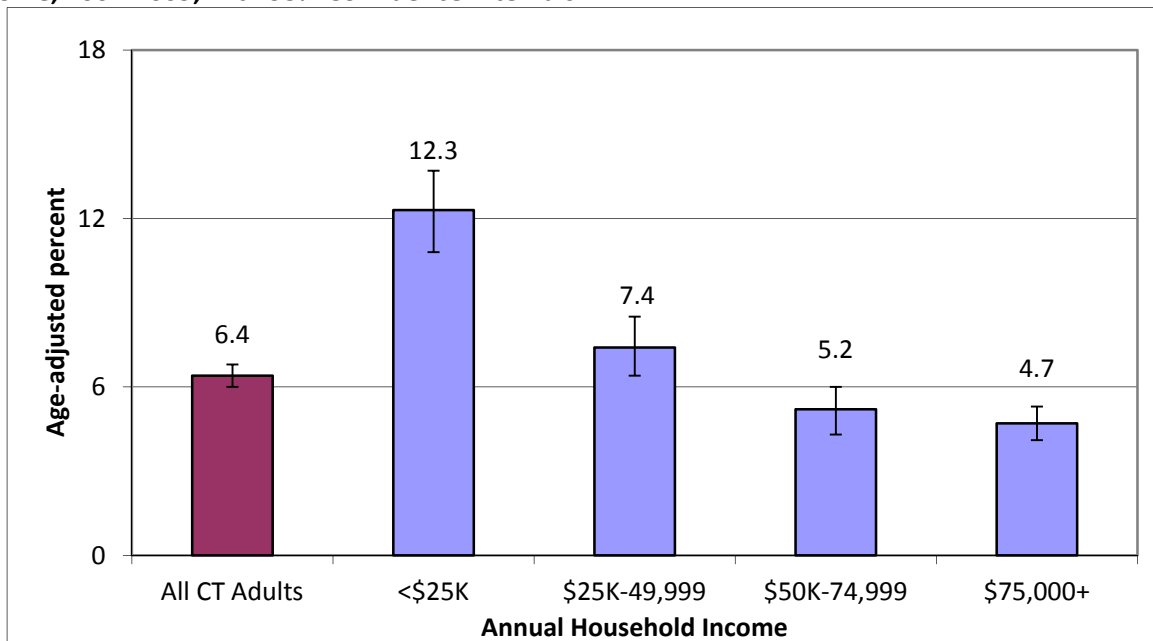


**Source:** Connecticut Department of Public Health, 2010.  BRFSS.

The prevalence of diabetes in Connecticut and the United States is likely to increase for a few reasons. First, large segments of both populations are aging and diabetes prevalence increases with age. Second, the fastest-growing segment of the United States and Connecticut populations include Hispanic Americans and other minority groups, who are considered at higher risk for diabetes. Third, individuals with diabetes are living longer than in previous generations. The prevalence of diabetes in the United States is predicted to increase to about 30% of the U.S. population by 2050.[11]

**MORTALITY**

Diabetes is the eighth leading cause of death in Connecticut (2008 data) [Table 1].[12] Most people with diabetes die from related complications rather than directly from the disease itself; therefore, examination of diabetes as the underlying cause of death alone does not accurately represent its extensive contribution to overall mortality. While diabetes was the underlying or "primary" cause of death for 618 residents in 2008, it was listed as a primary or secondary ("*diabetes-related*") cause of death for 2,186 Connecticut residents.[12] However, national data suggest that diabetes, either as the underlying or a contributing cause of death, is underreported on death certificates. Clearly, diabetes has a much greater impact than that described by mortality statistics alone.[1, 2]

**Table 1. Connecticut Resident Deaths, 2008**

| Rank | Cause of Death | Number of Deaths |
|---|---|---|
| - | All Causes | 28,749 |
| 1 | Heart Disease | 7,300 |
| 2 | Cancer | 6,765 |
| 3 | Chronic Lower Respiratory Disease | 1,494 |
| 4 | Cerebrovascular Disease | 1,407 |
| 5 | Unintentional Injury | 1,362 |
| 6 | Alzheimer's Disease | 831 |
| 7 | Pneumonia and Influenza | 688 |
| 8 | Diabetes Mellitus | 618 |

**Source***:* Connecticut Department of Public Health, Vital Records Mortality Files, 2010.

**Trends in Age-adjusted Mortality**

Age-adjusted diabetes mortality rates[†] of Connecticut residents increased significantly in the 1990s.[13]  While the 2006-2008 Connecticut resident diabetes mortality rate was significantly lower than the 1999-2001 rate (data not shown),  linear trend analyses of diabetes mortality rates did not show a statistically significant change ($p<0.05$) for the period 1999-2008.[12, 14]  The diabetes mortality rates of Connecticut residents have been consistently lower than comparable national rates (Figure 5).

**Figure 5. Age-adjusted Diabetes Mortality Rates, Connecticut and the United States, 1999-2006**
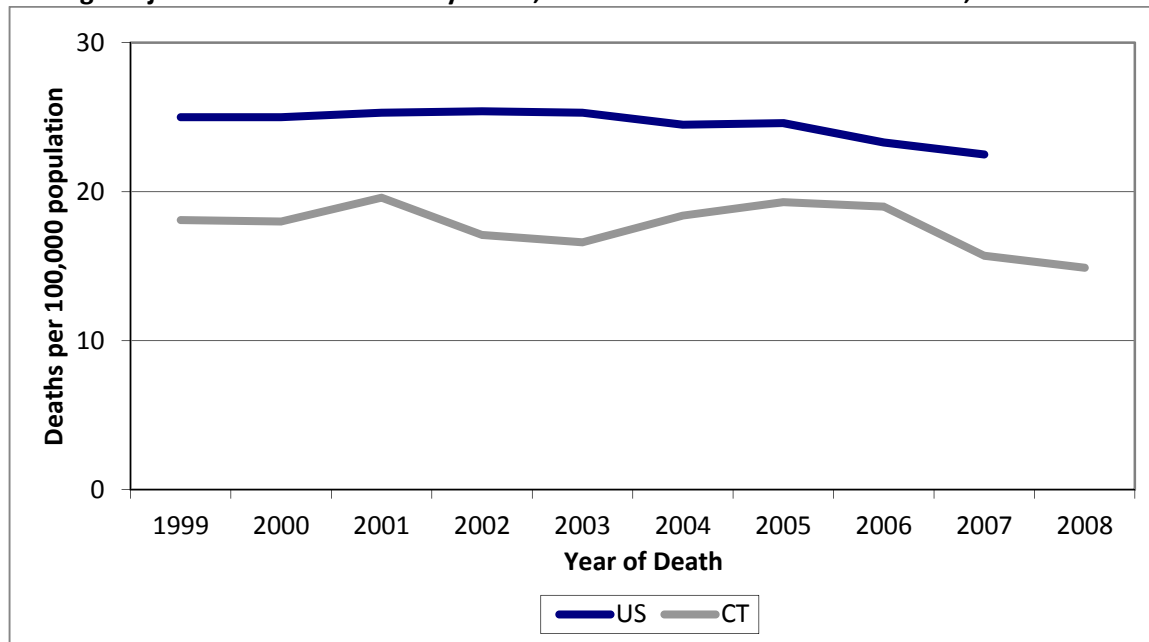


**Sources:** CDC, 2010; Connecticut Department of Public Health, 2010.  ICD-10 code E10-E14 used.

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[†] The mortality rates presented in this report are age-adjusted mortality rates (AAMR).  The AAMRs were computed by the direct method using the 2000 U.S. standard million population.  The AAMRs were calculated using the deaths records of Connecticut residents.

