



**VOLUME 5:**

The Burden of  
Stroke in Oregon

**2013**

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**Health**  
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This chapter summarizes the findings of Oregon’s stroke data system and includes the most up-to-date data on stroke prevalence,\* death and hospitalizations over time and across select demographics, chronic diseases and risk factors. The intent of this chapter is to highlight the burden of stroke in Oregon and to assist stakeholders, policymakers and other interested parties in efforts to reduce this burden. For more information on each dataset used in this chapter, see Appendix B.

## What is stroke?

- ▶ Stroke falls under a class of diseases, called cardiovascular disease, that involves the heart or blood vessels.
- ▶ There are two types of stroke: hemorrhagic and ischemic.
- ▶ An ischemic stroke occurs when blood flow to a part of the brain stops due to an obstruction, such as a fatty deposit or blood clot. If blood flow is stopped for longer than a few seconds, the brain cannot get blood or oxygen and brain cells can die, which can lead to permanent brain damage.
- ▶ Approximately 87% of all stroke cases in the United States are ischemic strokes.<sup>1</sup>
- ▶ Hemorrhagic stroke occurs when a weakened blood vessel within the brain ruptures or leaks.
- ▶ Anyone can have a stroke, but the risk of stroke can be reduced by eating a healthy diet, maintaining a healthy weight, being active, not smoking, limiting alcohol use, and managing chronic health conditions such as diabetes, high blood pressure and high cholesterol.
- ▶ If signs or symptoms of a stroke are present, call 9-1-1 immediately. The chance of stroke survival and recovery is higher if emergency treatment is received right away.

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\*There is an important limitation of the stroke prevalence estimates. In general, “prevalence” of stroke refers to the percentage of people reporting having had a stroke at a given time. This prevalence estimate is based on responses from adult Oregonians who had a stroke, but did not die from the stroke and are healthy enough to respond to a series of survey question about their health and health practices. This estimate does not capture strokes that resulted in death or significant disability, so it is likely an underestimate of the true stroke prevalence in Oregon. This caveat does not apply to the numbers of stroke deaths and hospitalizations presented in the chapter because these are based on death certificates and reports from Oregon hospitals rather than survey data.



### Who has stroke?

- ▶ In Oregon, an estimated 2.5% of adults reported having a history of stroke. This translates to approximately 86,000 Oregon adults who had ever had a stroke.
- ▶ Oregon has a smaller proportion of the population who have ever had a stroke than the United States overall. Since 2005, the percentage of people with a history of stroke in Oregon has remained relatively unchanged.
- ▶ More adult males (2.7%) reported having a history of stroke than adult females (2.5%) in 2011; however, there does not appear to be a consistent difference in stroke prevalence between adult males and females in Oregon over time.
- ▶ Oregonians aged 75 years or older (10.8%) were more likely to report ever having a stroke than younger Oregonians aged 18–44 years (0.4%).
- ▶ Oregon adults with less than a high school education (3.9%) were three times more likely to report ever having a stroke than Oregon adults with a college degree (1.3%).

- ▶ Oregon adults with an annual household income of less than \$20,000 (4.6%) were nearly four times more likely to report ever having a stroke than Oregon adults in households with an annual income of \$50,000 or more (1.2%).
- ▶ Oregon adults enrolled in the Oregon Health Plan (6.3%) were nearly three times more likely to report having a stroke than individuals with no insurance (2.0%) or those enrolled in private, Medicare or other health insurance plans (2.2%).
- ▶ A higher percentage of non-Latino African American (4.8%) and non-Latino American Indian/Alaska Native (4.2%) persons reported having a history of stroke compared to non-Latino white (2.5%) and non-Latino Asian/Pacific Islander (3.5%) persons.

### Risk factors for stroke

- ▶ **High blood pressure and high cholesterol:** Among the general population of Oregon adults, 28% reported high blood pressure and 32% high cholesterol. Among adults who reported a history of stroke, the proportion with high blood pressure nearly doubled at 51%, and the proportion with high cholesterol more than doubled at 70%.
- ▶ **Obesity:** More than one-quarter of adults in Oregon are obese. Among adults who report having a stroke, 35% are obese.

- ▶ **Cigarette smokers:** Approximately one-in-three adults who reported a history of stroke were current cigarette smokers, compared to 20% of adults overall.
- ▶ **Lack of physical activity:** Nearly half of adults who reported a history of stroke got inadequate physical activity, compared to 20% of adults overall.

### Stroke hospitalizations

- ▶ In 2011, 7,762 hospitalizations in Oregon were primarily attributed to stroke.
- ▶ Between 1997 and 2011, the stroke hospitalization rate decreased by 18.2%.
- ▶ Among those hospitalized for stroke, one-quarter had diabetes listed as a secondary diagnosis.

### Cost of stroke

- ▶ In 2011, the average cost of a hospitalization primarily due to stroke was \$32,723, with the total cost of all hospitalizations reaching almost \$254 million.

### Stroke mortality

- ▶ In 2011, stroke was the fourth leading cause of death in Oregon.
- ▶ From 1990 to 2010, stroke death rates in Oregon were consistently higher than national rates. However, in recent years the difference between Oregon and the United States has narrowed.

- ▶ Since 1990, the stroke death rate in Oregon has decreased by 44%, from 72.1 deaths per 100,000 population to 40.1 deaths per 100,000 population.
- ▶ In 2011, 1,906 deaths were primarily due to having a stroke, accounting for 6% of all deaths among Oregon residents.
- ▶ Stroke death rates are higher among older age groups, with a markedly higher rate in those aged 75 years and older.
- ▶ Stroke death rates are similar for men and women; declines in the stroke death rate have been observed in both men and women during the last decade.
- ▶ African Americans have consistently had a higher death rate from stroke compared with all other racial and ethnic groups. Over time, the disparity in the stroke death rate among racial and ethnic groups has lessened. However, African Americans still have a higher stroke death rate than other racial and ethnic groups.

### Meeting Healthy People 2020 goals

- ▶ Healthy People provides science-based, 10-year national objectives for improving the health of all Americans.
- ▶ One of the Healthy People goals to achieve by the year 2020 is the reduction of deaths due to stroke.
- ▶ The death rate due to stroke in Oregon is steadily decreasing; however, the stroke death rate will need to be reduced by an additional 16% over the remaining years to achieve the Healthy People 2020 goal of 33.8 stroke deaths per 100,000 population.



## Ways to reduce the burden of stroke in Oregon

Oregon is committed to preventing stroke through a wide range of evidence-based practices. The Health Promotion and Chronic Disease Prevention Section of the Oregon Public Health Division is working with local and state partners to:

- ▶ Increase availability of healthy foods and beverages in child care facilities, schools, worksites and neighborhoods;
- ▶ Increase places where people can move more safely;
- ▶ Increase the number of environments that are tobacco-free;
- ▶ Increase referrals to self-management programs so that people with chronic disease can live well and take care of themselves;
- ▶ Improve delivery and use of quality health care services through the physician promotion of the ABCS — appropriate **A**spirin therapy, **B**lood pressure control, **C**holesterol control, **S**moking cessation and reduced **S**odium consumption.

This comprehensive, community-wide approach makes it easier for all Oregonians to eat better, move more and live tobacco-free wherever they live, work, play and learn.



## What is stroke?

Stroke falls under a class of diseases, called cardiovascular disease, that involves the heart or blood vessels. There are two types of stroke: hemorrhagic and ischemic. An ischemic stroke occurs when blood flow to a part of the brain stops due to an obstruction, such as a fatty deposit. If blood flow is stopped for longer than a few seconds, the brain cannot get blood or oxygen and brain cells can die, which can lead to permanent brain damage. Approximately 87% of all stroke cases in the United States are ischemic strokes.<sup>1</sup> Hemorrhagic stroke occurs when a weakened blood vessel within the brain ruptures or leaks. Approximately 77% of strokes every year are first or new strokes, while approximately one-in-four are recurrent strokes.<sup>1</sup>

Anyone can have a stroke, but the risk of stroke can be reduced by practicing specific healthy behaviors and managing existing chronic medical conditions. Not smoking and limiting exposure to secondhand cigarette smoke, limiting alcohol use, increasing physical activity, and eating a diet high in fruits and vegetables and low in salt and artificial trans fats can help prevent a stroke from occurring. Stroke can also be prevented by controlling existing medical conditions such as high blood pressure, high cholesterol, heart disease, diabetes, and overweight and obesity. Healthy behaviors help control these pre-existing medical conditions. In addition, those with a family history of stroke, older adults, men, and African American, Latino, and American Indian/Alaska Native persons have all been identified as being more susceptible to having a stroke.





## Stroke risk factors

### Behaviors:

- ▶ Tobacco use;
- ▶ Alcohol use;
- ▶ Lack of physical activity;
- ▶ Diet high in salt or trans fats.

### Chronic conditions:

- ▶ High blood pressure;
- ▶ High cholesterol;
- ▶ Heart disease;
- ▶ Diabetes;
- ▶ Overweight and obesity;
- ▶ Previous stroke.

### Heredity:

- ▶ Family history;
- ▶ Older age;
- ▶ Male gender;
- ▶ African American, Latino or American Indian/Alaska Native race and ethnicity.

## Common stroke signs and symptoms

- ▶ Sudden numbness or weakness of the face, arm or leg;
- ▶ Sudden confusion or trouble speaking or understanding others;
- ▶ Sudden trouble seeing in one or both eyes;
- ▶ Sudden dizziness, trouble walking, or loss of balance or coordination;
- ▶ Sudden severe headache with no known cause.

If signs or symptoms of a stroke are present, call 9-1-1 immediately. The chance of stroke survival and recovery is higher if emergency treatment is received right away. People who have ever had a stroke are at high risk for another one. At least one in every eight stroke survivors has another stroke within five years.<sup>2</sup> It is important for stroke survivors to control chronic conditions that may cause another stroke — including high blood pressure, high cholesterol and diabetes — through healthy lifestyle behaviors such as not smoking and engaging in physical activity.

## Stroke is a public health priority

During the past 20 years, stroke prevalence, hospitalizations and mortality have consistently declined in both Oregon and nationally. However, stroke is still the fourth leading cause of death in Oregon and the third leading cause of death in the United States overall. In 2011, an estimated 86,000 Oregon adults reported having a stroke, and there were 7,762 hospitalizations due to stroke with a total cost of nearly \$254 million. Due to the significant morbidity and mortality associated with this disease, stroke prevention has been identified as a key component in the Oregon Public Health Division Strategic Plan 2012–2017,<sup>3</sup> as well as the Healthy People 2020 national health plan.<sup>4</sup> The Oregon Heart Disease and Stroke Prevention Program also supports the U.S. Department of Health and Human Services Million Hearts® campaign, which began in 2012 and aims to prevent one million heart attacks and strokes by 2017.

## Heart Disease and Stroke Prevention Program priorities

- ▶ Controlling high blood pressure and cholesterol;
- ▶ Recognizing the signs and symptoms of heart attack and stroke and taking appropriate actions;
- ▶ Improving emergency response;
- ▶ Eliminating health disparities between population groups;
- ▶ Providing facts and figures about heart disease and stroke in Oregon.

## Million Hearts® aims to prevent heart disease and stroke by:

- ▶ Improving access to effective care;
- ▶ Improving the quality of care for the ABCS – appropriate **A**spirin therapy, **B**lood pressure control, **C**holesterol control, **S**moking cessation and reduced **S**odium consumption;
- ▶ Focusing clinical attention on the prevention of heart attack and stroke;
- ▶ Activating the public to lead heart-healthy lifestyles;
- ▶ Improving prescription adherence to appropriate medications for the ABCS.

The Oregon Heart Disease and Stroke Prevention Program also developed Oregon’s Statewide Plan for Heart Disease and Stroke Prevention and Care. The statewide plan was completed by Oregon’s Coordinating Council for Heart Disease and Stroke in order to create a vision for the prevention, early detection, treatment and self-management of these diseases and their related risk factors. In addition to the statewide plan, the 2013 Oregon legislative session saw the passage of Senate Bill 375, which created a stroke care subcommittee charged with developing guidelines related to stroke care in Oregon, and directed the Oregon Health Authority to establish and implement a plan for improving the quality of stroke care in Oregon.



# Stroke in Oregon

Approximately **86,000** adults

have had a stroke in their lifetime. Stroke is the fourth leading cause of death in Oregon.

**\$** Stroke costs Oregonians \$254 million in hospitalizations and, combined with heart disease, causes nearly 1 in 4 deaths.

Certain risk factors can complicate recovery from a stroke and can increase the chance of having another stroke.

Among Oregon adults who have survived a stroke:

-  **1 in 4** has diabetes.
-  **1 in 3** is obese.
-  **1 in 3** smokes cigarettes.
-  **2 in 3** have high cholesterol.
-  **1 in 2** has high blood pressure.
-  **1 in 2** is physically inactive.

## STROKE affects some communities more than others.

Compared to adults with a college degree, adults with less than a high school education are:

**3x** more likely to have a stroke.

Compared to non-Latino whites, African American people are:

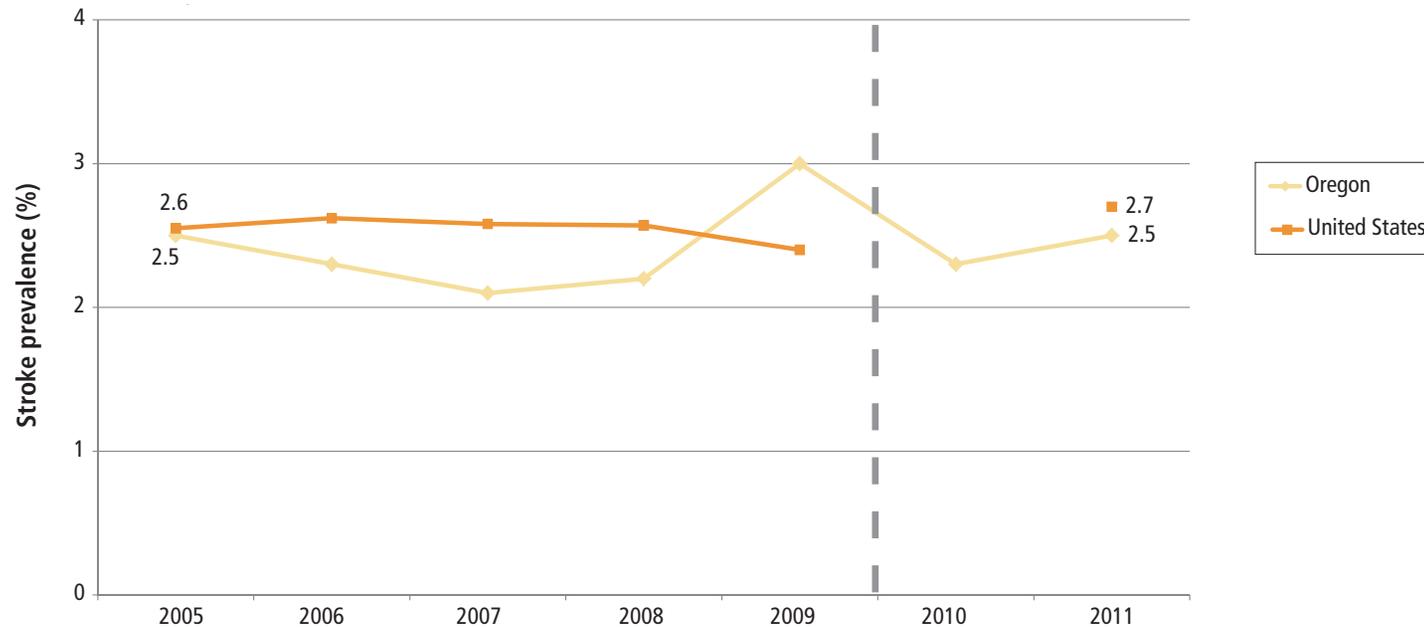
**2x** more likely to have a stroke in their lifetime.