**Mortality by Gender, Race and Ethnicity**

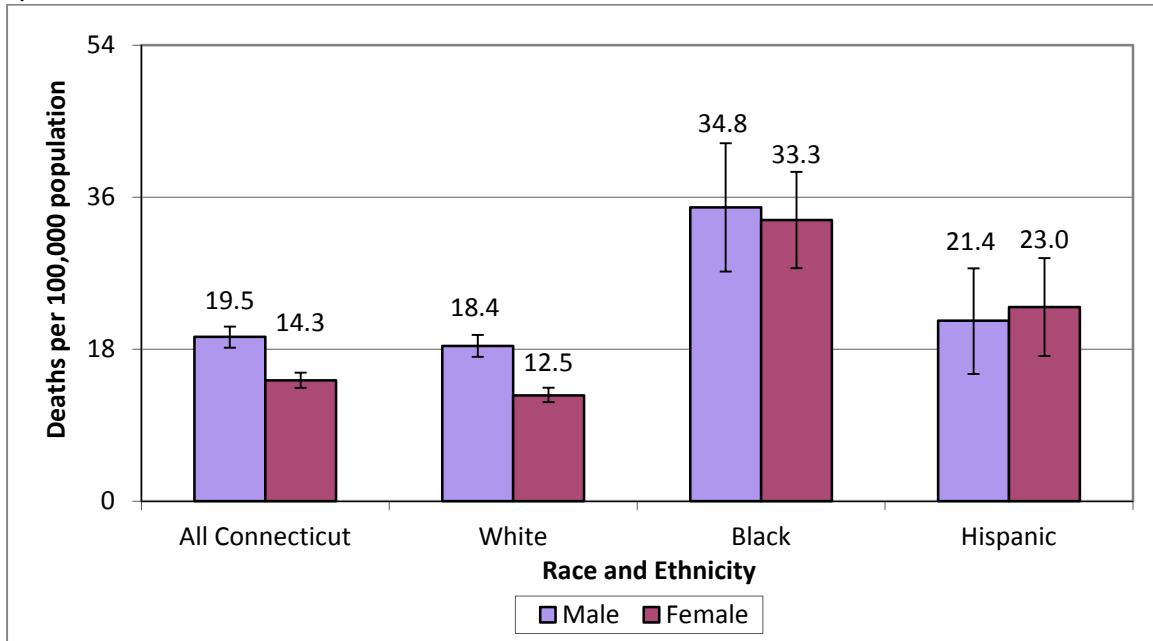Diabetes and *diabetes-related* mortality rates differ by gender (2006-2008 data). Connecticut male residents have significantly higher mortality rates from both diabetes and *diabetes-related* causes than Connecticut females (p<0.001 for both comparisons) [Figure 6 and Figure 7].[12] These findings are consistent with national data showing slightly higher diabetes mortality rates among males.[15]

Diabetes and *diabetes-related* mortality rates also differ by race and ethnicity (2006-2008 data). The diabetes and *diabetes-related* mortality rates of Black residents are significantly higher than rates of White residents (p<0.001 for both comparisons) and Hispanic residents (p<0.05 for diabetes mortality rate; p<0.005 for *diabetes-related* mortality rate).[12] The diabetes and *diabetes-related* mortality rates among Black males are approximately twice that of White males (p<0.001 for both comparisons).[12] Similarly, the diabetes mortality rate of Black females is 2.7 times the diabetes mortality rate and 2.1 times the *diabetes-related* mortality rate of White females (p<0.001 for both comparisons) [Figure 6 and Figure 7].[12]

Hispanic residents also have significantly higher diabetes and *diabetes-related* mortality rates than White Connecticut residents (p<0.005 for diabetes mortality rate; p<0.001 for *diabetes-related* mortality rate) [2006-2008 data].[12] The diabetes mortality rate of Hispanic females is 1.8 times the diabetes mortality rate (p<0.005) and 1.7 times the *diabetes-related* mortality rate of White females (p<0.001).[12] The diabetes and *diabetes-related* mortality rates of Hispanic males are 1.2 times that of White males. The differences in diabetes and *diabetes-related* mortality rates among Hispanic and White males do not reach statistical significance (Figure 6 and Figure 7).[12]

The diabetes mortality rate decreased significantly among only White females (p<0.05) between 1999-2001 and 2006-2008 [data not shown].[12] The *diabetes-related* mortality rate decreased significantly among White females, White males, Black females, and Black males (p<0.001 for all comparisons) between 1999-2001 and 2006-2008 (data not shown).[12]

**Figure 6. Age-adjusted Diabetes Mortality Rates by Race and Ethnicity and Gender, Connecticut, 2006-2008, with 95% Confidence Intervals**



**Source:** Connecticut Department of Public Health, Vital Records Mortality Files, 2010.

**Figure 7. Age-adjusted Diabetes-related Mortality Rates by Race and Ethnicity and Gender, Connecticut, 2006-2008, with 95% Confidence Intervals**
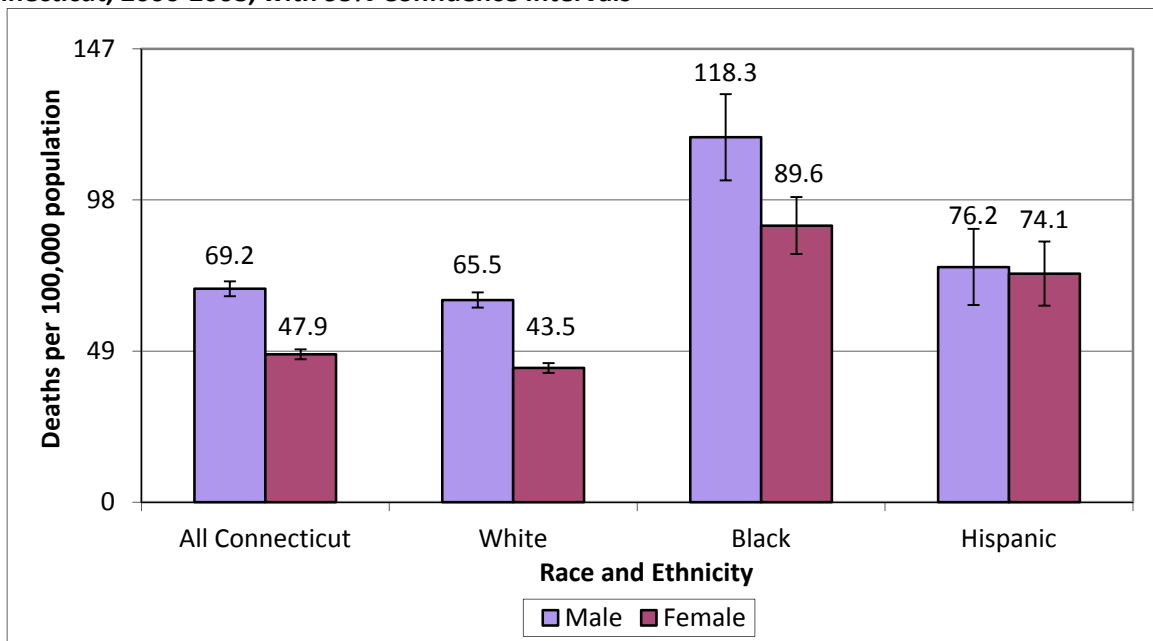


**Source:** Connecticut Department of Public Health, Vital Records Mortality Files, 2010.

**Premature Mortality by Gender, Race and Ethnicity**

Premature mortality[‡], defined as the "years of potential life lost before age 75," focuses on deaths that occur at younger ages.  For example, a person who dies at age 45 is considered to have lost 30 years of life, and a person who dies at 70 is considered to have lost 5 years of life.[16]  Premature mortality is important because it emphasizes the years of productive life that are lost to society.

Diabetes premature mortality rates differ by gender (2006-2008 data).  Male residents have significantly higher diabetes premature mortality rates compared with females (p<0.001) [Figure 8].[12]

Diabetes premature mortality rates also vary by race and ethnicity (2006-2008 data).  The diabetes premature mortality rate is significantly higher among Black compared with White residents (p<0.001).[12] Also, Black males have 2.2 times the diabetes premature mortality rate of White males (p<0.005) while Black females have nearly 3 times the diabetes premature mortality rate of White females (p<0.001) [Figure 8].[12] Differences in the diabetes premature mortality rates of Black males and females compared with Hispanic males and females are not statistically significant (Figure 8).[12]

Similarly, Hispanic residents have a significantly higher diabetes premature mortality rate compared with White residents (p<0.05) [2006-2008 data].[12]  Hispanic males have approximately 1.5 times the diabetes premature mortality of White males and Hispanic females have 1.7 times the diabetes premature mortality rate of White females (Figure 8).[12]  These differences, however, do not reach statistical significance.