## 5.1 Who has stroke?

To understand the burden of stroke in Oregon, the prevalence\* of the disease needs to be known. Prevalence is the percentage of people with stroke in a particular population, at a given time. It is important to report the prevalence of stroke among subpopulations of Oregonians (e.g., racial

and ethnic minorities) to identify groups of Oregonians who are disproportionately affected by stroke compared to the general population in Oregon. This section will describe the burden of stroke among Oregon adults over time and by select demographics including gender, age, education, income, health insurance status, race and ethnicity, chronic disease risk factors, and chronic conditions.

**FIGURE 5.1.1 ADULTS WHO HAD EVER HAD A STROKE, BY YEAR, OREGON VS. UNITED STATES, 2005–2011**



**Data sources:** Oregon Behavioral Risk Factor Surveillance System; national data from the National Behavioral Risk Factor Surveillance System.

**Notes:** National data were not included for 2010 as the method for weighting the data was different from the method used in Oregon. The national estimate excludes territories. The vertical dashed line denotes a different adjustment method and inclusion of cellular phones in the sample. Starting in 2010, estimates are not comparable to earlier years. Estimates are age-adjusted.

\*For this report, stroke prevalence was determined by the percentage of adults who responded “Yes” when asked if they have ever been told by a doctor, nurse or other health professional that they had a stroke.

**TABLE 5.1.1 ADULTS WHO HAD EVER HAD A STROKE, BY YEAR, OREGON AND UNITED STATES, 2005–2011**

YEAR	OREGON	UNITED STATES
2005	2.5	2.6
2006	2.3	2.6
2007	2.1	2.6
2008	2.2	2.6
2009	3.0	2.4
2010	2.3	N/A
2011	2.5	2.7

**Data sources:** Oregon Behavioral Risk Factor Surveillance System; national data from the National Behavioral Risk Factor Surveillance System.

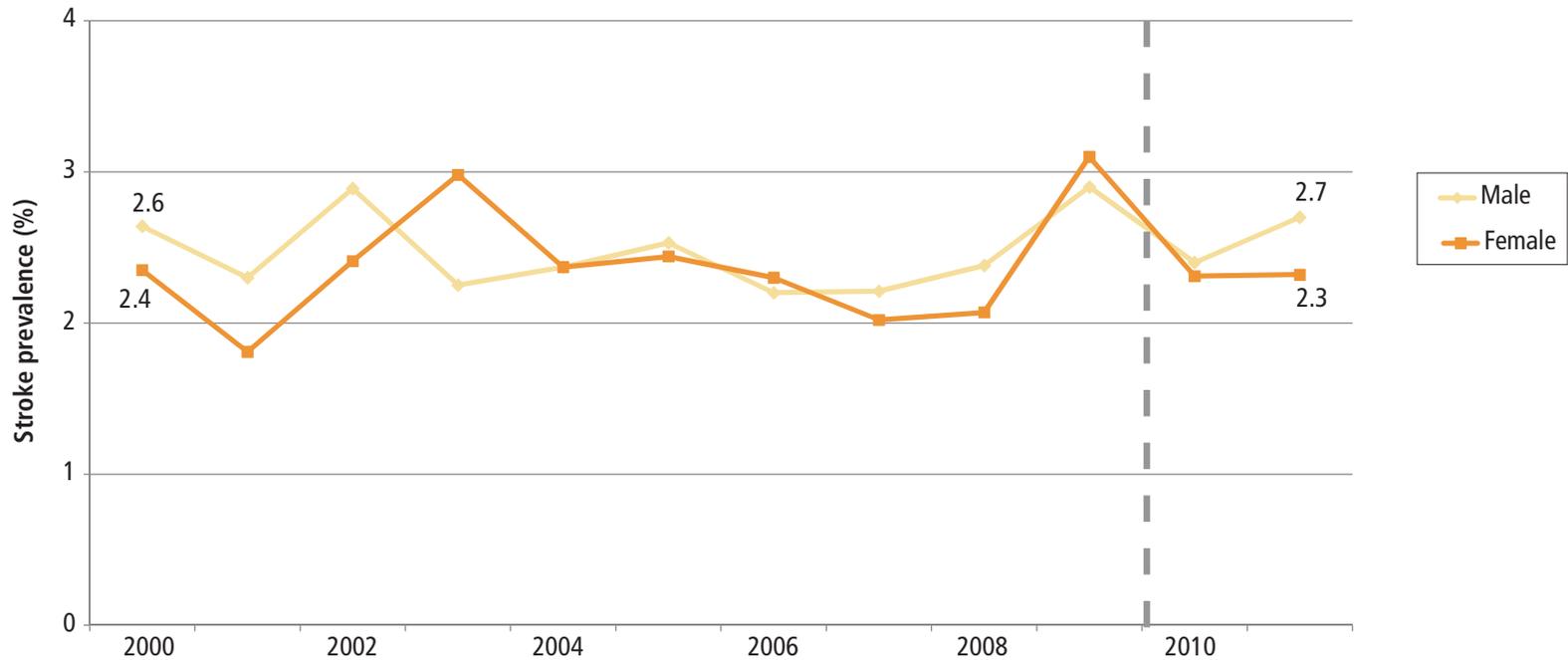
**Notes:** National data were not included for 2010 as the method for weighting the data was different from the method used in Oregon. The national estimate excludes territories. Starting in 2010, estimates are not comparable to earlier years. Estimates are age-adjusted.



- ▶ Fewer Oregon adults reported ever having a stroke compared with the overall U.S. population (Figure 5.1.1 and Table 5.1.1). This has been fairly consistent over time, but the reason for this difference is unknown.
- ▶ In general, since 2005, the percentage of Oregonians who had a history of stroke remained steady at around 2.5% (Table 5.1.1 and Figure 5.1.1). This was true even though the method for adjusting the data changed starting in 2010, and is not comparable to prior years.

- ▶ In 2011, nearly 86,000 Oregon adults were estimated to have a history of stroke.

FIGURE 5.1.2 ADULTS WHO HAD EVER HAD A STROKE, BY GENDER AND YEAR, OREGON, 2000–2011

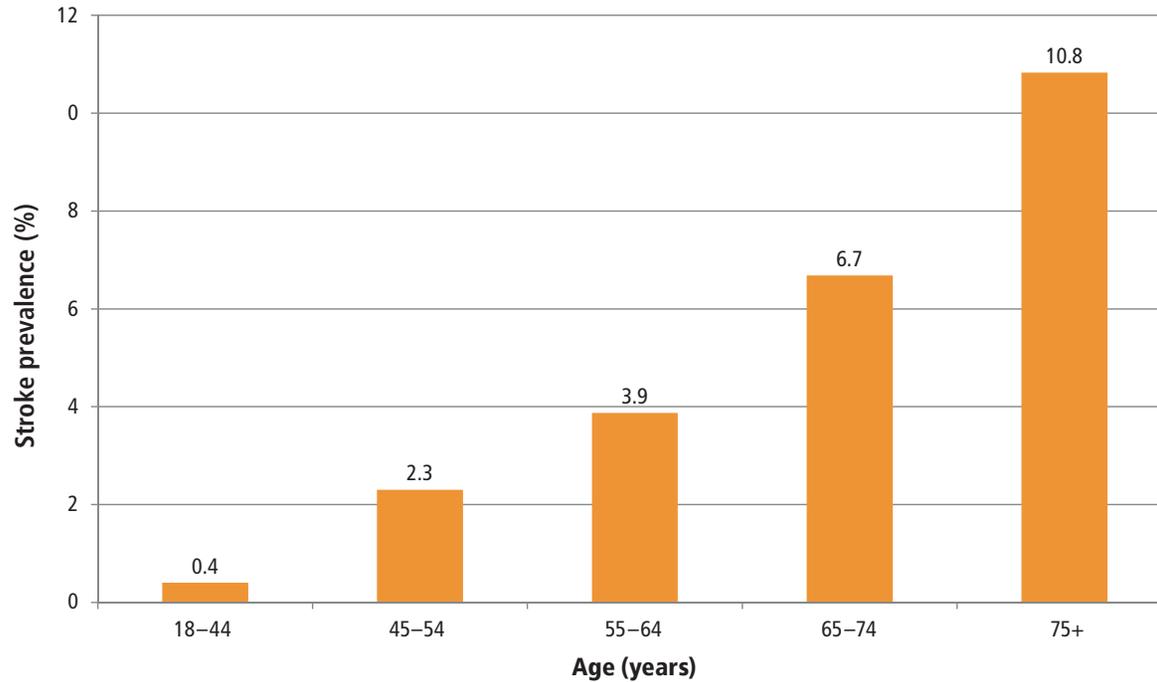


**Data sources:** Oregon Behavioral Risk Factor Surveillance System.

**Notes:** The vertical dashed line denotes a different adjustment method and inclusion of cellular phones in the sample. Starting in 2010, estimates are not comparable to earlier years. Estimates are age-adjusted.

- ▶ Over time, there does not appear to be a consistent difference between adult males and females in having a history of stroke (Figure 5.1.2).
- ▶ Nationally, the proportion of adult males with a history of stroke has been consistently higher compared to adult females.<sup>5</sup>
- ▶ In 2011, the percentage of adult males reporting ever having a stroke was higher compared to adult females at 2.7% and 2.3%, respectively (Figure 5.1.2).
- ▶ However, a recent systematic review of gender differences in stroke showed that while stroke is more common among men, women become more severely ill after having a stroke.<sup>6</sup>

FIGURE 5.1.3 ADULTS WHO HAD EVER HAD A STROKE, BY AGE GROUP, OREGON, 2011



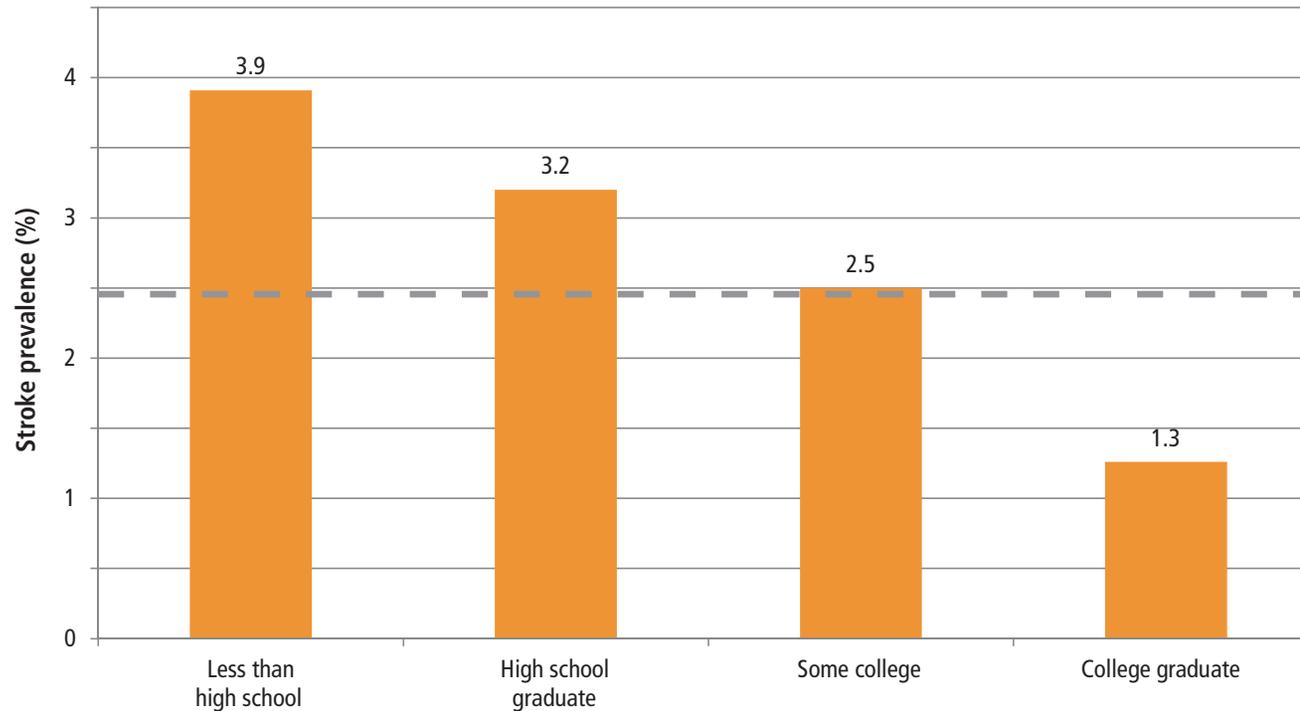
**Data sources:** Oregon Behavioral Risk Factor Surveillance System.

**Notes:** Estimates are not age-adjusted.

\*This number may be statistically unreliable and should be interpreted with caution.

- ▶ The percentage of adults reporting ever having a stroke was higher in older age groups (Figure 5.1.3).
- ▶ Approximately one-in-ten Oregonians aged 75 years or older reported ever having a stroke, compared to less than 1% of adults aged 18–44 years (Figure 5.1.3).

FIGURE 5.1.4 ADULTS WHO HAD EVER HAD A STROKE, BY EDUCATION, OREGON, 2011

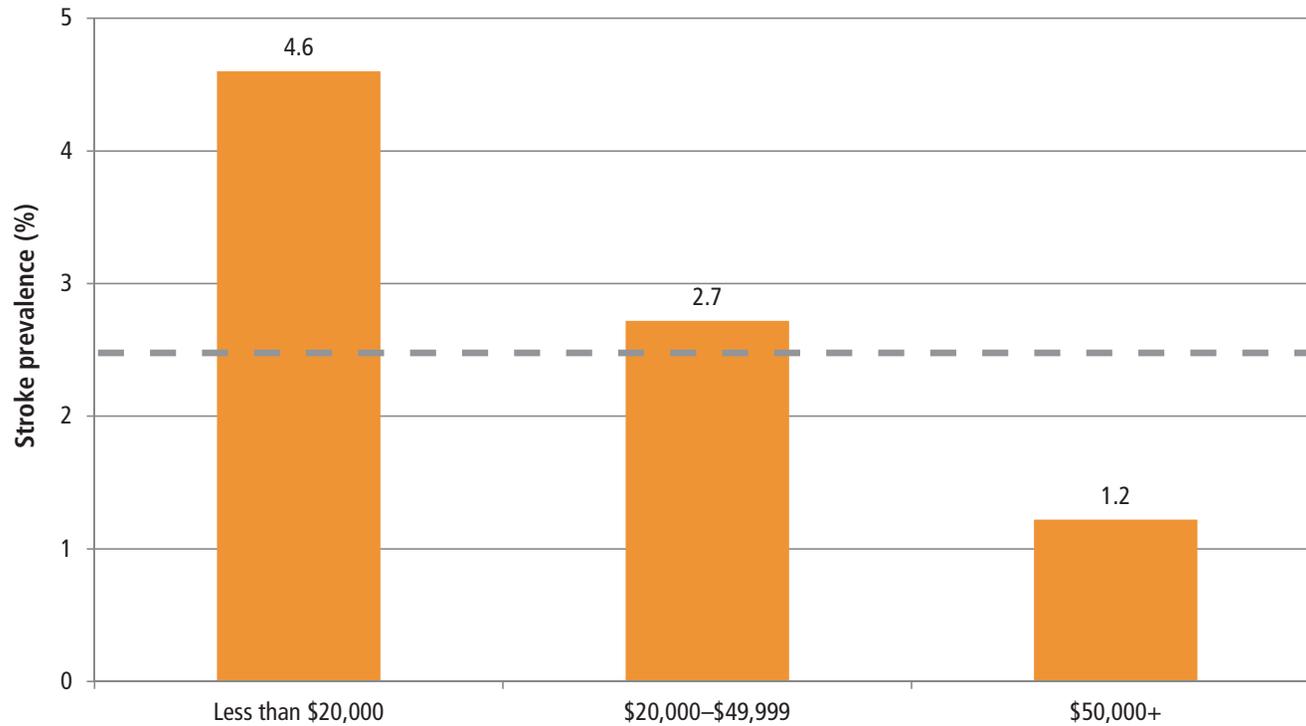


**Data sources:** Oregon Behavioral Risk Factor Surveillance System.

**Notes:** The horizontal line represents the percentage of the general population in Oregon that reported ever having a stroke (2.5%). Estimates are age-adjusted.

- ▶ Oregon adults with less than a high school education were three times more likely to report ever having a stroke compared to Oregon adults with a college degree (Figure 5.1.4).
- ▶ This reflects similar national data from 2010, where adults with less than a high school education were nearly three times as likely to report stroke compared to those with a college degree.<sup>5</sup> This was true even though the method for adjusting the national data in 2010 was different than the method used to adjust Oregon-specific data in 2011.

FIGURE 5.1.5 ADULTS WHO HAD EVER HAD A STROKE, BY ANNUAL HOUSEHOLD INCOME, OREGON, 2011

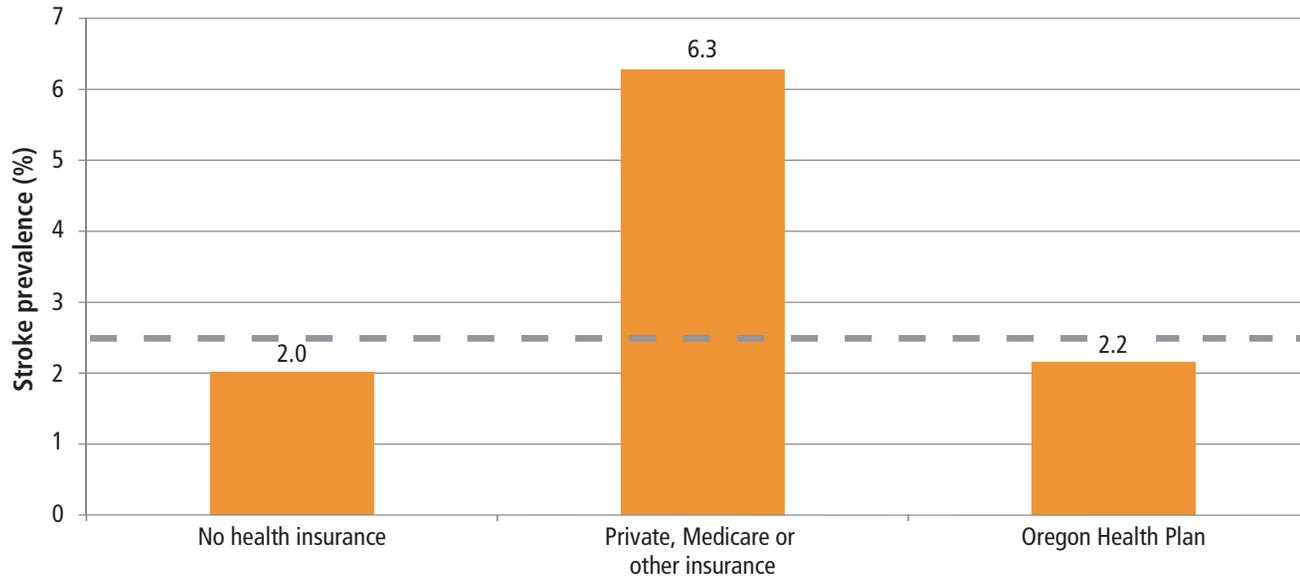


**Data sources:** Oregon Behavioral Risk Factor Surveillance System.

**Notes:** The horizontal line represents the percentage of the general population in Oregon that reported ever having a stroke (2.5%). Estimates are age-adjusted.

- ▶ Oregon adults in households with an annual income of less than \$20,000 were nearly four times more likely to report ever having a stroke compared to Oregon adults in households with an annual income of \$50,000 or more (Figure 5.1.5).

FIGURE 5.1.6 ADULTS WHO HAD EVER HAD A STROKE, BY CURRENT TYPE OF HEALTH INSURANCE STATUS, OREGON, 2011

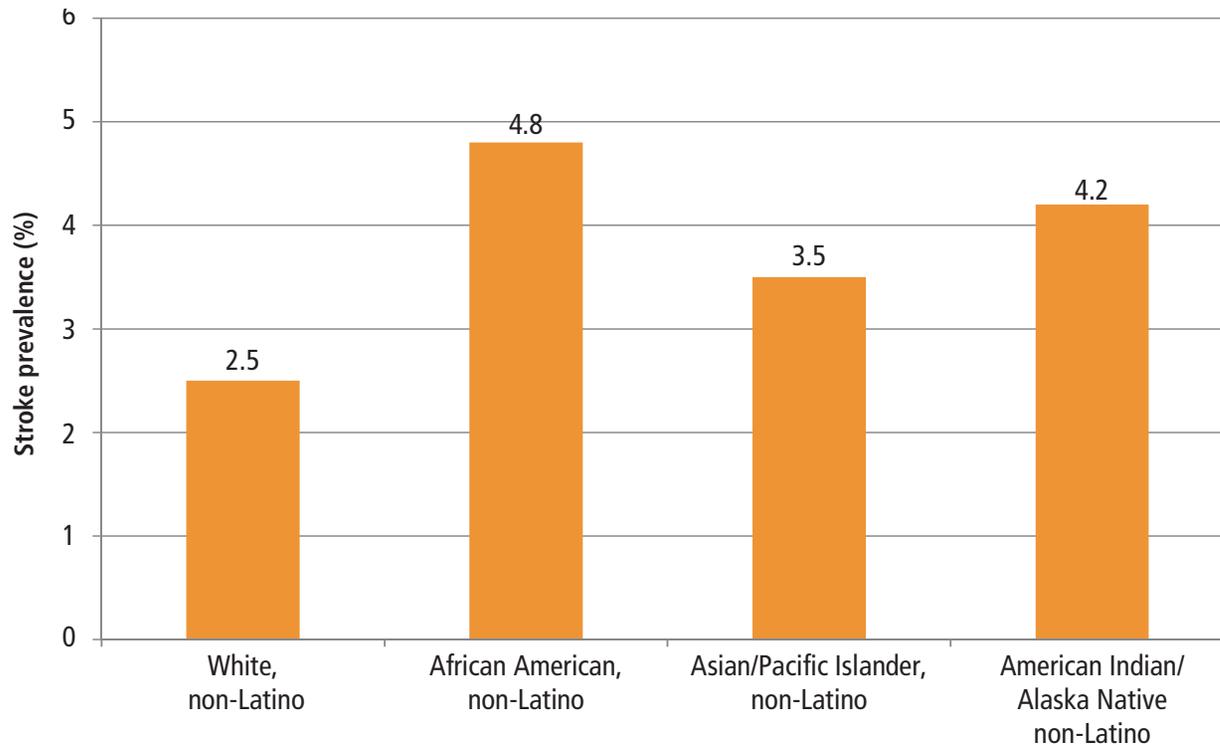


**Data sources:** Oregon Behavioral Risk Factor Surveillance System.

**Notes:** The horizontal line represents the percentage of the general population in Oregon that reported ever having a stroke (2.5%). Estimates are age-adjusted.

- ▶ Oregon Health Plan (OHP) members were nearly three times more likely to report ever having a stroke compared to individuals with no health insurance or those enrolled in private, Medicare or other health insurance plans (Figure 5.1.6).
- ▶ Those with no health insurance may have a lower prevalence of stroke due to inadequate access to health care. Access to care and contact with a health care provider are required to receive a diagnosis of stroke. In addition, those with no health insurance are generally younger and healthier and therefore are less likely to have chronic health conditions.
- ▶ The higher prevalence of stroke observed among the adult population enrolled in OHP may be due to the demographic composition of this vulnerable population. Adult OHP members are low-income and include pregnant women, seniors and people with disabilities. Adult OHP members are more than twice as likely to smoke cigarettes as people with any other type of health insurance.<sup>7</sup> Smoking is an important risk factor for stroke. OHP is intended to help ensure that medical care is affordable for those with a low income.<sup>8</sup> People with lower incomes are more likely to live in substandard housing, smoke cigarettes and have higher disease morbidity.<sup>9</sup>

FIGURE 5.1.7 ADULTS WHO HAD EVER HAD A STROKE, BY RACE AND ETHNICITY, OREGON, 2010–2011



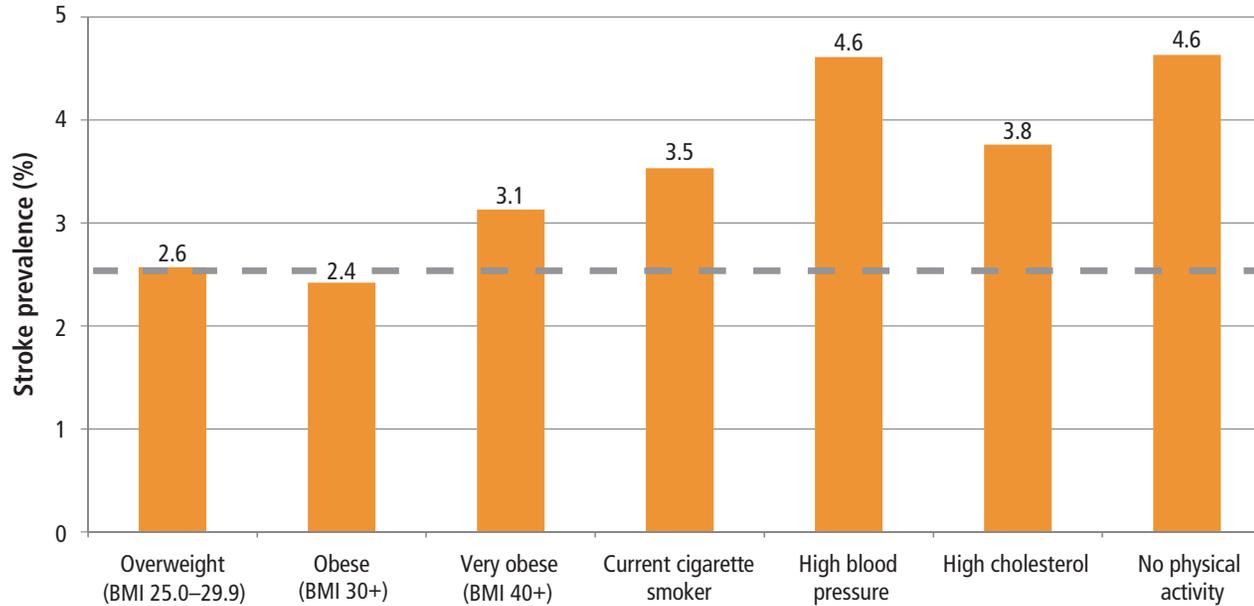
**Data source:** Oregon Behavioral Risk Factor Surveillance System Race Oversample, 2010–2011.

**Notes:** Estimates are age-adjusted. The stroke prevalence estimate for Latino ethnicity has been suppressed because it is statistically unreliable.

\*This number may be statistically unreliable and should be interpreted with caution.

- ▶ A higher percentage of non-Latino African American (4.8%) and non-Latino American Indian/Alaska Native (4.2%) persons reported ever having a stroke compared to other racial and ethnic groups (Figure 5.1.7).
- ▶ Non-Latino African Americans (3.9%) and non-Latino American Indians/Alaska Natives (5.9%) also had the highest prevalence of stroke nationally.<sup>1</sup>
- ▶ The percentage of non-Latino African American persons who reported having a stroke was nearly double that of non-Latino white persons (Figure 5.1.7).
- ▶ Non-Latino African American persons' risk of having a first stroke was also nearly double that of non-Latino white persons at the national level.<sup>1</sup>

FIGURE 5.1.8 ADULTS WHO HAD EVER HAD A STROKE, BY SELECTED STROKE RISK FACTORS, OREGON, 2011



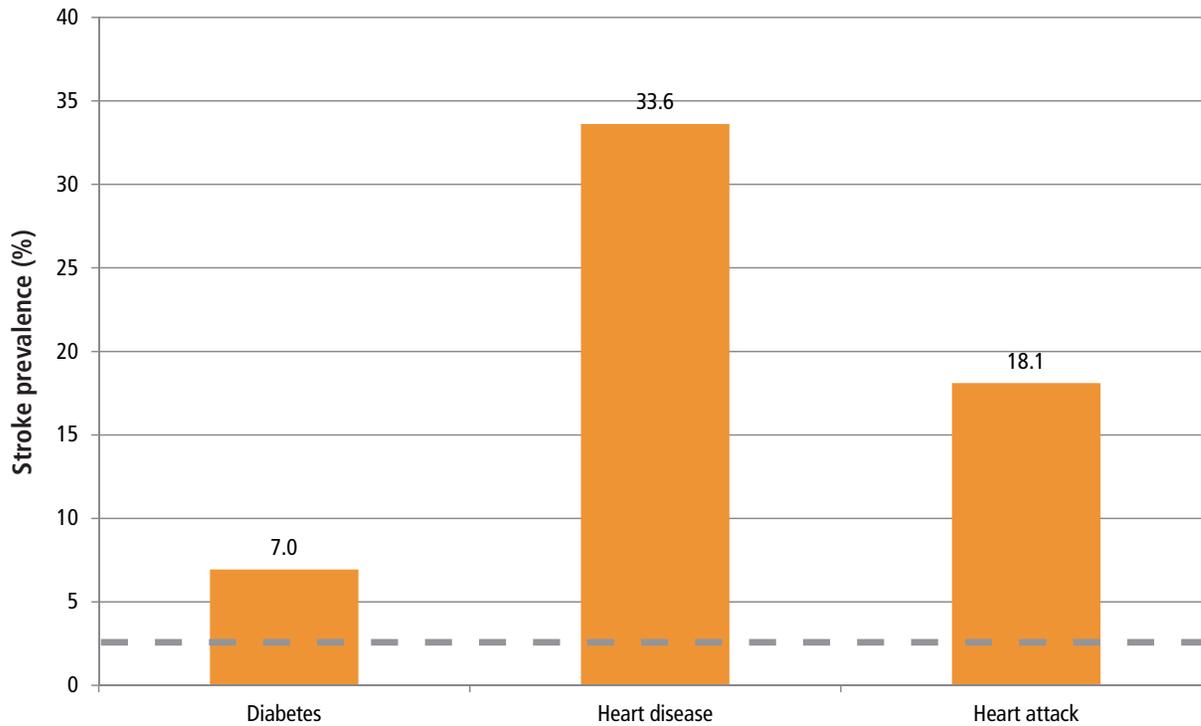
**Data source:** Oregon Behavioral Risk Factor Surveillance System

**Notes:** The horizontal line represents the percentage of the general population in Oregon that reported a stroke (2.5%). Estimates are age-adjusted.

- ▶ Adult Oregonians who were either current cigarette smokers or who had high blood pressure or high cholesterol reported ever having a stroke more often than the general population of Oregon adults (Figure 5.1.8).
- ▶ Although Oregonians who were overweight or obese had similar prevalence of stroke compared to the general population, those who were very obese\* reported having a stroke more often than the general Oregon adult population (Figure 5.1.8).
- ▶ The percentage of Oregon adults who had a stroke was 40% higher among cigarette smokers compared to the general population (Figure 5.1.8).
- ▶ Oregon adults with high blood pressure were nearly twice as likely as the general adult population to report ever having a stroke (Figure 5.1.8).
- ▶ The percentage of Oregon adults who had ever had a stroke was 52% higher among those with high cholesterol compared to the general population (Figure 5.1.8).

\*To determine adult overweight and obesity ranges, self-reported weight and height are used to calculate body mass index (BMI). For most people, BMI correlates with the amount of body fat a person has, although it is not a direct measure of body fat. An adult who has a BMI between 25 and 29.9 is considered overweight, 30 to 39.9 is considered obese, and 40.0 and above is considered very obese.