Premature mortality rates for diabetes did not change significantly among any of Connecticut's subpopulations between 1999-2001 and 2006-2008 (data not shown).[12]

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[‡] The premature mortality rates presented in this report are age-adjusted "Years of Potential Life Lost (YPLL) under 75 years".  Age-adjusted rates were computed by the direct method using the 2000 U.S. standard million population and Connecticut resident death records.

**Figure 8. Age-adjusted Premature Mortality Rates for Diabetes by Race and Ethnicity, Connecticut, 2006-2008, with 95% Confidence Interval**
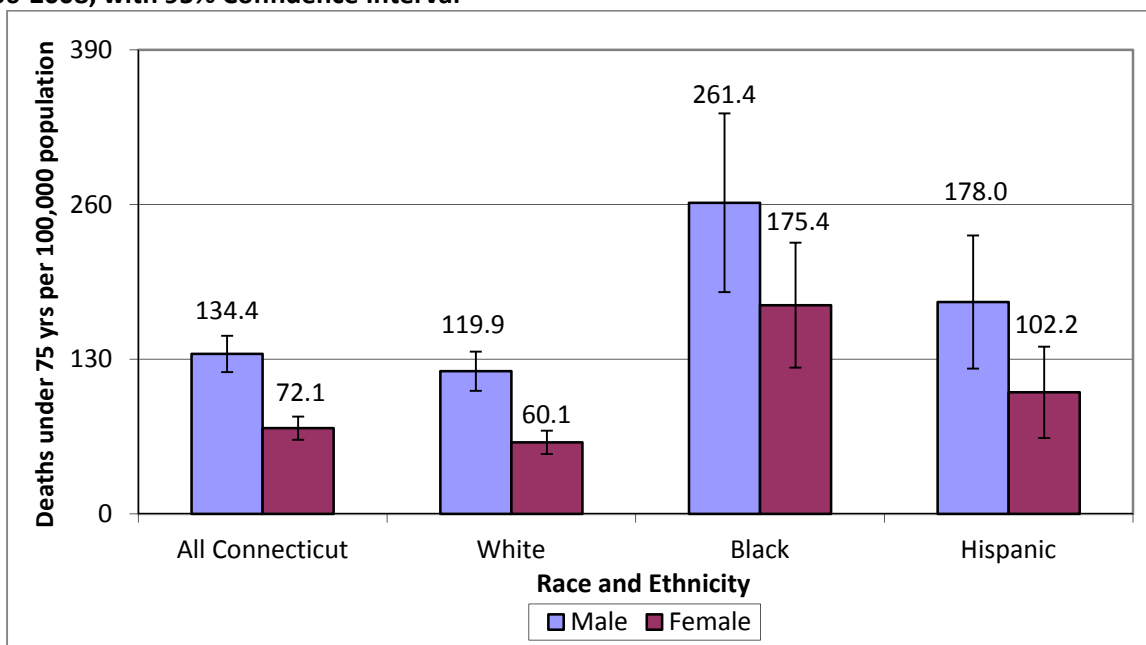


**Source:** Connecticut Department of Public Health, Vital Records Mortality Files, 2010.

**MORBIDITY**

Diabetes can lead to a number of serious complications. Some of the complications of diabetes include cardiovascular disease (CVD), lower extremity amputations, end-stage renal disease, and blindness. CVD and lower extremity amputations are significantly more likely to occur in persons with diabetes than those without the disease. For example, national data show that women with diabetes are two to four times more likely to be hospitalized for CVD than women without diabetes. Also, those hospitalized with diabetes are 28 times more likely to have an amputation than hospitalized individuals without diabetes.[1, 8]

Multiple hospitalizations are common among persons with diabetes. In fact, nearly one-third of those with diabetes are hospitalized two or more times in the same year due to complications associated with the disease. Persons with diabetes who are racial or ethnic minorities, enrolled in public insurance programs, or living in low-income communities, are especially more likely to experience multiple hospitalizations.[8]

**Hospitalization Rates by Gender**

Males have significantly higher rates of diabetes hospitalizations,[§] as well as higher rates of *diabetes-related* hospitalizations with lower-extremity amputations, compared with Connecticut females (p<0.001 for both comparisons).[17] Connecticut males have 1.4 times the rate of diabetes hospitalizations, and 2.4 times the rate of *diabetes-related* hospitalizations with lower-extremity amputations, compared with Connecticut females (Figure 9 and Figure 10).[17]

**Figure 9. Age-adjusted Diabetes Hospitalization Rates by Gender, Connecticut Residents, 2008, with 95% Confidence Intervals**
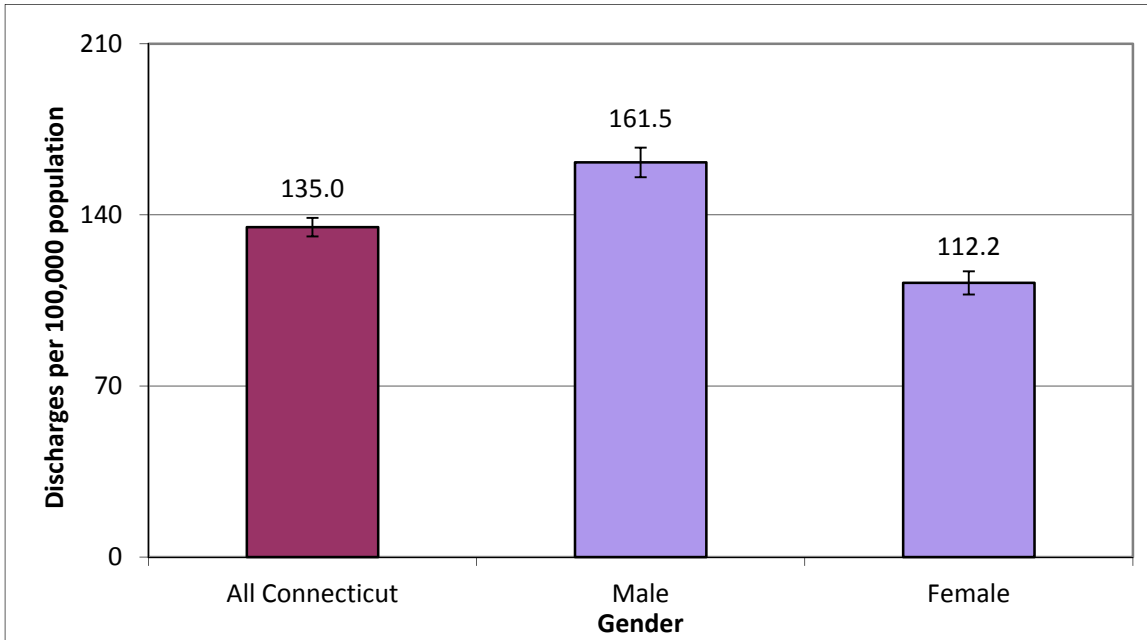


**Source***: Connecticut Department of Public Health, Hospital Discharge and Abstract Billing Data Base, 2010.

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[§] Hospitalization rates were calculated using 2008 Connecticut resident hospitalization discharge data and were age-adjusted based on the 2000 U.S. standard million population.