FIGURE 5.1.9 ADULTS WHO HAD EVER HAD A STROKE, BY SELECTED CHRONIC DISEASES, OREGON, 2011

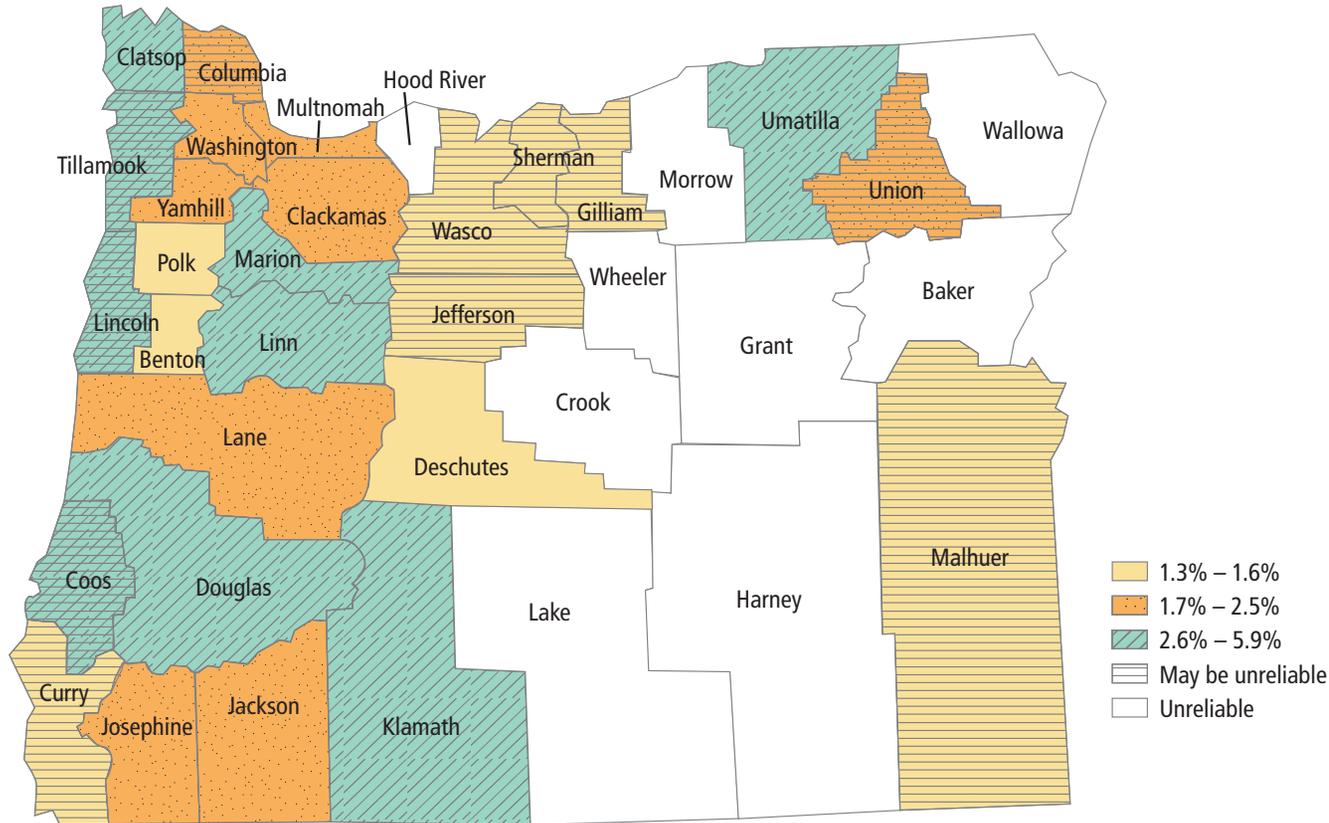


**Data source:** Oregon Behavioral Risk Factor Surveillance System

**Note:** The horizontal line represents the percentage of Oregon's general population who reported a stroke (2.5%). Estimates are age-adjusted.

- ▶ Oregon adults with diabetes reported a history of stroke at nearly three times the rate of adults in the general population (Figure 5.1.9).
- ▶ History of stroke was especially common among Oregonians who reported ever having a heart attack or having heart disease. Oregon adults who have ever had a heart attack reported having a history of stroke more than seven times as often as the general population of adults (Figure 5.1.9).
- ▶ The percentage of Oregonians with heart disease who also reported a history of stroke was more than 13 times greater than the percentage of the general adult population who reported a history of stroke (Figure 5.1.9).

**FIGURE 5.1.10 ADULTS WHO HAD EVER HAD A STROKE, BY COUNTY, OREGON, 2008–2011**

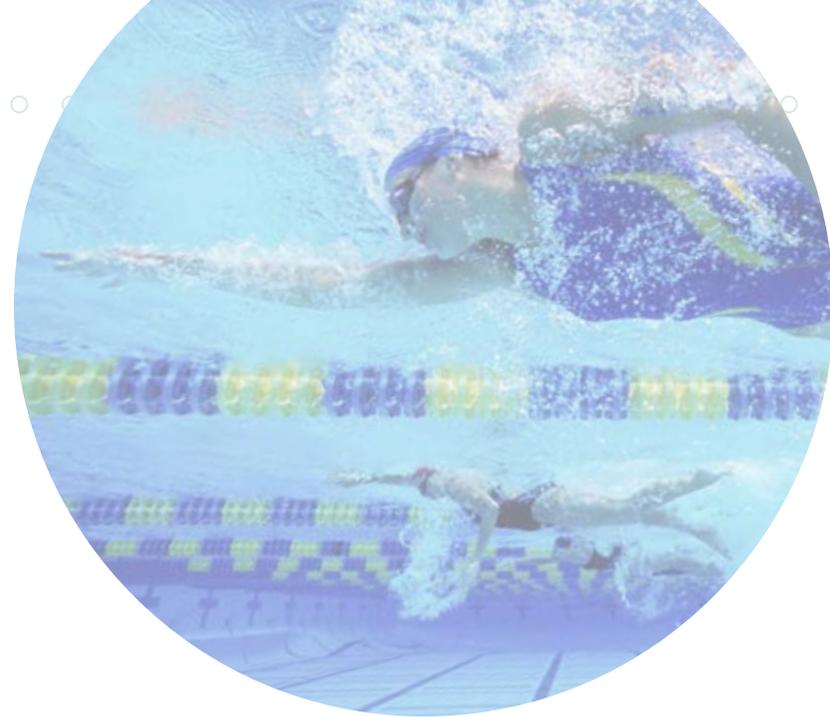


**Data source:** Oregon Behavioral Risk Factor Surveillance System county combined file  
**Note:** Estimates are age-adjusted. The state stroke prevalence for 2008–2011 was 2.3%.

- ▶ During 2008–2011, the prevalence of diagnosed stroke among Oregon counties ranged from 1.3% to 5.9%.
- ▶ Benton, Deschutes, Multnomah and Polk counties had significantly lower percentages of adults with a history of stroke compared to the rest of the state.
- ▶ See Appendix A for detailed county estimates of stroke prevalence.

## Conclusions

The percentage of Oregon adults with a history of stroke has remained relatively consistent over time. Although there does not appear to be a difference in having a history of stroke by gender, many other vulnerable groups of Oregonians are disproportionately affected by stroke. These groups include older Oregonians, those with less education and a smaller annual household income, those enrolled in OHP, African American persons, and American Indian and Alaska Native persons. Oregon adults with chronic disease risk factors and other chronic conditions were also more likely to report having a history of stroke than the general population. Most notably, adults with high blood pressure were twice as likely as the general population to report having a history of stroke and adults with angina or coronary heart disease were 13 times more likely to report a history of stroke.

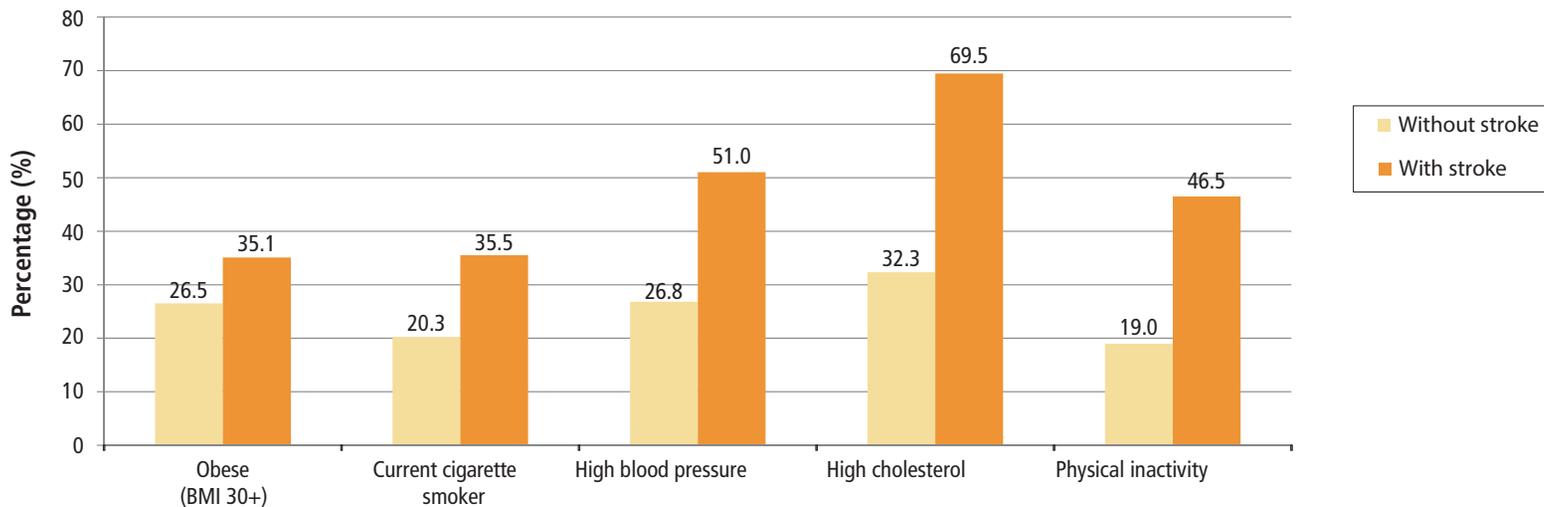


## 5.2 Risk factors among the stroke population

Many Oregon adults who report ever having a stroke are affected by risk factors such as high blood pressure, high cholesterol, obesity and cigarette smoking that can lead to the development of additional chronic diseases and increase the chance for another stroke. Understanding the disproportionate burden of chronic disease risk factors and other chronic diseases among the stroke population will inform the prevention and treatment of stroke. This section will describe the burden of chronic disease risk factors and behaviors and other chronic conditions among Oregon adults who have reported having a stroke.

- ▶ Oregon adults who had had a stroke were 32% more likely to be obese, 75% more likely to smoke, and more than twice as likely to get no physical activity outside of work compared to those who had not had a stroke (Figure 5.2.1).
- ▶ A little more than half of adults who had ever had a stroke also reported a diagnosis of high blood pressure; adults who had ever had a stroke were nearly twice as likely to report high blood pressure compared to adults who had not had a stroke (Figure 5.2.1).
- ▶ More than two out of three adults who had ever had a stroke also reported high cholesterol; adults who had had a stroke were more than twice as likely to report high cholesterol compared to adults who had not had a stroke (Figure 5.2.1).

**FIGURE 5.2.1 SELECTED CHRONIC DISEASE RISK FACTORS AMONG ADULTS WHO HAD EVER HAD A STROKE, OREGON, 2011**



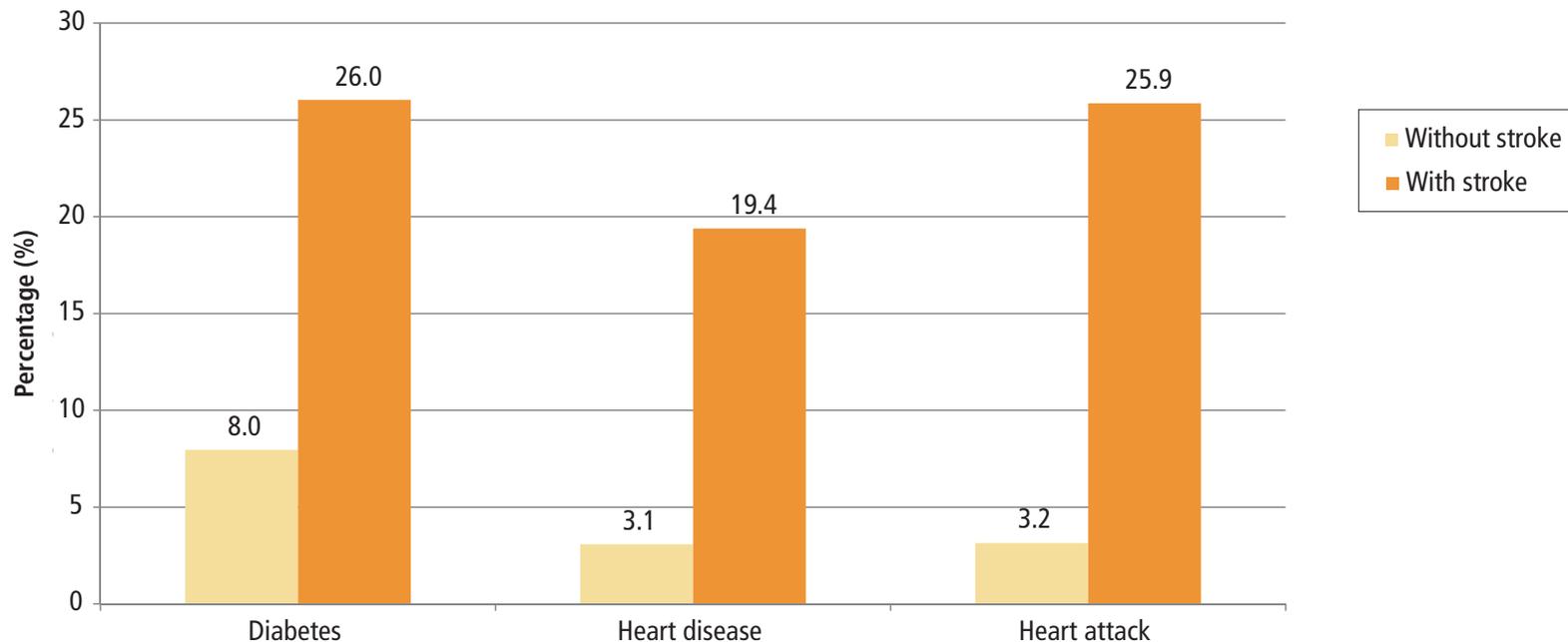
**Data source:** Oregon Behavioral Risk Factor Surveillance System

**Note:** Estimates are age-adjusted.

- ▶ More than one-quarter of Oregon adults who had ever had a stroke had also been diagnosed with diabetes; adults who had ever had a stroke were more than three times as likely to also have diabetes compared to adults who had not had a stroke (Figure 5.2.2).
- ▶ Nearly one-in-five adults who had ever had a stroke had also been diagnosed with heart disease; adults who had ever had a stroke were more than six times more likely to have heart disease compared to adults who had not had a stroke (Figure 5.2.2).

- ▶ More than one-quarter of adults who had ever had a stroke also reported having had a heart attack; adults who had ever had a stroke were eight times more likely to report having had a heart attack compared to adults who had not had a stroke (Figure 5.2.2).

**FIGURE 5.2.2 SELECTED CHRONIC DISEASES AMONG ADULTS WHO HAD EVER HAD A STROKE, OREGON, 2011**



**Data source:** Oregon Behavioral Risk Factor Surveillance System  
**Note:** Estimates are age-adjusted.

## Conclusions

Overall, Oregon adults who reported having had a stroke also reported chronic disease risk factors and other chronic conditions at a higher rate than those who had not had a stroke. A higher proportion of adults who had ever had a stroke was obese, smoked cigarettes, had high blood pressure and high cholesterol and a lack of physical activity compared to adults who had not had a stroke. Most notably, adults who had ever had a stroke were approximately two times more likely to report high cholesterol and high blood pressure than adults who had not had a stroke. High blood pressure and high cholesterol, along with smoking and lack of physical activity, are key contributors to having a first stroke and increase the likelihood of having another stroke if not properly controlled.



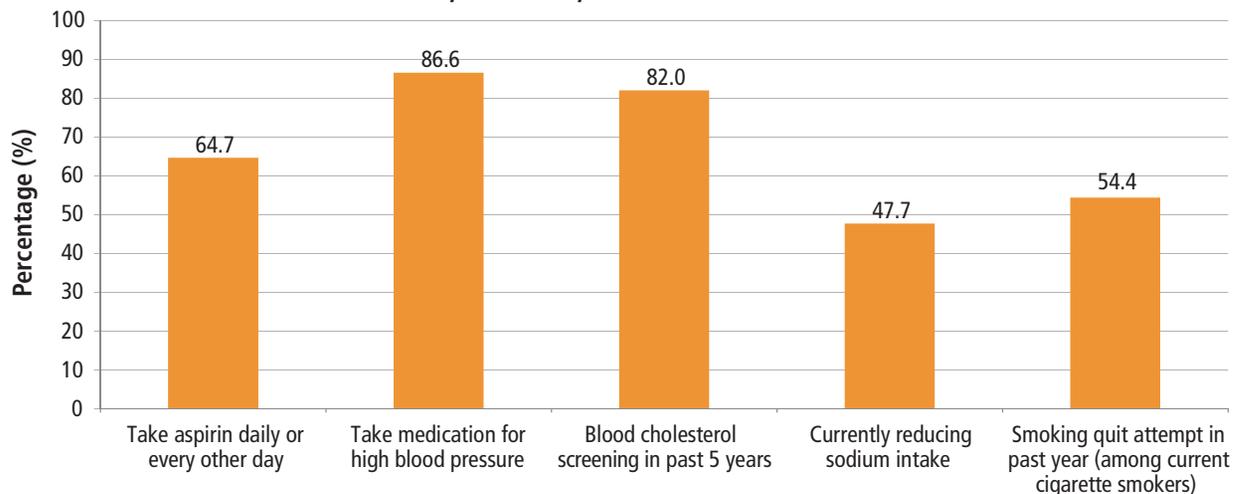
## 5.3 Prevention and management of stroke

Stroke can be prevented and managed by living a healthy lifestyle and managing other chronic diseases. A healthy lifestyle includes eating a diet high in fruits and vegetables and low in salt and trans fats, being active, maintaining a healthy weight, and not smoking cigarettes. Individuals with high cholesterol, high blood pressure, diabetes or heart disease can lower risk for stroke or prevent another stroke from occurring by having their cholesterol checked, monitoring blood pressure, managing diabetes and taking medicine prescribed by a health care provider. Many stroke survivors may also require rehabilitation that often involves physical

therapy to help relearn skills such as eating and bathing, which may have been lost because of the stroke. Oregon is committed to preventing stroke by addressing the ABCS of stroke prevention — appropriate **A**spirin therapy, **B**lood pressure control, **C**holesterol control, **S**moking cessation and reduced **S**odium consumption. This section will describe the proportion of Oregon adults who had ever had a stroke who practice behaviors that help prevent future strokes.

- ▶ More than four out of five Oregon adults who had ever had a stroke had had a cholesterol screening in the past five years (82%) and nearly two-in-three took aspirin daily or every other day (Figure 5.3.1).
- ▶ A little less than half (47.7%) of adults who had ever had a stroke were currently reducing their sodium

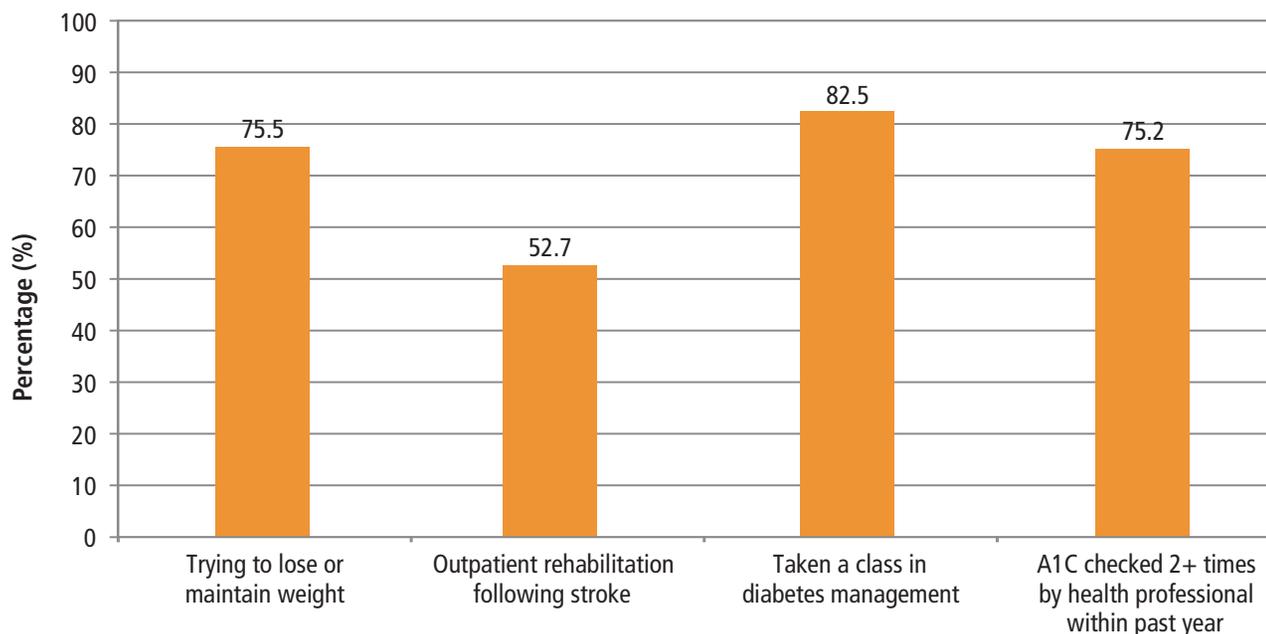
**FIGURE 5.3.1 SELECTED STROKE PREVENTION AND MANAGEMENT BEHAVIORS AMONG ADULTS WHO HAD EVER HAD A STROKE, OREGON, 2011**



**Data source:** Oregon Behavioral Risk Factor Surveillance System

**Note:** Estimates are age-adjusted.

**FIGURE 5.3.2 SELECTED STROKE PREVENTION AND MANAGEMENT BEHAVIORS AMONG ADULTS WHO HAD EVER HAD A STROKE, OREGON, 2011**



**Data source:** Oregon Behavioral Risk Factor Surveillance System  
**Note:** Estimates are age-adjusted.

intake (Figure 5.3.1); this percentage increased to 59.7% if the stroke survivor had also been diagnosed with high blood pressure.

- ▶ Among adults who had ever had a stroke and a diagnosis of high blood pressure, 59.6% were taking medication for high blood pressure (Figure 5.3.1); however, this does not imply that high blood pressure was under control.
- ▶ Among adults who had ever had a stroke who were current cigarette smokers, 54.4% had attempted to quit smoking within the past year (Figure 5.3.1).

- ▶ Three-in-four Oregon adults who had ever had a stroke were trying to lose or maintain weight.
- ▶ A little more than half (52.7%) received outpatient rehabilitation following the stroke (Figure 5.3.2).
- ▶ Among adults who had ever had a stroke and a diagnosis of diabetes, 56.8% had taken a class on diabetes management and 51.8% had had their A1C checked two or more times by a health professional within the past year (Figure 5.3.2). These are both recommended diabetes management practices.

## Conclusions

Encouragingly, many Oregon adults who reported having had a stroke are taking steps to prevent a future stroke. A majority of stroke survivors met recommendations for cholesterol screening including taking doctor-prescribed medication for high blood pressure, taking an aspirin daily or every other day, and making attempts to quit smoking if they were current cigarette smokers. In addition, the majority of adults who had ever had a stroke were trying to lose or maintain weight and had taken a class in diabetes self-management if they also had diabetes. However, there is room for improvement. Less than half of adults who had ever had a stroke were trying to reduce their sodium intake, which can lower high blood pressure, and 46% of adults who had ever had a stroke who smoke cigarettes did not make an attempt to quit smoking.



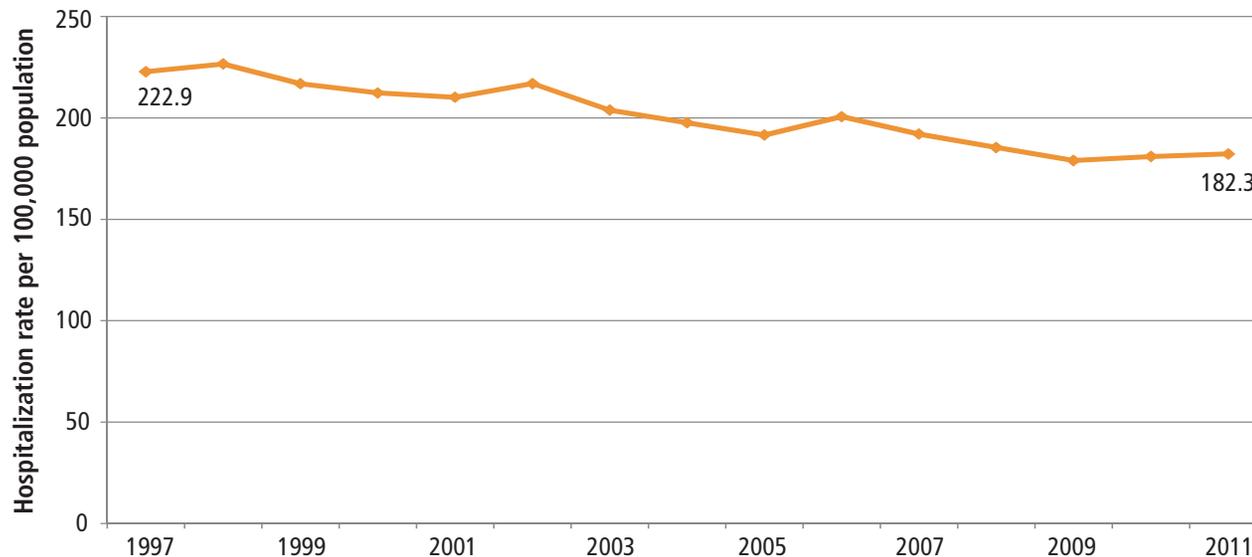
## 5.4 Stroke hospitalizations

Stroke is a leading cause of disability and among the top five reasons for emergency department (ED) visits in the United States.<sup>10</sup> Like ED visits, hospitalizations for stroke are an important measure to track acute stroke events. Nationally, there were more than one million hospital discharges for stroke in 2010, which is a stroke hospitalization rate of 33.0 per 10,000 U.S. residents.<sup>11</sup> The average length of stay for a person hospitalized with stroke was 6.1 days.<sup>11</sup> Among Oregon residents, 7,762 were hospitalized with

a primary diagnosis of stroke in 2011, and another 10,555 individuals were hospitalized with stroke as a non-primary diagnosis or contributing cause. Stroke accounted for 2% of all hospitalizations in Oregon in 2011. The average length of stay for a person hospitalized with stroke was 4.2 days. This section will describe stroke-related hospitalizations in Oregon over time and by select patient characteristics including gender, age and comorbid heart disease or diabetes.

- ▶ The overall rate of stroke hospitalizations in Oregon decreased since 1997, with year-to-year variation in the numbers (Figure 5.4.1 and Table 5.4.1).

**FIGURE 5.4.1 NUMBER OF STROKE HOSPITAL DISCHARGES PER 100,000 PEOPLE, BY YEAR, OREGON, 1997–2011**



**Data source:** Oregon Hospital Discharge Database

**Note:** ICD-9 codes 430–434 and 436–438.

**TABLE 5.4.1 NUMBER OF STROKE HOSPITAL DISCHARGES PER 100,000 PEOPLE, BY YEAR, OREGON, 1997–2011**

<b>YEAR</b>	<b>STROKE HOSPITALIZATION RATE</b>
<b>1997</b>	222.9
<b>1998</b>	226.7
<b>1999</b>	216.9
<b>2000</b>	212.3
<b>2001</b>	210.2
<b>2002</b>	217.0
<b>2003</b>	203.8
<b>2004</b>	197.6
<b>2005</b>	191.6
<b>2006</b>	200.7
<b>2007</b>	192.1
<b>2008</b>	185.5
<b>2009</b>	179.0
<b>2010</b>	181.0
<b>2011</b>	182.3

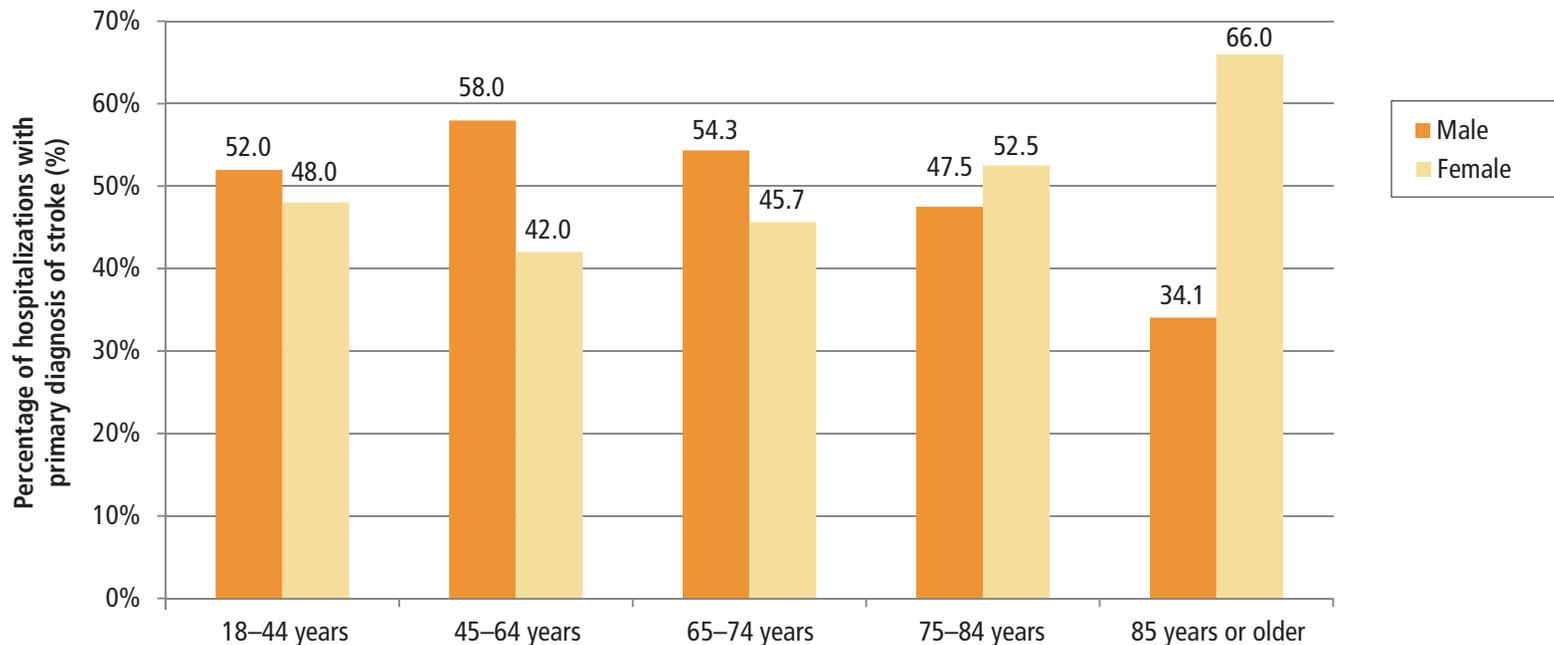
**Data source:** Oregon Hospital Discharge Database

**Note:** ICD-9 codes 430–434 and 436–438.

- ▶ From 1997 to 2011, the stroke hospitalization rate decreased by 18.2%.
- ▶ Nationally, the stroke hospitalization rate decreased by 8.9% from 1999 to 2009.<sup>12</sup>

- ▶ The distribution of stroke hospital discharges between men and women varies substantially by age group.
- ▶ In 2011, in all age groups before the age of 75 years, men accounted for a higher proportion of stroke hospital discharges, whereas women comprised the majority of hospital discharges in the 75–84 year age group (52.5%) and in the 85 years or older age group (66%) (Figure 5.4.2).
- ▶ This pattern has also been observed in national hospital discharge data where women constituted 66.2% of stroke hospital discharges in the 85 years or older age group in 2010. This has been attributed to the longer lifespan of women compared to men.<sup>13</sup>