**Figure 10. Age-adjusted Hospitalization Rates for Diabetes with Lower Extremity Amputation by Gender, Connecticut Residents, 2008, with 95% Confidence Intervals**
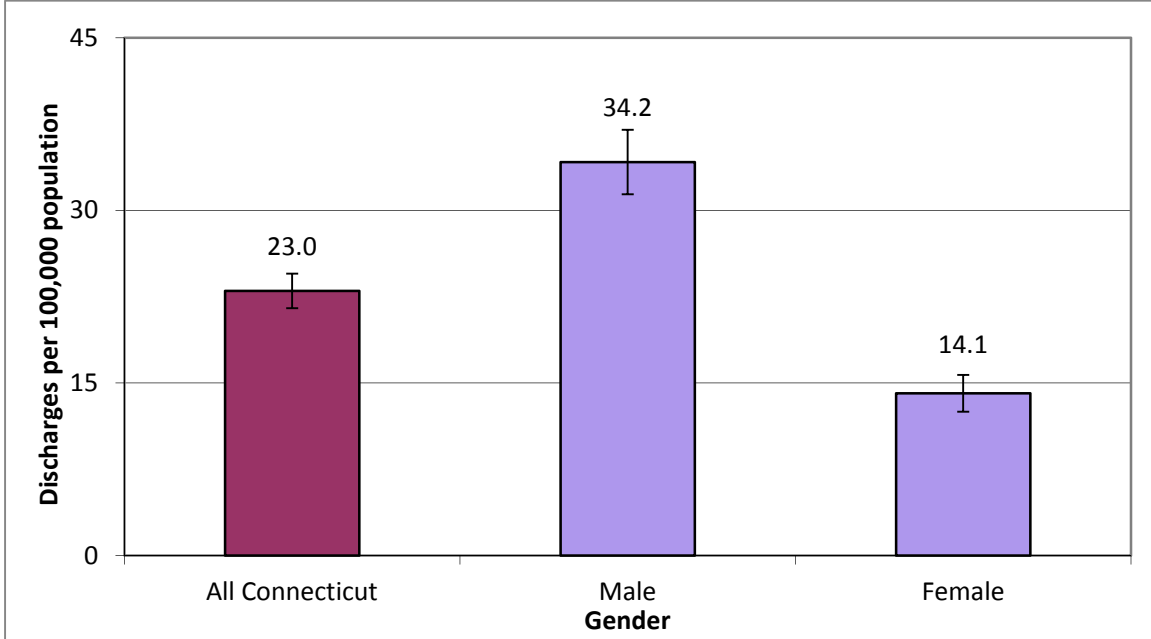


**Source:** Connecticut Department of Public Health, Hospital Discharge and Abstract Billing Data Base, 2010.

**Hospitalization Rates by Race and Ethnicity**

Black Connecticut residents have the highest rates of diabetes hospitalizations, and *diabetes-related* hospitalizations with lower-extremity amputations (2008 data).[17]  Black residents have 4.3 times the rate of diabetes hospitalizations and *diabetes-related* hospitalizations with lower extremity amputations compared with White residents (p<0.001 for both comparisons).[17]  Also, Black residents have 1.5 times the rate of diabetes hospitalizations (p<0.001) and 1.6 times the rate of *diabetes-related* hospitalizations with lower extremity amputations (p<0.01) compared with Hispanic residents (Figure 11 and Figure 12).[17]

Hispanic Connecticut residents have higher rates of hospitalizations for diabetes and *diabetes-related* lower extremity amputations than White residents.  Hispanic residents have 2.9 times the rate of diabetes hospitalizations, and 2.7 times the rate of *diabetes-related* hospitalizations with lower extremity amputations, compared with White  residents (p<0.001 for both comparisons) [Figure 11 and Figure 12].[17]

**Figure 11. Age-adjusted Diabetes Hospitalization Rates by Race and Ethnicity, Connecticut Residents, 2008, with 95% Confidence Intervals**



**Source:** Connecticut Department of Public Health, Hospital Discharge and Abstract Billing Data Base, 2010.

**Figure 12. Age-adjusted Hospitalization Rates for Diabetes with Lower Extremity Amputations by Race and Ethnicity, Connecticut Residents, 2008, with 95% Confidence Intervals**
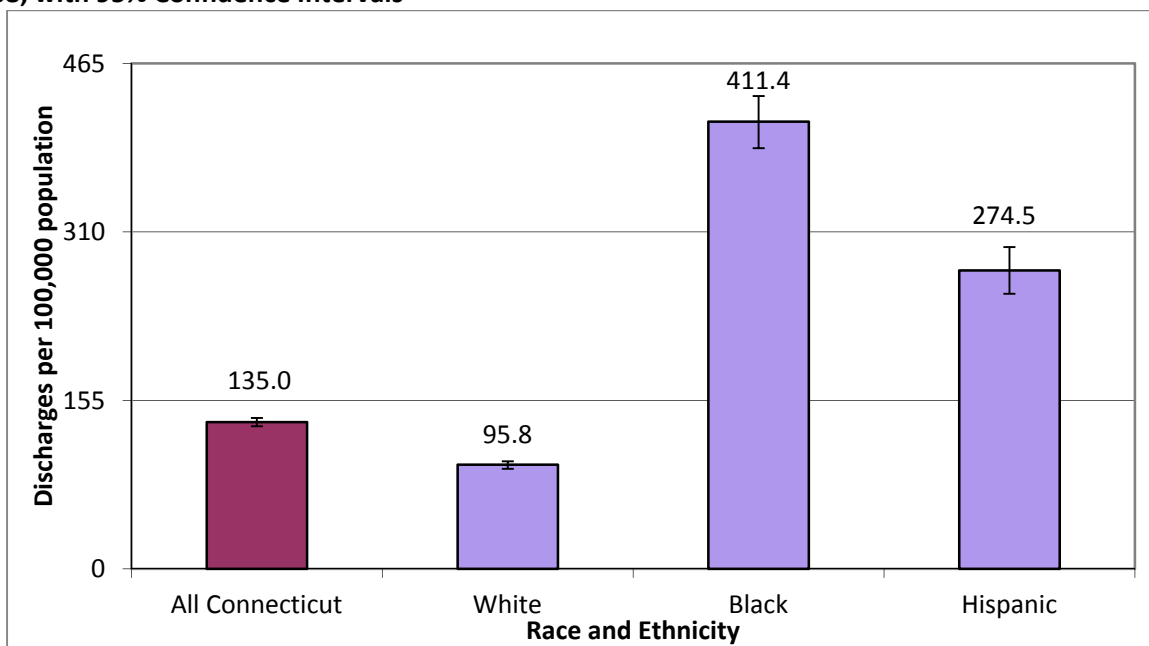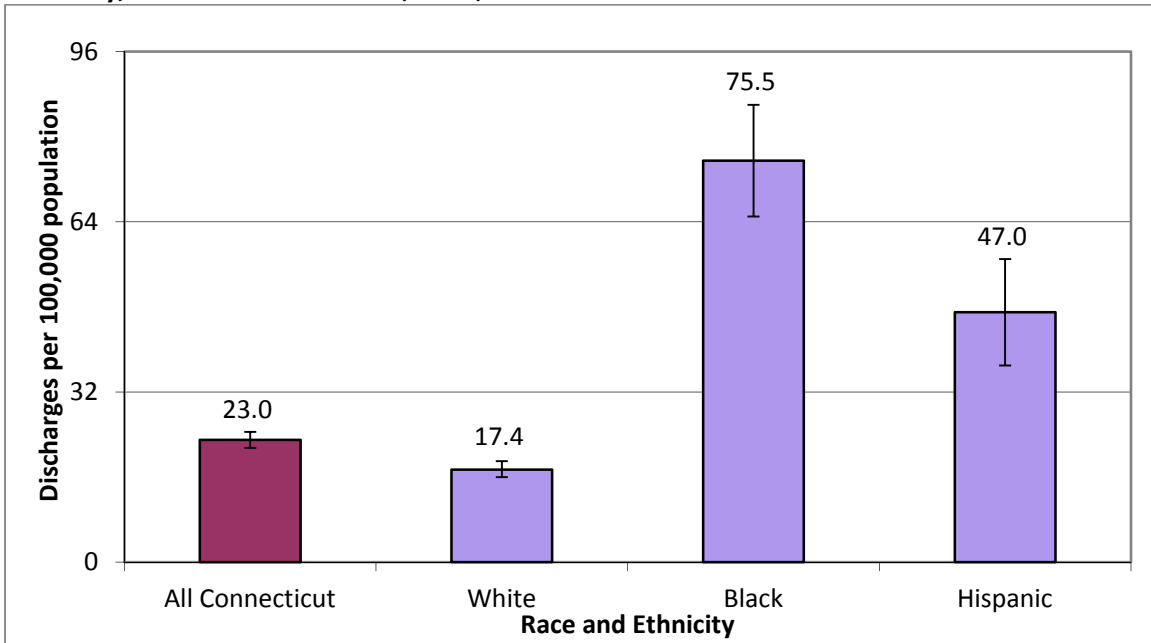


**Source:** Connecticut Department of Public Health, Hospital Discharge and Abstract Billing Data Base, 2010.

**Economic Costs**

The total cost of diabetes for people in Connecticut was estimated at $2.43 billion in 2006.[18]  This estimate includes direct (medical) costs and indirect costs, which result from lost productivity due to illness and premature death.  Also, diabetes is a major cause of disability, limiting the ability to live independently and negatively affecting the quality of life for individuals and families.   For these reasons, diabetes can incur enormous indirect costs.