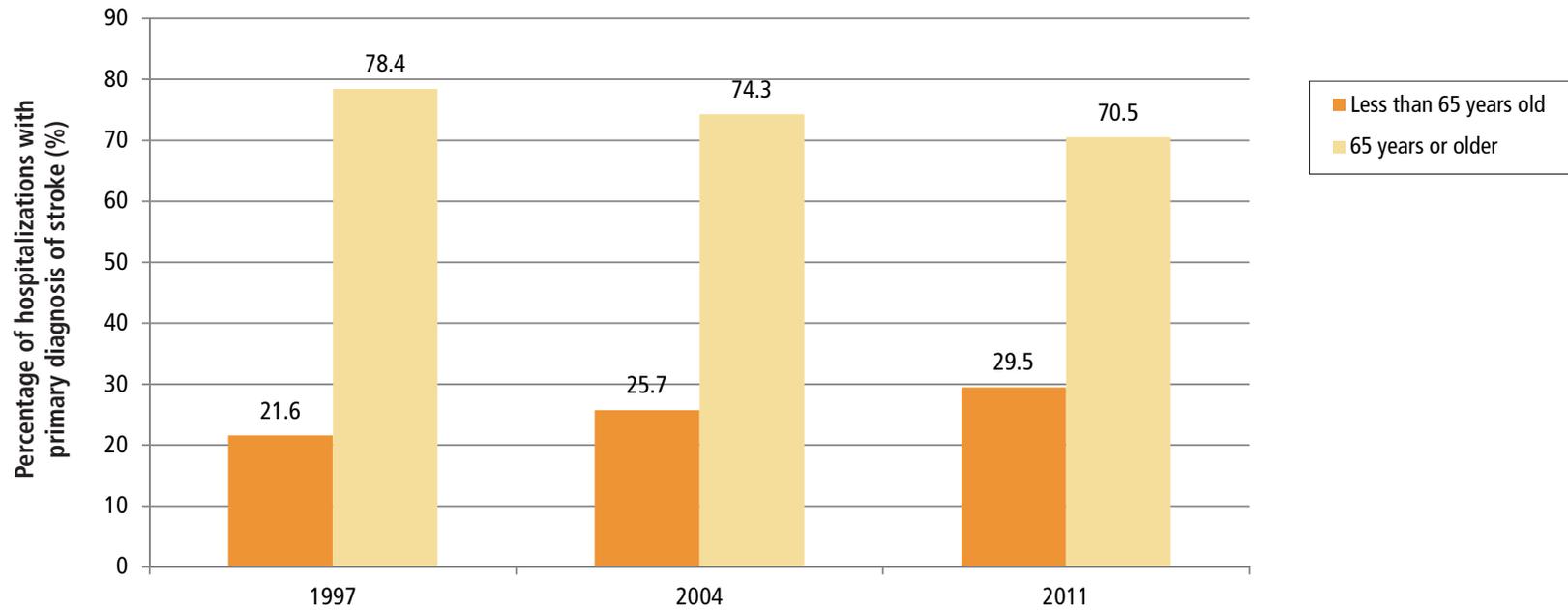
**FIGURE 5.4.2 PERCENTAGE OF TOTAL STROKE HOSPITAL DISCHARGES WITHIN AGE GROUPS, BY GENDER, OREGON, 2011**



**Data source:** Oregon Hospital Discharge Database

**Note:** ICD-9 codes 430–434 and 436–438.

FIGURE 5.4.3 PERCENTAGE OF TOTAL HOSPITALIZATIONS WITH A PRIMARY DIAGNOSIS OF STROKE, BY AGE GROUP OVER TIME, OREGON, 1997–2011

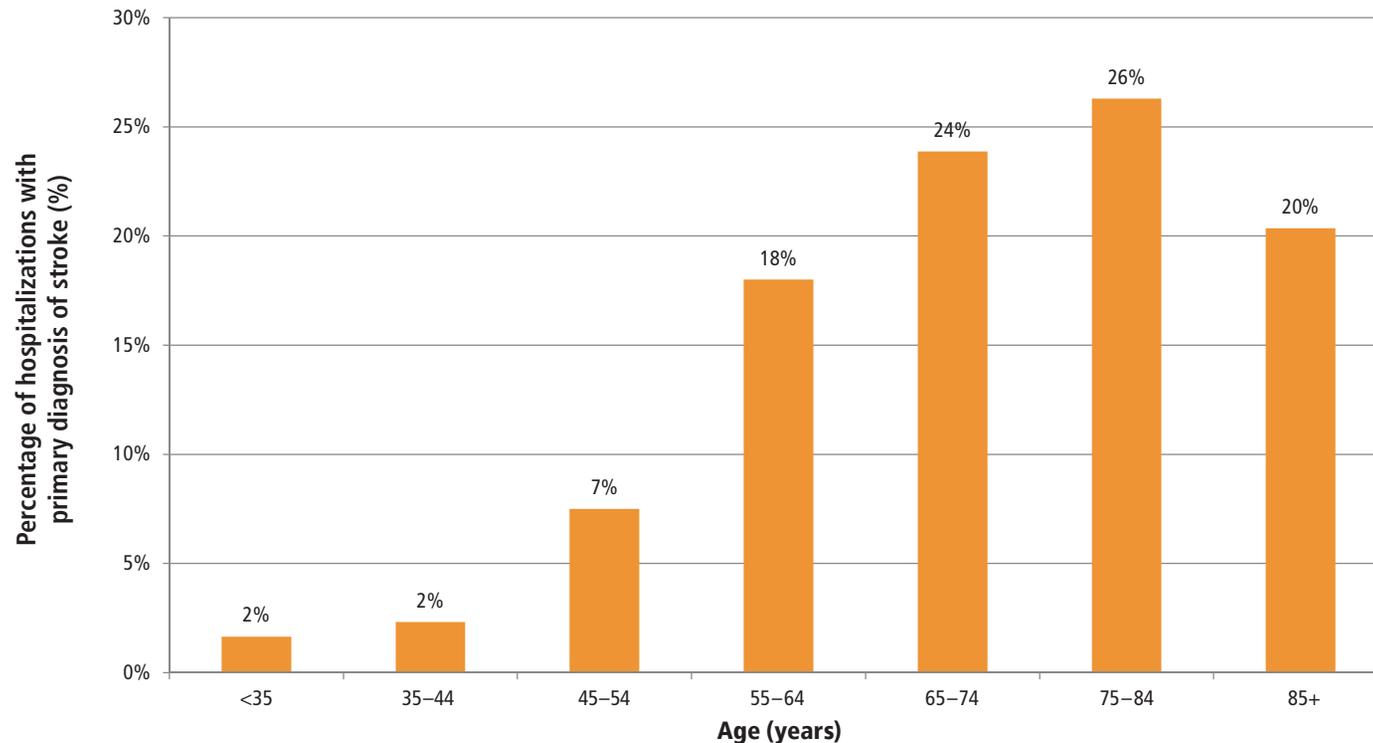


**Data source:** Oregon Hospital Discharge Database

**Note:** ICD-9 codes 430–434 and 436–438.

- ▶ From 1997 to 2011, the proportion of hospitalizations with a primary diagnosis of stroke decreased 10% (Figure 5.4.3).
- ▶ Over time, the average age of hospital inpatients with a primary diagnosis of stroke has remained constant; the average age in 1997 was 73 years, 72 years in 2004 and 72 years in 2011.
- ▶ The proportion of total stroke hospitalizations comprised of those less than 65 years old increased by 37% from 1997 to 2011 (Figure 5.4.3).

FIGURE 5.4.4 PERCENTAGE OF TOTAL HOSPITALIZATIONS WITH A PRIMARY DIAGNOSIS OF STROKE, BY AGE GROUP, OREGON, 2011

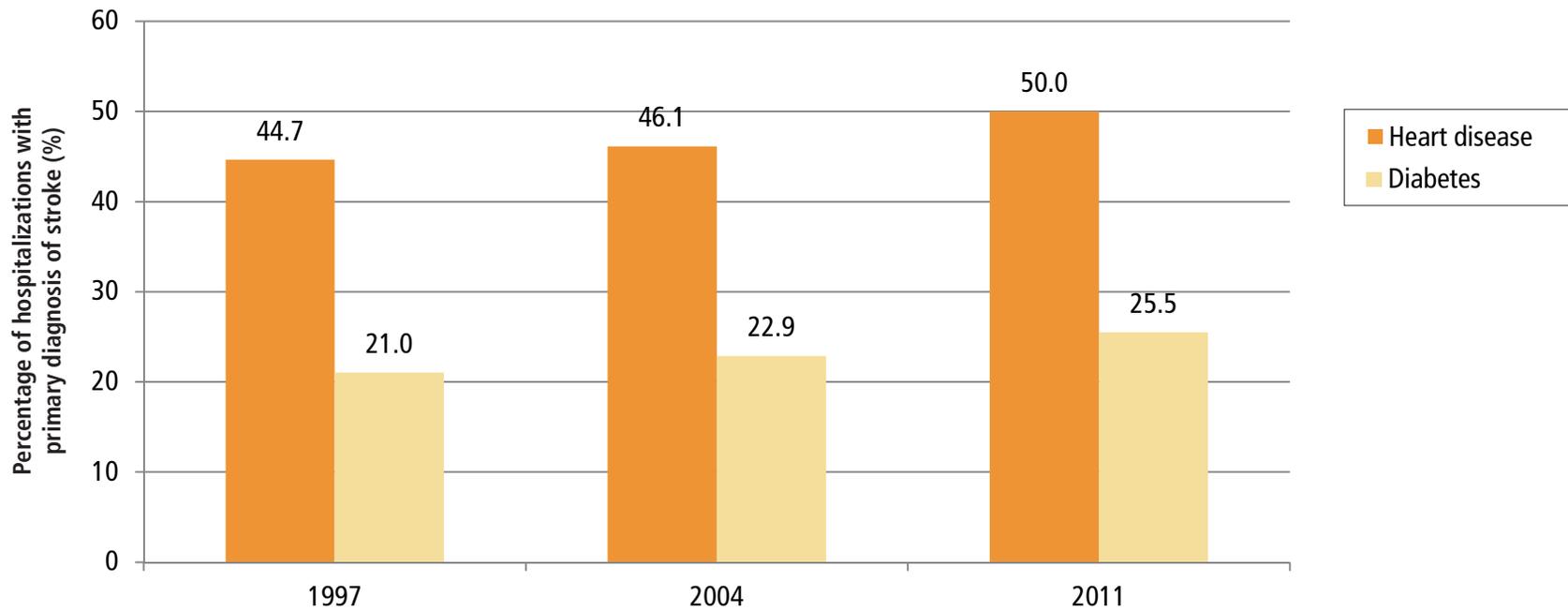


**Data source:** Oregon Hospital Discharge Database

**Note:** ICD-9 codes 430–434 and 436–438.

- ▶ In 2011, 70% of stroke hospitalizations occurred among people aged 65 years or older (Figure 5.4.4).
- ▶ The average age of a person hospitalized for stroke in 2011 was 72 years; this average age has been consistent over time.
- ▶ Although the majority of stroke hospitalizations occurred in older Oregonians over the age of 65, those under 65 years of age were still susceptible to stroke, accounting for nearly one-in-three stroke hospitalizations (Figure 5.4.4).
- ▶ This is similar to national hospital data from 2009, when 34% of people hospitalized for stroke were under the age of 65.<sup>12</sup>

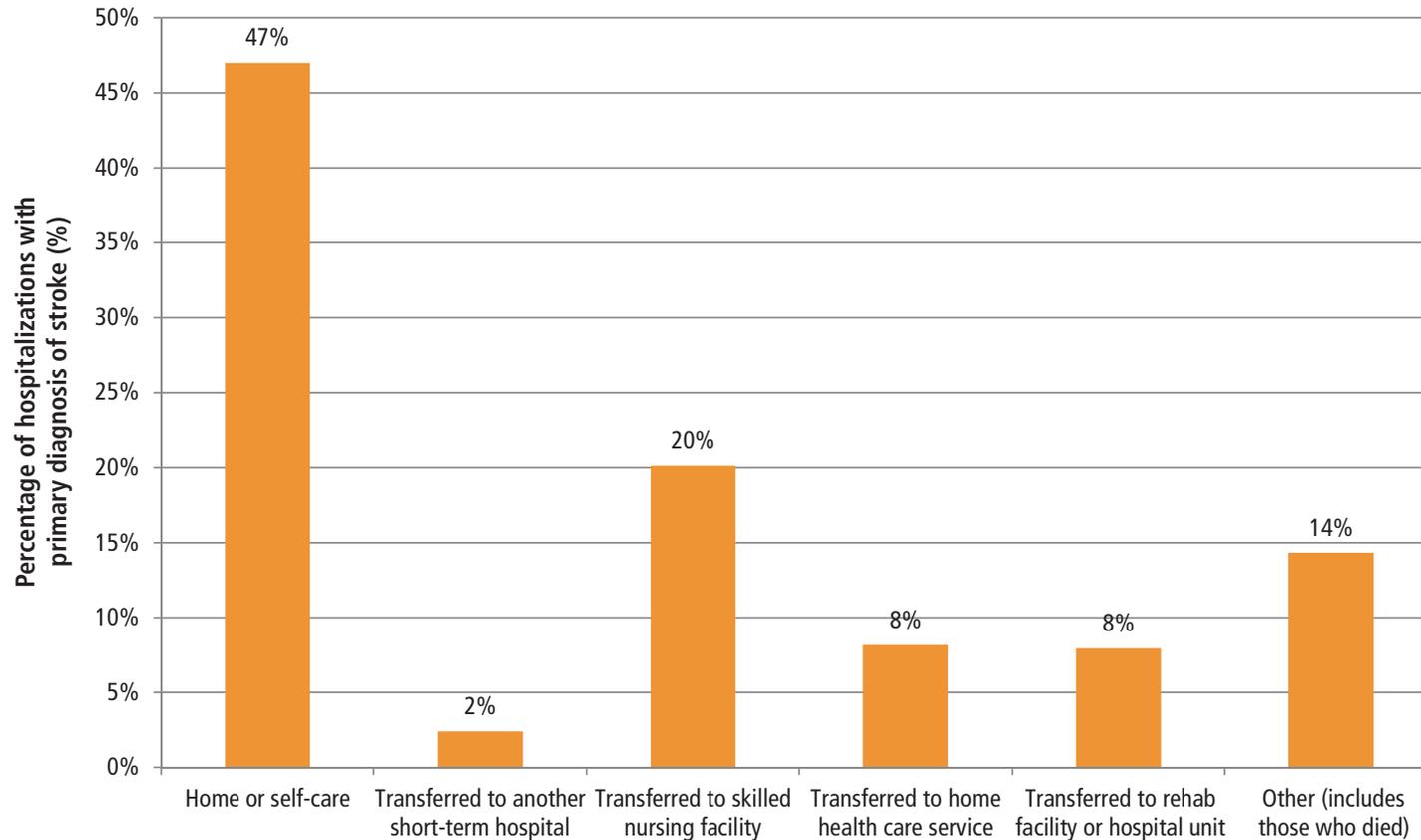
**FIGURE 5.4.5 PRIMARY STROKE HOSPITALIZATIONS WITH SECONDARY DIAGNOSIS OF HEART DISEASE OR DIABETES OVER TIME, OREGON, 1997–2011**



**Data source:** Oregon Hospital Discharge Database  
**Note:** ICD-9 codes 430–434 and 436–438.

- ▶ Among those hospitalized with a primary diagnosis of stroke, one-quarter also had a secondary diagnosis of diabetes and half had a secondary diagnosis of coronary heart disease. These are both conditions that increase the risk of having a stroke (Figure 5.4.5).
- ▶ From 1997 to 2011, the proportion of hospitalizations due to stroke with a contributing cause of diabetes or heart disease increased by 12% and 21%, respectively (Figure 5.4.5).
- ▶ In addition to stroke hospitalization disparities across age and gender, national data on stroke hospitalizations have identified disparities among racial and ethnic groups.
- ▶ According to 2008 national data on stroke hospitalizations among Medicare beneficiaries, African American persons had a stroke hospitalization rate that was 27% higher than the general population, 30% higher than white persons, and 36% higher than Latino persons.<sup>13</sup>

FIGURE 5.4.6 DISCHARGE STATUS AMONG HOSPITALIZATIONS WITH A PRIMARY DIAGNOSIS OF STROKE, OREGON, 1997–2011



**Data source:** Oregon Hospital Discharge Database

**Note:** ICD-9 codes 430–434 and 436–438.

- ▶ In 2011, nearly half of stroke hospitalizations resulted in a discharge to home or self-care; one-in-five stroke hospitalizations resulted in transfer to a skilled nursing facility; and approximately 8% of those hospitalized for a stroke were discharged to a rehabilitation facility or hospital unit (Figure 5.4.6).



## Conclusions

The rate of stroke hospitalizations in both Oregon and the nation has steadily decreased over time. The majority of stroke hospitalizations occur among people aged 65 years or older, but those under the age of 65 years are susceptible to stroke and accounted for 30% of stroke hospitalizations in 2011. Although men account for a higher proportion of stroke hospitalizations overall, women comprise the majority of stroke hospitalizations in older age groups, particularly in the 85 years or older age group.



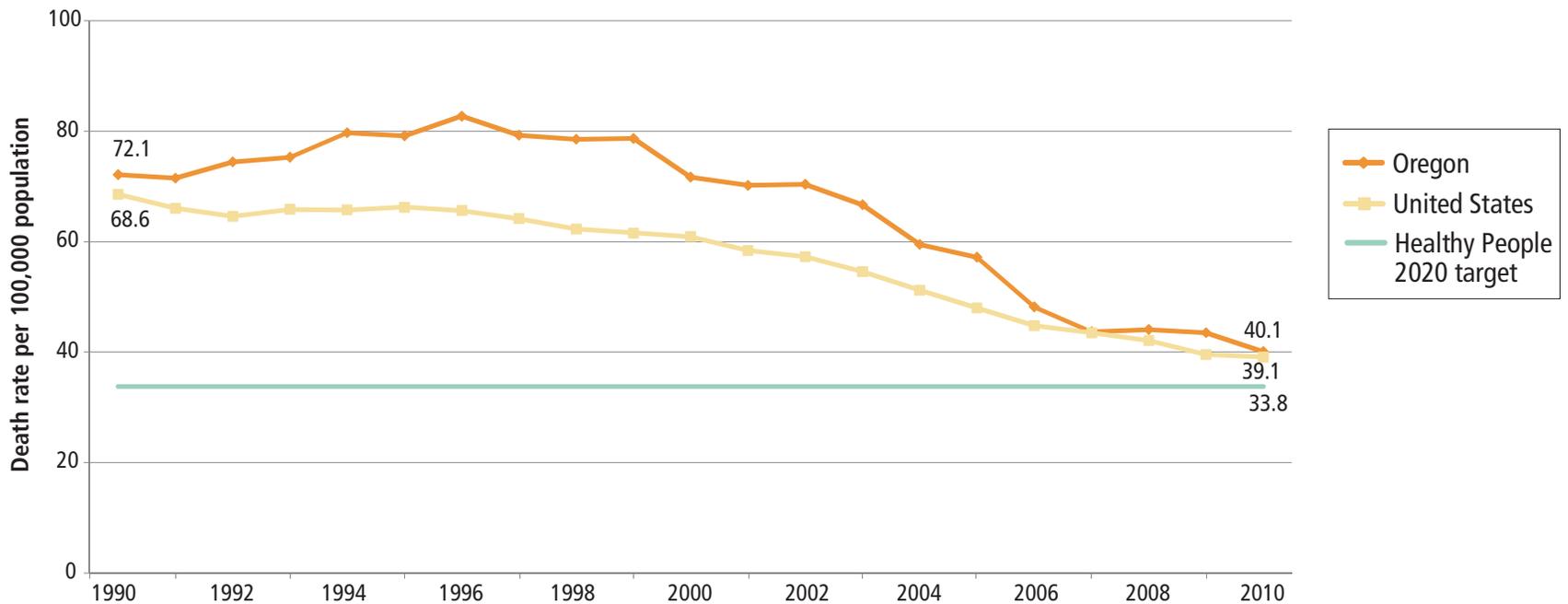
## 5.5 Stroke mortality

Stroke can be prevented by eating a healthy diet, maintaining a healthy weight, being physically active, not smoking, and preventing or managing high blood pressure, high cholesterol and diabetes. Unfortunately, stroke is the fourth leading cause of death in Oregon and nationally.<sup>13</sup> In 2009, stroke accounted for one of every 19 deaths in the United States, killing almost

130,000 Americans.<sup>14</sup> In 2011, stroke was the primary cause of death for 1,906 Oregonians, accounting for 6% of all deaths among Oregon residents. This section will describe deaths from stroke among the Oregon population.

- ▶ From 1990 to 2010, stroke death rates in Oregon were consistently higher than national rates. However, in recent years the difference between Oregon and the United States has lessened (Figure 5.5.1 and Table 5.5.1).

**FIGURE 5.5.1 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY YEAR, OREGON VS. UNITED STATES AND HEALTHY PEOPLE 2020 TARGET, 1990–2010**



**Data source:** Centers for Disease Control and Prevention (CDC) WONDER data system

**Note:** Estimates are age-adjusted. Death rates reflect stroke as the primary cause of death.



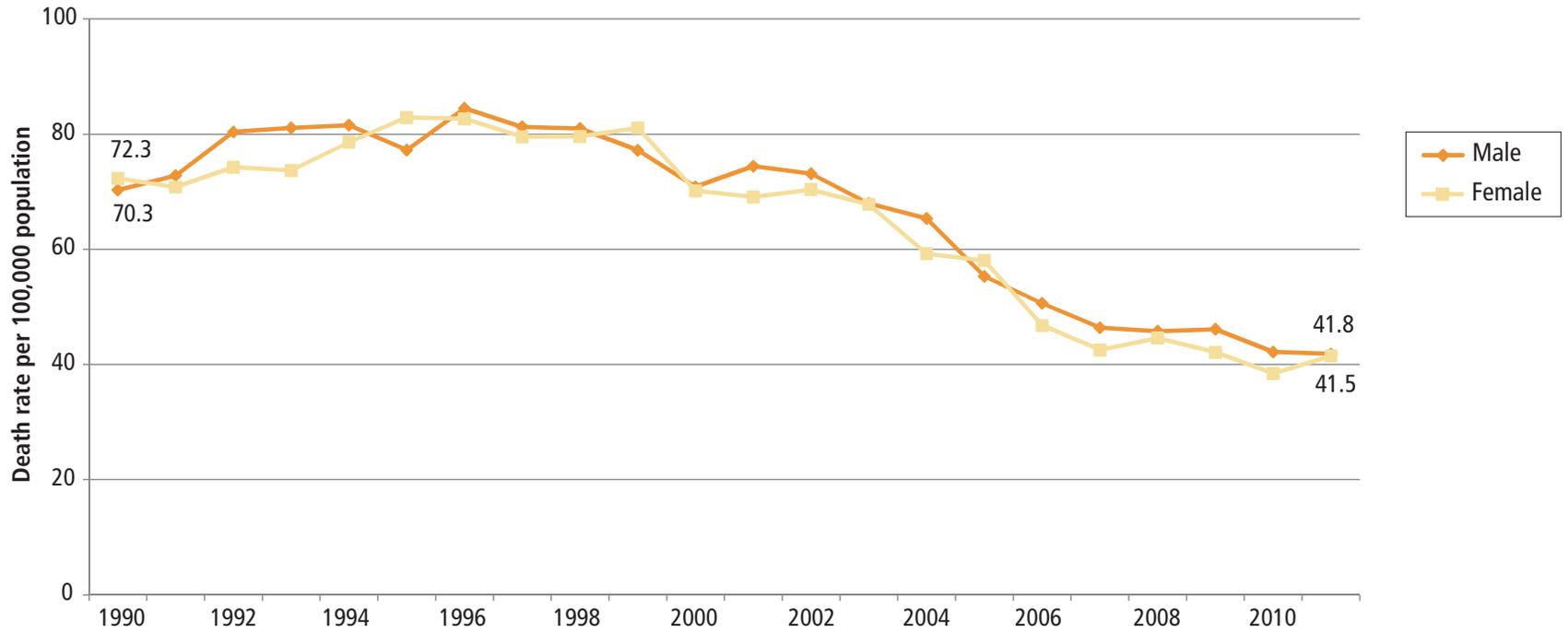
**TABLE 5.5.1 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY YEAR, OREGON VS. UNITED STATES, 1990–2010**

<b>YEAR</b>	<b>STROKE DEATH RATES — OREGON</b>	<b>STROKE DEATH RATES — UNITED STATES</b>
<b>1990</b>	72.1	68.6
<b>1991</b>	71.5	66.1
<b>1992</b>	74.5	64.6
<b>1993</b>	75.3	65.8
<b>1994</b>	79.7	65.7
<b>1995</b>	79.2	66.3
<b>1996</b>	82.8	65.6
<b>1997</b>	79.3	64.2
<b>1998</b>	78.6	62.3
<b>1999</b>	78.7	61.6
<b>2000</b>	71.7	60.9
<b>2001</b>	70.2	58.4
<b>2002</b>	70.4	57.3
<b>2003</b>	66.7	54.6
<b>2004</b>	59.5	51.2
<b>2005</b>	57.2	48.0
<b>2006</b>	48.2	44.8
<b>2007</b>	43.7	43.5
<b>2008</b>	44.1	42.1
<b>2009</b>	43.5	39.6
<b>2010</b>	40.1	39.1

- ▶ Since 1990, the death rate due to stroke in Oregon and nationally has decreased 44.4% and 43%, respectively.
- ▶ To achieve the Healthy People 2020 goal of 33.8 stroke deaths per 100,000 people, the stroke death rate in Oregon must be reduced by 16% (Figure 5.5.1).

**Data source:** Centers for Disease Control and Prevention (CDC) WONDER data system  
**Note:** Estimates are age-adjusted. Death rates reflect stroke as the primary cause of death.

**FIGURE 5.5.2 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY GENDER AND YEAR, OREGON, 1990–2011**

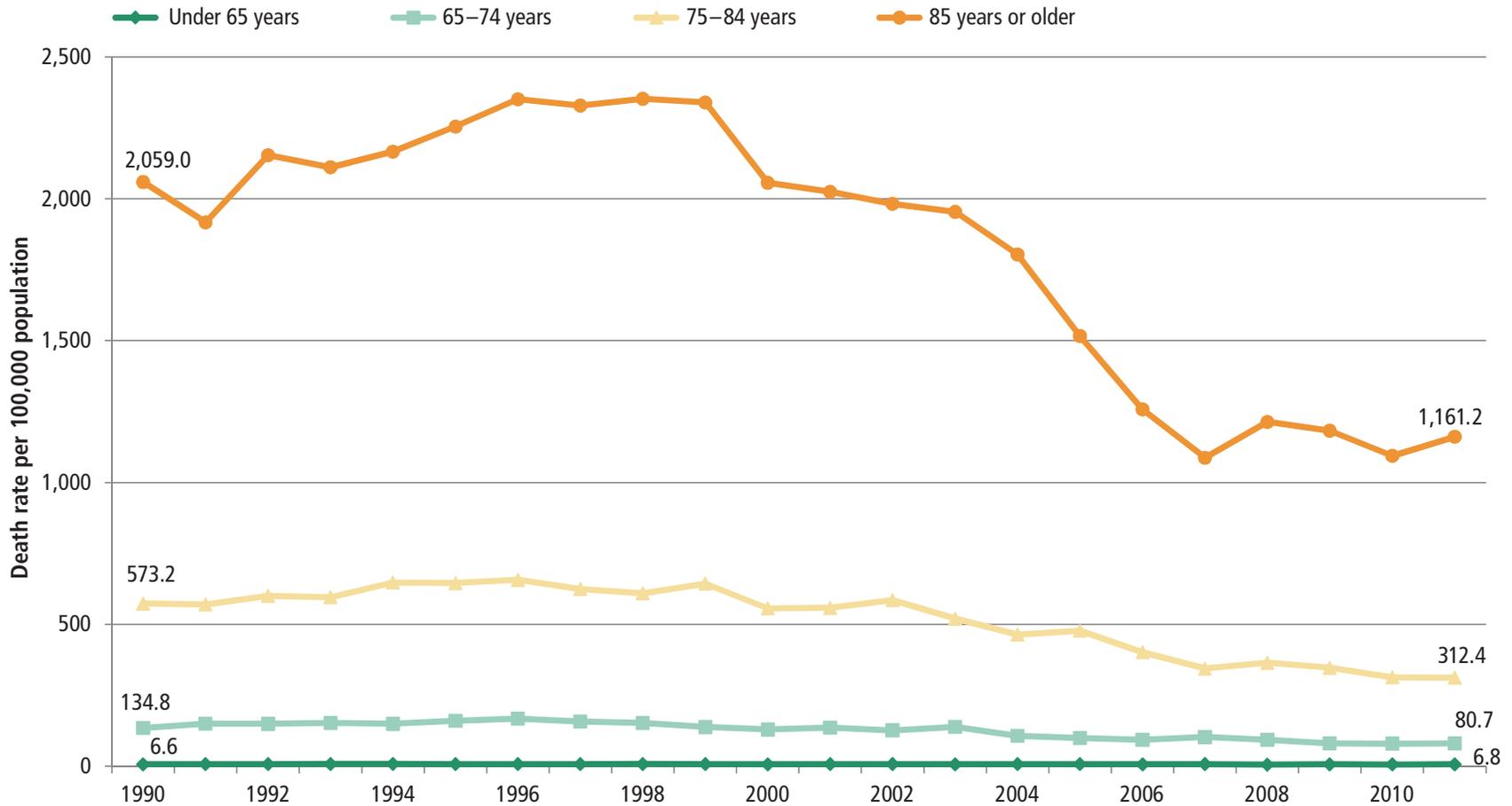


**Data source:** Oregon death certificates

**Note:** Death rates reflect stroke as the primary cause of death.

- ▶ Over time, stroke death rates between males and females in Oregon have remained relatively similar (Figure 5.5.2).
- ▶ Declines in stroke death rates have been observed in both genders during the last decade (Figure 5.5.2).
- ▶ Nationally, there has been a greater decline in stroke death rates in men than women.<sup>13</sup>
- ▶ In 2011, 775 male and 1,131 female Oregonians died from stroke. This is a stroke death rate of 41.8 per 100,000 population for males and 41.5 per 100,000 population for females.