In 2008, approximately $128 million was billed for hospitalizations with a principal diagnosis of diabetes in Connecticut.  Almost $46 million was billed for *diabetes-related* hospitalizations with a lower extremity amputation.[17]

**RISK FACTORS**

Risk factors for diabetes may be non-modifiable or modifiable (Table 2).  Non-modifiable risk factors include increasing age, family history of diabetes, history of gestational diabetes, and having given birth to a baby weighing more than nine pounds.[1]  There are several modifiable risk factors that increase an individual's likelihood of developing diabetes and complications of the disease.  These modifiable risk factors include overweight and obesity; hypertension; high LDL cholesterol or high triglycerides along with low HDL cholesterol; and lack of physical activity.[19]  Obesity is considered the chief modifiable risk factor for diabetes.[1]

**Table 2. Modifiable and Non-modifiable Risk Factors for Diabetes**

| Modifiable | Non-Modifiable |
|---|---|
| • Overweight or obesity | • Increasing age over 45 years |
| • Blood pressure of ≥ 140/90 mmHg | • Family history |
| • HDL cholesterol ≤ 35 mg/dL | *Women only:*<br>• History of gestational diabetes |
| • Triglyceride levels of ≥ 250 mg/dL | • Having given birth to a baby >9 lbs. |
| • Lack of physical activity | |

**Obesity as a Modifiable Risk Factor**

Body mass index (BMI), or weight adjusted for height, is a widely used screening method for obesity. For children and adolescents, BMI is compared to age- and gender-specific percentiles on growth charts developed by the Centers for Disease Control and Prevention (CDC).  Children and adolescents with a BMI greater than or equal to the 85 percentile but less than the 95 percentile are considered overweight.  Children and adolescents with a BMI greater than or equal to the 95 percentile are considered obese.[20]  Medical guidelines for adults identify normal or desirable weight as a BMI under 25.0, overweight as a BMI of 25.0 to 29.9, and obese as a BMI of 30.0 or more.[20]

Obesity is a chronic disease, which can be explained by a combination of hereditary and environmental factors.  However, the primary causes of obesity are high calorie diets combined with less physical activity.[20, 21]  Obesity imposes a significant public health burden.  Studies among adults and children have demonstrated that excess weight is associated with an increase in the presence of risk factors for type 2 diabetes and CVD.[20]

According to data from the 2009 Connecticut School Health Survey, an estimated 14.5% of high school students are overweight and 10.4% are obese.[22]  Obesity rates among high school students vary by gender, and race and ethnicity.  Male Connecticut high school students are significantly more likely to be obese than female high school students ($p < 0.05$).  An estimated 13.8% of male and 6.7% of female high school students are obese (data not shown).[22]  Also, Hispanic Connecticut high school students have higher rates of obesity than both White ($p < 0.001$) and Black ($p < 0.05$) high school students.   The difference in the rate of obesity among White and Black high school students does not reach statistical significance.  An estimated 17% of Hispanic, 8.7% of White, and 12.5% of Black high school students are obese (data not shown).[22]

According to BRFSS survey responses, approximately 21% of Connecticut adults are obese, 38% are overweight, and 41% are neither overweight nor obese (2007-2009 data).[3]  Among adults, rates of obesity differ by gender.  Connecticut males are more likely to be obese than females.  An estimated 27.9% of males are obese compared with 19.2% of females ($p < 0.005$) [Figure 13].[3]

The prevalence of obesity among adults also differs by race and ethnicity.  Black adults have the highest rates of obesity in Connecticut.  The rate of obesity among Black adults is significantly higher than the obesity rates of White ($p < 0.001$) and Hispanic adults ($p < 0.05$).[3]  Similarly, Hispanic adults have a significantly higher rate of obesity than White residents ($p < 0.005$).[3]  Among Connecticut males, Black adults are more likely to be obese than White adults ($p < 0.05$).[3]  However, there is no statistical difference observed between the obesity rates of Hispanic and White or Black adult males.[3]  Among Connecticut females, Black adults have a significantly higher rate of obesity compared with White ($p < 0.001$) and Hispanic adults ($p < 0.05$).[3]  Also, Hispanic females are significantly more likely to be obese than White females ($p < 0.001$) [Figure 14].[3]

**Figure 13. Age-adjusted Prevalence of Obesity among Adults in Connecticut by Gender, 2007-2009, with 95% Confidence Intervals**
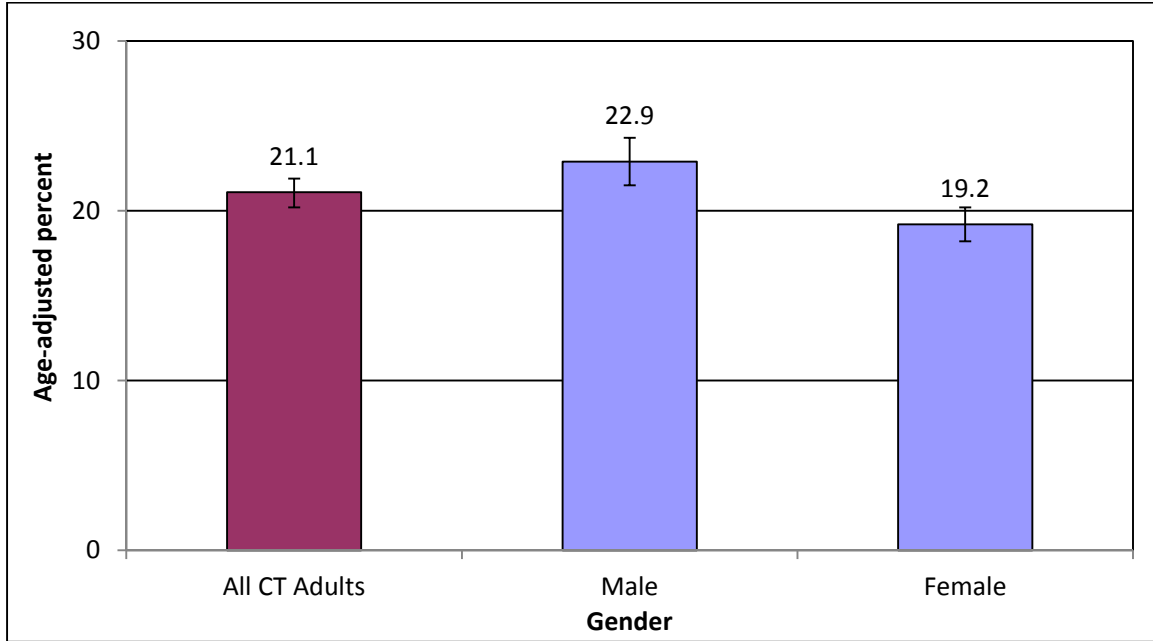


**Source:** Connecticut Department of Public Health, BRFSS, 2010

**Figure 14. Age-adjusted Prevalence of Obesity among Adults in Connecticut by Gender and Race and Ethnicity, 2007-2009, with 95% Confidence Intervals**
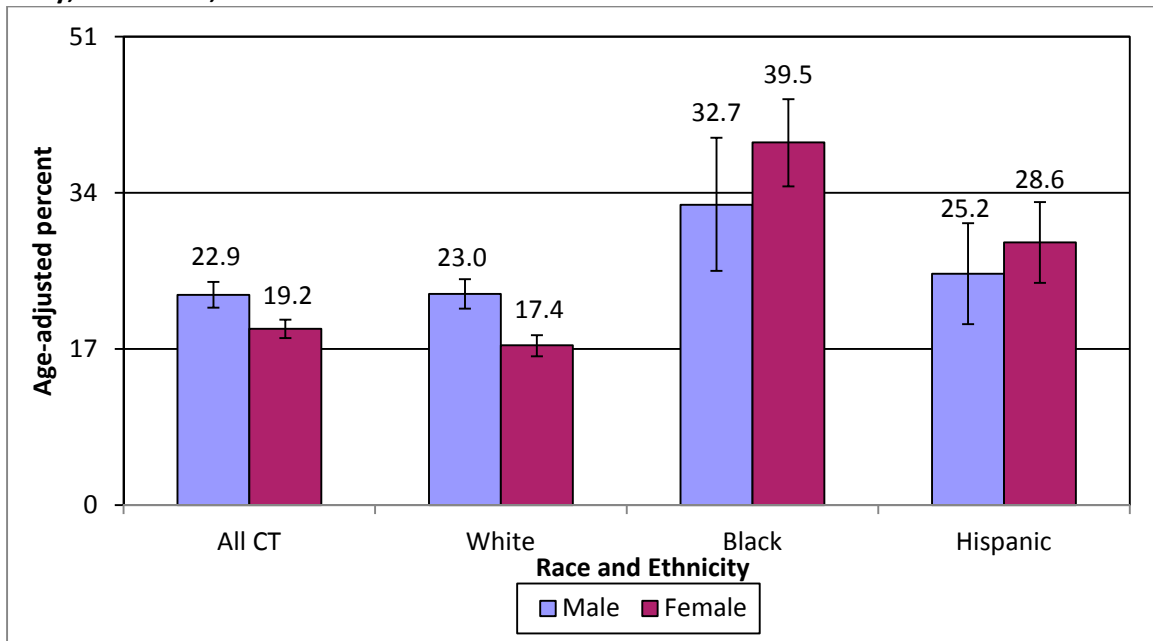


**Source:** Connecticut Department of Public Health, BRFSS, 2010.

The rates of obesity among adults differ by age and socioeconomic position.  The prevalence of obesity increases with age among Connecticut adults 18-64 years old.  For example, about  19% of adults 18-44 years old are obese compared to 25% of adults 45-64 years old (p<0.001).[3]  The rate of obesity among adults 65 years and older is not significantly different than that of adults 18-44 years old (data not shown).[3]  Also, Connecticut adults with lower annual household incomes are significantly more likely to be obese than adults with higher annual household incomes.[3]  For example, about 30% of adults with annual household incomes of less than $25,000 are obese compared with about 17% of adults with annual household incomes greater than $75,000 (p<0.001) [Figure 15].[3]

Approximately 80% of people with diabetes are obese at the time of diagnosis.[1]  Being overweight puts added pressure on the body's ability to properly control blood sugar, making it much more likely for diabetes to develop.[20]  Being overweight or obese has also been associated with an increased risk for diabetes-related complications.[20, 21]  For this reason, it is of particular concern that about 82% of Connecticut adults with diabetes are overweight or obese.[3]

**Figure 15. Age-adjusted Prevalence of Obesity among Connecticut Adults by Annual Household Income, 2007-2009, with 95% Confidence Intervals**
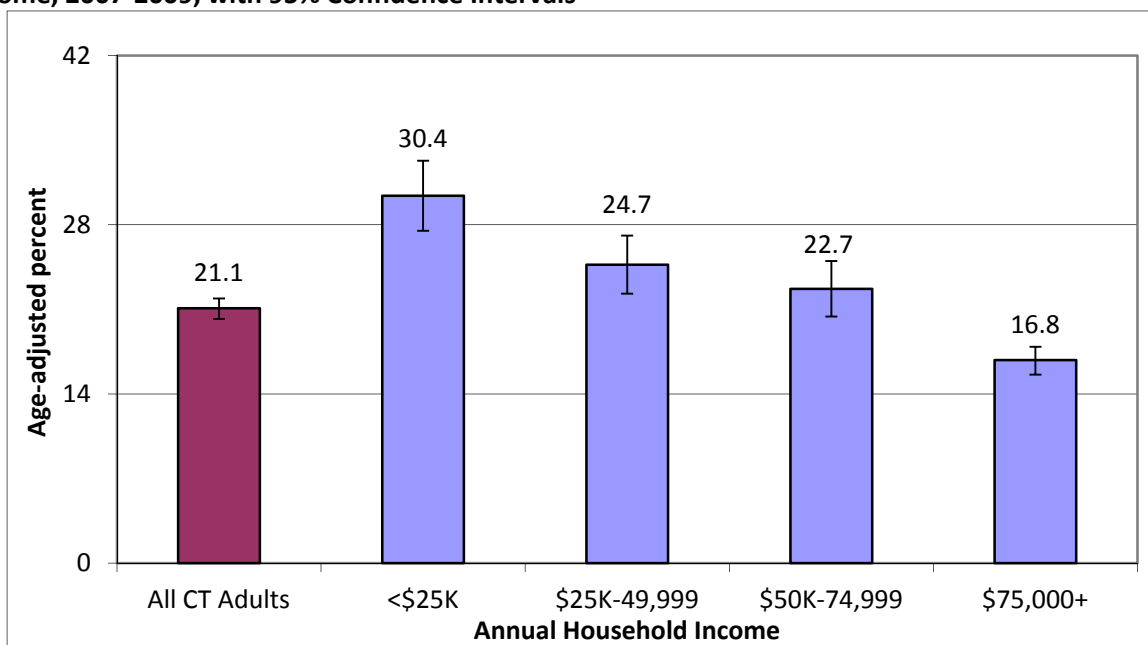


**Source:** Connecticut Department of Public Health, BRFSS, 2010.

**ACCESS TO HEALTH CARE**

Access to health care is crucial to the prevention, treatment, and management of diabetes. People without health insurance are less likely than those who are insured to have a usual source of care, to receive preventive health care services, and to receive appropriate medical management of chronic conditions such as high blood pressure and high blood cholesterol.[23] Lack of timely, appropriate care may contribute to the complications of diabetes, such as lower extremity amputations, end-stage renal disease, and blindness.[8]

About 9% of Connecticut adults aged 18 and over do not have health insurance (2007-2009 data) compared with approximately 14% of adults nationwide (2009 data).[3, 4] Black and Hispanic adults in Connecticut are significantly less likely to have health insurance than White adults (p<0.001 for both comparisons).[3] In Connecticut, approximately 30% of Hispanic, 21% of Black, and 6% of White adults do not have health insurance.[3] Nationally, about 31% of Hispanic, 21% of Black, and 11% of White adults report having no health insurance (Figure 16).[4]

**Figure 16. Percentage of Adults Who Do Not Have Health Care Coverage by Race and Ethnicity, US (2009, with 5% Error Bars) and CT (2007-2009, with 95% Confidence Intervals)**
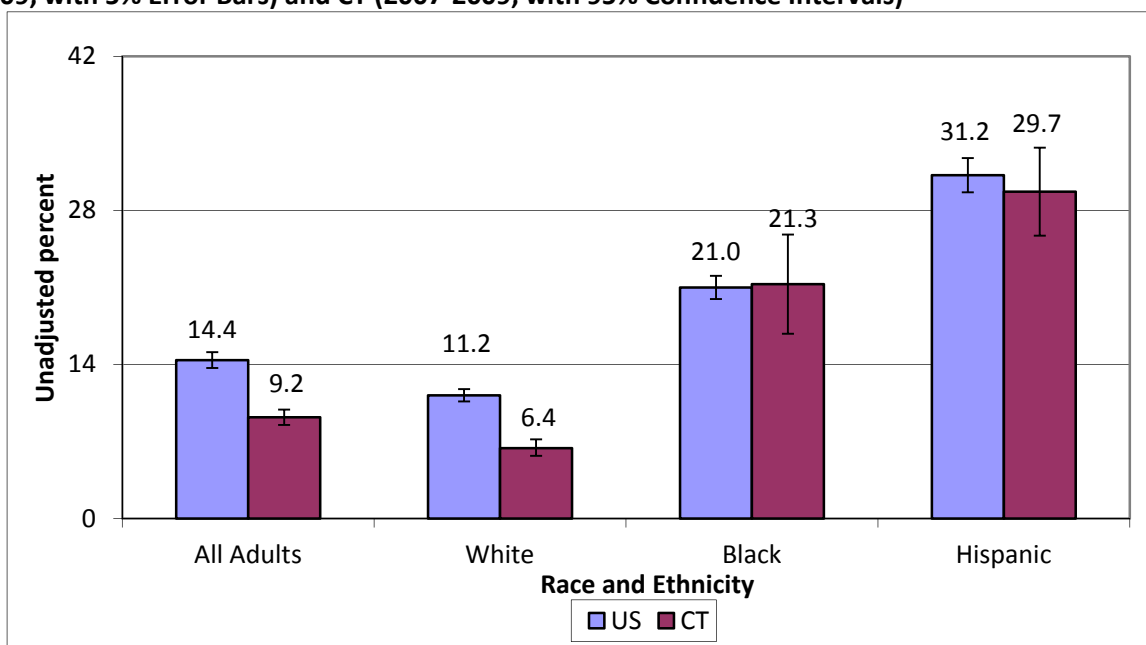


**Source:** CDC, BRFSS, 2010. Connecticut Department of Public Health, BRFSS, 2010.

**TARGETING HIGH RISK POPULATIONS**

Populations at high risk for diabetes and its complications include Black, Hispanic, and lower-income Connecticut residents.  Black, Hispanic, and lower-income adults in Connecticut have higher prevalence rates of diagnosed diabetes compared with White and higher-income adults.  Black and Hispanic Connecticut residents experience higher rates of mortality and premature mortality due to diabetes as well as higher rates of hospitalization due to diabetes and lower-extremity amputations.  Also, Black and Hispanic adults in Connecticut are significantly less likely than White adults to have health insurance, and thus access to preventive health care services.

Targeted evidence-based public health interventions that address the risk factors for the development of diabetes, the timely diagnosis of the disease, as well as appropriate care for those with diagnosed diabetes are warranted for all Connecticut residents with multiple risk factors.  Special emphasis should be placed on interventions that address risk factor reduction among Black, Hispanic, and lower-income Connecticut residents.  Evidence-based guidelines for disease prevention in the areas of diabetes, nutrition, physical activity, tobacco, and obesity are provided in the *CDC's Guide to Community Preventive Services*.[24]  The 2011 Connecticut Chronic Disease planning process has focused its statewide health promotion and disease prevention efforts on policy, systems, and environmental changes at the state and local levels.  Such policy, systems, and environmental changes have the potential for broad reach and impact on the general population and high-risk populations.

**APPENDICES AND REFERENCES**

**Appendix 1. Data Sources**

*Behavioral Risk Factor Surveillance System*

    The Behavioral Risk Factor Surveillance System (BRFSS) survey is a state-based system of health surveys that generate information about health risk behaviors, clinical preventive practices, and health care access and use. The BRFSS, sponsored by the Centers for Disease Control and Prevention, is the world's largest telephone survey, and is conducted in all 50 states.  It is an on-going random sample telephone survey of non-institutionalized adults, 18 years and older.  Information from the survey is used to improve the health of people nationwide and in Connecticut.  Racial and ethnic classifications are based on self-report and include White, non-Hispanic, Black, non-Hispanic, and Hispanic (including persons of any race). Other national and state-specific risk factor data and information regarding BRFSS methodology can be accessed on the CDC's BRFSS Web site at: http://www.cdc.gov/brfss/.

*Connecticut Vital Records Mortality Files*

    The Connecticut Vital Records Mortality Files are part of the state's vital statistics data base that contains records pertaining to deaths that occur within the state as well as deaths of Connecticut residents occurring in other states, or in Canada.  Mortality statistics are compiled in accordance with the World Health Organization (WHO) regulations, which specify that deaths be classified by the current Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death.  Deaths for the 1989-1998 period included in this report are classified by the Ninth Revision of the International Classification of Diseases (ICD-9).[25]  Deaths for the 1999-2008 period are classified by the Tenth Revision of the International Classification of Diseases (ICD-10).[26]

    The race-ethnicity designation is typically based on report by next of kin, a funeral director, coroner, or other official, often based on observations.  As such, the race-ethnicity designation based on observation may be reported incorrectly.   Another potential source of error is the fact that death rates are calculated using two different sources of data – the death certificate for the numerator and the U.S. Census Bureau population estimates for the denominator.  Errors in under- or over-counting populations by race and/or ethnicity will affect the death rates reported for these groups.   Mortality data are reported using racial categories that exclude persons of Hispanic origin (White, non-Hispanic and Black, non-Hispanic) and by Hispanic ethnicity (Hispanics of any race).  Death Registry data follow the National Center for Health Statistics guidelines for coding race and Hispanic ethnicity.[13]

*Connecticut Hospital Discharge Abstract and Billing Data Base*

The Connecticut Hospital Discharge Abstract and Billing Data Base is the source of inpatient hospitalization data.  It is maintained by the Connecticut Office of Health Care Access, and it contains patient-level demographic, clinical, and billing data for all non-federal acute care hospitals in the state.  In addition to age, gender, and town of residence, the demographic data elements include race and ethnicity.  Race and ethnicity may be based upon observation of the patient or self-reporting by the patient.  Race is designated as White, non-Hispanic and Black, non-Hispanic; Hispanic ethnicity includes persons of any race.

It should be noted that counts reflect hospitalizations not persons.  For example, a patient admitted to a hospital on two separate occasions in 2008 would be counted twice in these data.  Another limitation of the data is the fact that it is an administrative data set.  It contains diagnoses and procedures based on the International Classification of Diseases, Clinical Modification (ICD-9-CM) codes.  The literature contains many reports on the reliability and validity of hospital discharge data with clinical conditions emphasizing discrepancies between ICD-9-CM codes and clinical data.[27]

*Connecticut School Health Survey- Youth Behavior Component*

The Connecticut School Health Survey (CSHS) is a comprehensive survey that consists of two components: Youth Tobacco Component (YTC) and the Youth Behavior Component (YBC).  The YBC collects data that is used to monitor priority health-risk behaviors and the prevalence of obesity and asthma among high school students in Connecticut.  The CSHS is conducted by the Connecticut Department of Public Health in cooperation with the CDC, the Connecticut State Department of Education, and partners from local school health districts and local health departments.   The YBC is administered to a representative sample of all regular public high school students in Connecticut.  Racial and ethnic classifications are based on self-report and include White, non-Hispanic; Black, non-Hispanic; and Hispanic (including persons of any race).  Further information about the CSHS can be found on the Connecticut Department of Public Health's web site: http://www.ct.gov/dph/cshs.  Other national and state-specific youth risk factor data and information can be accessed on the CDC's web site: http://www.cdc.gov/HealthyYouth/YRBS/.

**Appendix 2A. ICD-10 Coding for Selected Causes of Death, 1999-2008**

| Cause of Death | ICD-10 Code |
| --- | --- |
| All Causes | A00.0 – Y89.9 |
| All Cancers | C00 – C97 |
| Alzheimer's Disease | G30 |
| Cerebrovascular Disease | I60 – I69 |
| Chronic Lower Respiratory Diseases | J40 – J47 |
| Diabetes Mellitus | E10 – E14 |
| Diseases of the Heart | I00 – I09, I11, I13, I20 – I51 |
| Pneumonia and Influenza | J10 – J18 |
| Unintentional Injuries | V01 – X59, Y85 – Y86 |

**Source:** World Health Organization. 1992. *Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, based on the recommendations of the Tenth Revision Conference, 1992 (ICD-10)* Geneva: World Health Organization.

**Appendix 2B. ICD-9-CM Coding for Selected Causes of Hospitalizations**

| Cause of Hospitalization | ICD-9-CM Code |
| --- | --- |
| Diabetes | 250 |
| Diabetes-related | 250 as any listed diagnosis |
| Diabetes-related with lower-extremity amputation | 250 as any listed diagnosis with a procedure code 84.1 and not having 895-897 |

**Source:** Practice Management Information Corporation. 2004. *The International Classification of Diseases, Ninth Revision, Clinical Modification, 6th edition*. Los Angeles, CA.

**Appendix 3. Glossary of Statistical Terms**

**Age-adjustment.** "Age adjustment, using the direct method, is the application of observed age-specific rates to a standard age distribution to eliminate differences in crude rates in populations of interest that result from differences in the populations' age distributions. This adjustment is usually done when comparing two or more populations at one point in time or one population at two or more points in time. Age adjustment is particularly relevant when populations being compared have different age structures, for example, the U.S. white and Hispanic populations….".[28]

**Age-adjusted BRFSS rates.** Some of the Behavioral Risk Factor Surveillance System (BRFSS) rate estimates presented in this report were age-adjusted, using the direct method, in order to eliminate differences in crude rates in populations of interest that result from differences in the populations' age distributions, such as those of Hispanics and Whites. The following age distributions and age-adjustment weights, based on the 2000 projected U.S. population, were used[29]:

**Age Distributions and Age-adjustment Weights, 2000 Projected U.S. Population**

| Age | Population in thousands | Adjustment weight |
| --- | --- | --- |
| 18 years and over | 203,851 | 1.000000 |
| 18 – 24 years | 26,258 | 0.128810 |
| 25 – 44 years | 81,892 | 0.401725 |
| 45 – 64 years | 60,991 | 0.299194 |
| 65 years and over | 34,710 | 0.170271 |

**Age-adjusted Mortality Rates (AAMR) and  Age-adjusted Hospitalization Rates (AAHR)** are used to compare relative mortality and hospitalization risk, respectively, across groups and over time.  They are not actual measures of risk but rather an index of risk. They are weighted statistical averages of the age-specific rates, in which the weights represent the fixed population proportions by age.[30]  The AAMR and AAHR were computed by the direct method.  The 1940 and 2000 U.S. standard million population distributions are shown below:

| Age group | 1940 | 2000 |
|-----------|------|------|
| 0-4 | 80,057 | 69,136 |
| 5-9 | 81,151 | 72,533 |
| 10-14 | 89,209 | 73,032 |
| 15-19 | 93,665 | 72,169 |
| 20-24 | 88,002 | 66,477 |
| 25-29 | 84,280 | 64,529 |
| 30-34 | 77,787 | 71,044 |
| 35-39 | 72,501 | 80,762 |
| 40-44 | 66,744 | 81,851 |
| 45-49 | 62,696 | 72,118 |
| 50-54 | 55,116 | 62,716 |
| 55-59 | 44,559 | 48,454 |
| 60-64 | 36,129 | 38,793 |
| 65-69 | 28,519 | 34,264 |
| 70-74 | 19,519 | 31,773 |
| 75-79 | 11,423 | 26,999 |
| 80-84 | 5,878 | 17,842 |
| 85+ | 2,765 | 15,508 |
| Total | 1,000,000 | 1,000,000 |

**Cause-of-death classification.**  Mortality statistics for this report were compiled in accordance with the World Health Organization (WHO) regulations, which specify that member nations classify causes of death by the current Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death. Deaths for the 1989-1998 period were classified by the Manual of the International Statistical Classification of Diseases, Injuries, and Causes of Death, Ninth Revision of the International Classification of Diseases (ICD-9).[25]  Deaths for the 1999-2008 period were classified according to the Tenth Revision of the International Classification of Diseases (ICD-10).[26]

*Healthy People 2010* is part of a national strategy addressing the prevention of major chronic illnesses, injuries, and infectious diseases.  It is the product of an effort, involving expert working groups, a consortium of national organizations, all state health departments, and the Institute of Medicine of the National Academy of Sciences to set health objectives for the nation.  After extensive national and regional hearings were conducted with a period of public review and comment, the health objectives were published in 1990 as *Healthy People 2000—National Health Promotion and Disease Prevention Objectives.*  It established national objectives and served as the basis for the development of state and community plans.  *Healthy People 2010* provides a comprehensive view of the nation's health in 2000, and establishes national goals and targets to be achieved by 2010, and monitors progress over time.[31]

**Hispanic origin** refers to people whose origins are from Spain, the Spanish-speaking countries of Central America, South America, and the Caribbean, or persons of Hispanic origin identifying themselves as Spanish, Spanish-American, Hispanic, Hispano, or Latino.  Since 1988, the Connecticut death certificate has had a separate line item for Hispanic ethnicity.  Individuals identified as "Hispanic" can be of any race, and are also counted in the race breakdown as either "white," "black," "Asian or Pacific Islander," "American Indian," or other.[13]

**International Classification of Diseases 9th and 10th Revisions(ICD-9, ICD-10)** have been the internationally accepted coding system for determining cause of death since the early 1900s.  It is periodically revised.  The Ninth Revision (ICD-9) was in use from 1975 through 1998.  Beginning with 1999 deaths, the Tenth Revision (ICD-10) is being used.

Preliminary estimates of the comparability of ICD-9 to ICD-10 have been published and indicate that the discontinuity in trends from 1998 to 1999 for some leading causes of death (septicemia, influenza and pneumonia, Alzheimer's disease, nephritis, nephrotic syndrome, and nephrosis) is substantial.[32]

**International Classification of Diseases, Clinical Modification (ICD-9-CM)** is a coding system recommended for use in all clinical settings to describe medical procedures and diagnoses.  It is required for reporting diagnoses and diseases to all U.S. Public Health Service and Department of Health and Human Services programs, including Medicare and Medicaid.  The foundation of the ICD-9-CM is the *International Classification of Diseases, 9th Revision* published by the World Health Organization.[25]

**Population bases** for computing rates are taken from the U.S. Census Bureau's *Estimates of the population of states by age, sex, race, and Hispanic origin*.  These data are estimates of the population of Connecticut by 5-year age groups (age 0 to 4, 5 to 9,…85 and over), sex (male, female), modified race (white; black; Native American including Alaska Natives; Asian and Pacific Islander) and Hispanic origin (Hispanic, ) for each year, July 1, 1999 through July 1, 2009.[13]

**Race**  refers to a population of individuals identified from a common history, nationality, or geographical place.  Race is widely considered a valid scientific category, but not a valid biological or genetic category.[33, 34]  Available scientific evidence indicates that racial and ethnic classifications do not capture biological distinctiveness, and that there is more genetic variation within racial groups than there is between racial groups.[35, 36]  Contemporary race divisions result from historical events and circumstances and reflect current social realities.  Thus, racial categories may be viewed more accurately as proxies for social and economic conditions that put individuals at higher risk for certain disease conditions.[27]

Data presented in this report include two racial groups in Connecticut: White, non-Hispanic and Black, non-Hispanic. Individuals identified as "Hispanic" can be of any race.

**Socioeconomic position** refers to a person's social and economic place in a society, and is operationalized or measured by characteristics such as per capita or household income, educational attainment, or occupation.  Historically, lower socioeconomic position has been strongly correlated with less favorable health outcomes such as premature mortality and higher death rates from all causes; conversely, persons of higher socioeconomic position do better on most measures of health status.[10]

**Years of potential life lost (YPLL)** represents the number of years of potential life lost by each death before a predetermined end point (e.g., 75 years of age).  Whereas the crude and adjusted death rates are heavily influenced by the large number of deaths among the elderly, the YPLL measure provides a picture of premature mortality by weighting deaths that occur at younger ages more heavily than those occurring at older ages, thereby emphasizing different causes of death. Age-adjusted YPLLs are calculated using the methodology of Romeder and McWhinnie.[37]  This method consists of a summation of the number of deaths occurring at each age (betweem 1 and 75) multiplied by the remaining years of life had the deceased lived up to age 75.

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