**FIGURE 5.5.3 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY AGE GROUP AND YEAR, OREGON, 1990–2011**



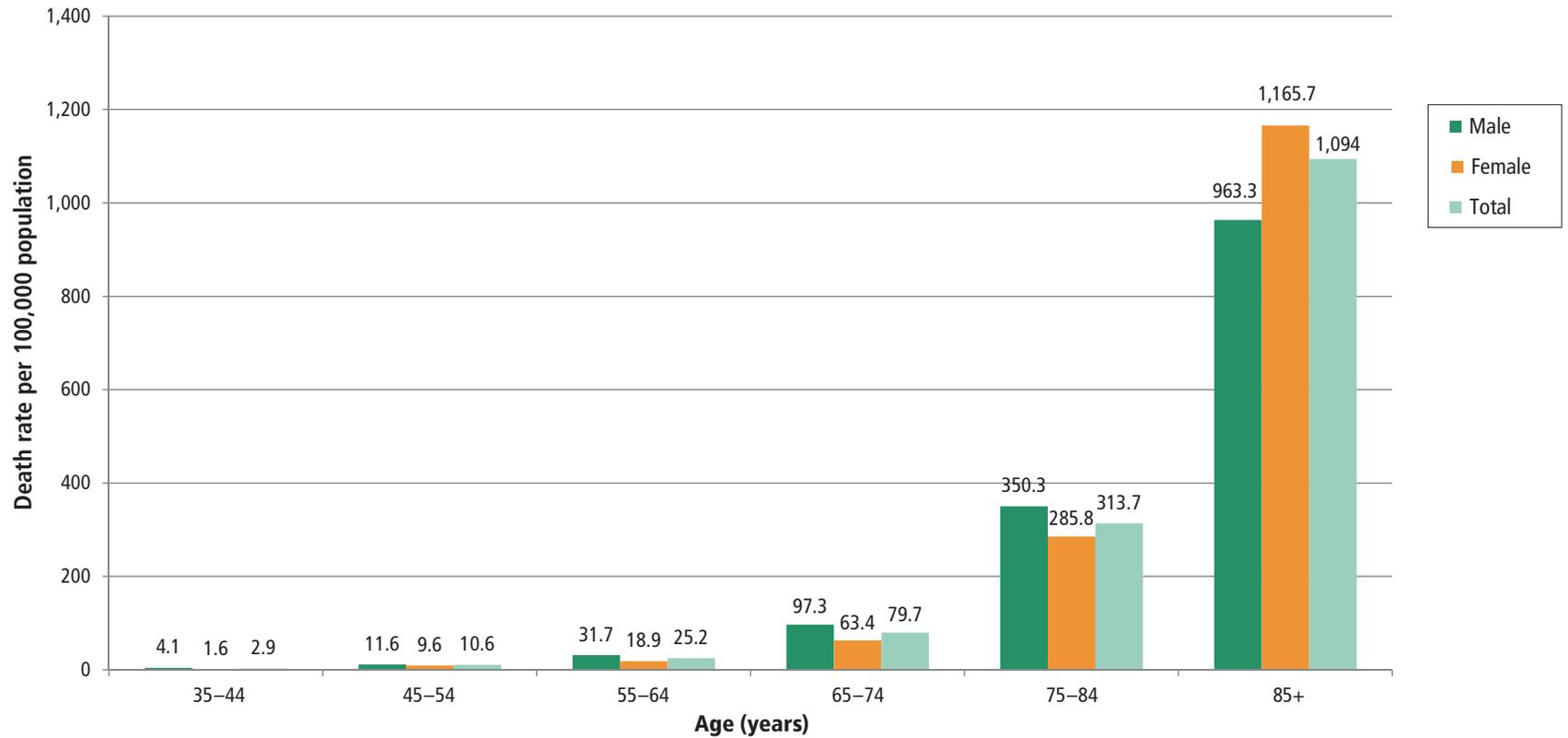
**Data source:** Oregon death certificates

**Note:** Death rates reflect stroke as the primary cause of death. Calculated death rate for each year is the average of adjacent 3 years due to small numbers (e.g., death rate in 1991 is the average of 1990–1992).

► Over time, stroke death rates have declined across all age groups, except those under the age of 65 (Figure 5.5.3).

► From 1990 to 2011, there was a 40.1% decrease in the stroke death rate among those aged 65–74 years, a 45.5% decrease in those aged 75–84 years and a 43.6% decrease in those aged 85 years or older (Figure 5.5.3).

**FIGURE 5.5.4 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY AGE GROUP AND GENDER, OREGON, 2011**

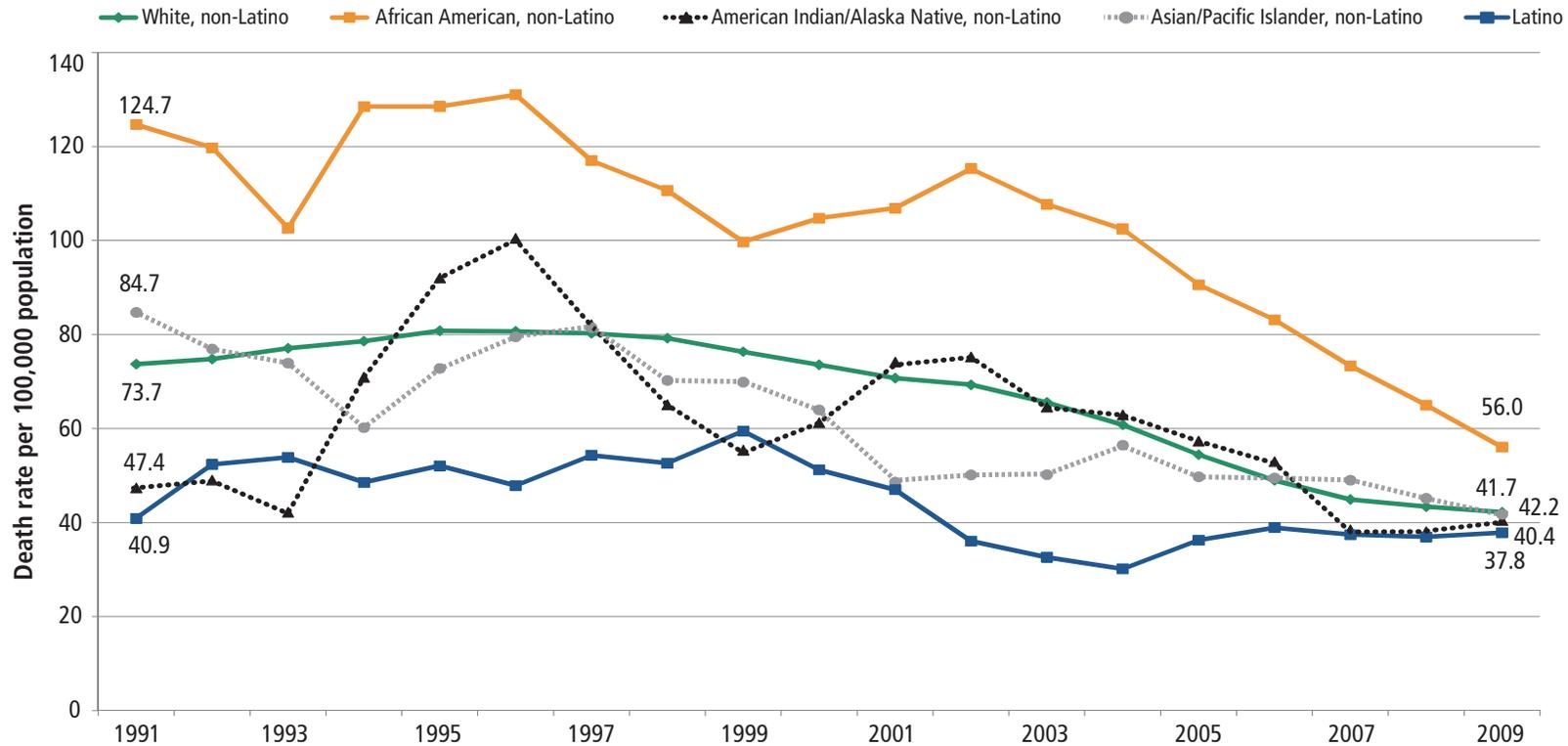


**Data source:** Oregon death certificates

**Note:** Death rates reflect stroke as the primary cause of death.

- ▶ Stroke death rates were higher in older age groups, and particularly in those aged 75 years old or older (Figure 5.5.4).
- ▶ Stroke death rates were higher among men than women in most age groups with the exception of those aged 85 years old and older, where women had a higher stroke death rate (Figure 5.5.4). This is likely due to the longer life expectancy of females compared to males.

**FIGURE 5.5.5 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY RACE AND ETHNICITY, OREGON, 1991–2009**

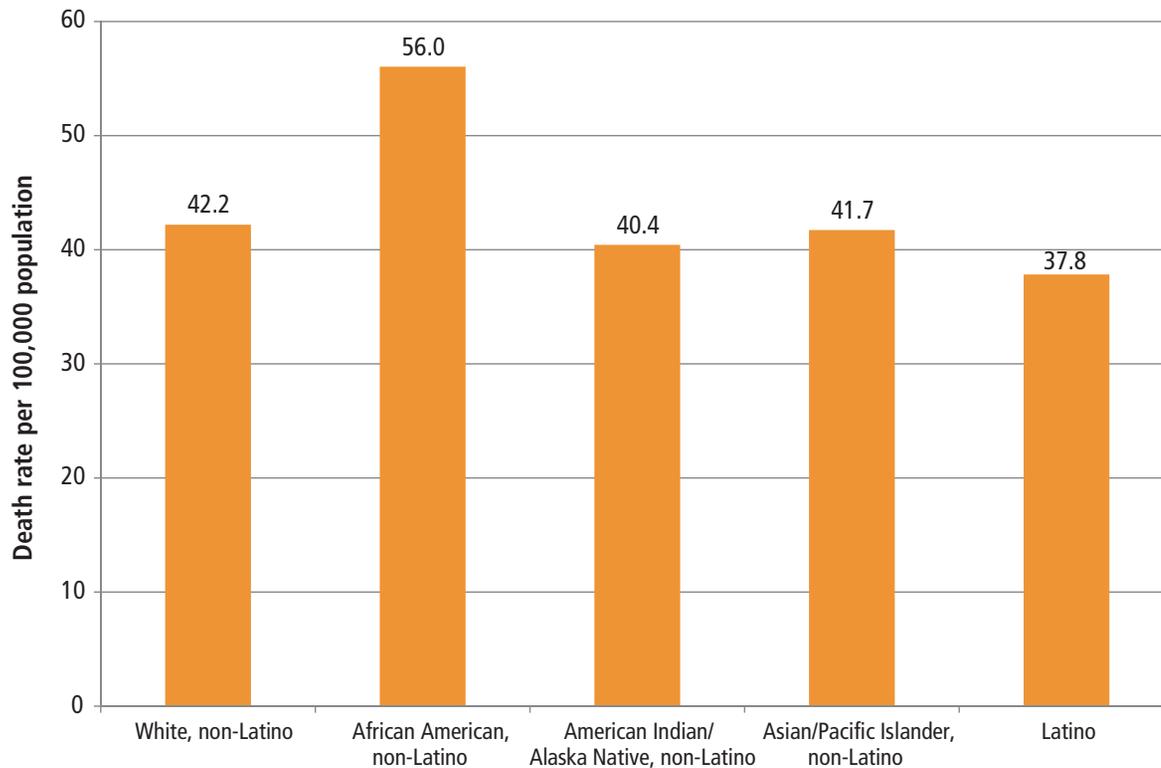


**Data source:** Oregon Behavioral Risk Factor Surveillance System

**Notes:** Estimates are age-adjusted. Calculated death rate for each year is the average of adjacent 3 years due to small numbers (e.g., death rate in 1991 is the average of 1990–1992).

- ▶ From 1991 to 2009, death rates from stroke decreased for all racial and ethnic groups (Figure 5.5.5).
- ▶ Over time, the disparity in the stroke death rate among racial and ethnic groups has lessened; however, non-Latino African American persons had consistently higher death rates from stroke compared with all other racial and ethnic groups (Figure 5.5.5).
- ▶ A higher percentage of the non-Latino African American population in Oregon reported high blood pressure, obesity, diabetes and cigarette smoking than other racial and ethnic groups, which may contribute to this disparity.
- ▶ Nationally, African American persons are more likely to die following a stroke than are white persons.<sup>1</sup>

FIGURE 5.5.6 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY RACE AND ETHNICITY, OREGON, 2008–2010

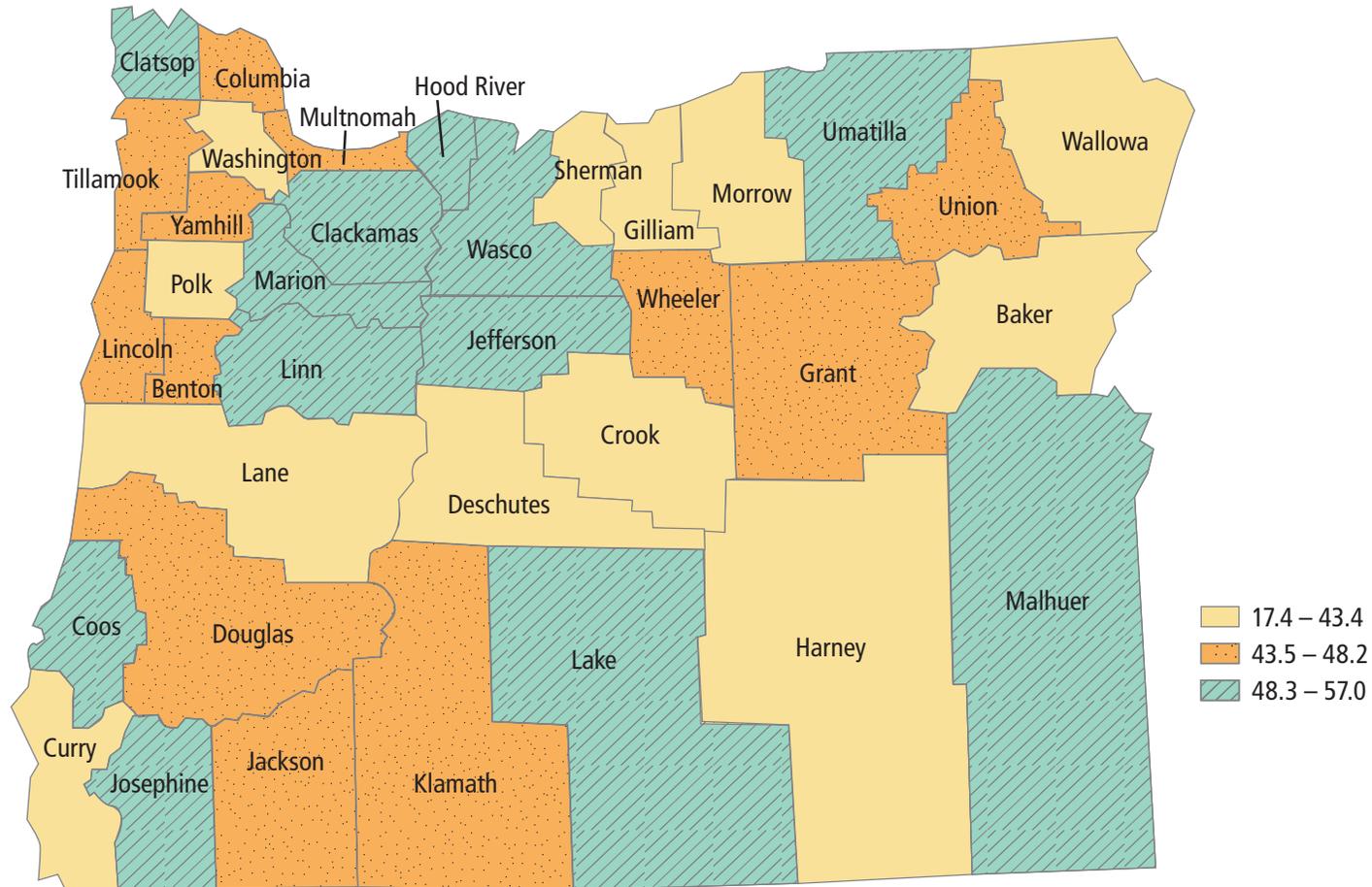


**Data source:** Oregon Vital Records

**Notes:** Estimates are age-adjusted. Calculated death rate for year 2009 is the average of adjacent 3 years due to small numbers (e.g., death rate in 2009 is the average of 2008–2010).

- ▶ African American persons had the highest death rate from stroke at 56.0 stroke deaths per 100,000 people.
- ▶ The African American population had an additional 18.2 stroke deaths per 100,000 people compared to the Latino population, who had the lowest stroke death rate of all racial and ethnic groups in Oregon (Figure 5.5.6).
- ▶ There also appears to be a disparity in age at stroke death across racial and ethnic groups (data not shown). Nationally, death certificate data show that the average age at stroke death was younger for African American, American Indian/Alaska Native and Asian/Pacific Islander persons compared to white persons. The average age at stroke death was also younger for Latino persons than non-Latino persons.<sup>13</sup>

**FIGURE 5.5.7 NUMBER OF STROKE DEATHS PER 100,000 PEOPLE, BY COUNTY, OREGON, 2005–2010**



**Data source:** Oregon Vital Records

**Note:** Stroke death rate for each county is the annual average of 6 years (2005–2010).

- ▶ The stroke death rate among Oregon counties ranged from 17.4 per 100,000 people in Sherman County to 57.0 per 100,000 people in Jefferson County.

## Conclusions

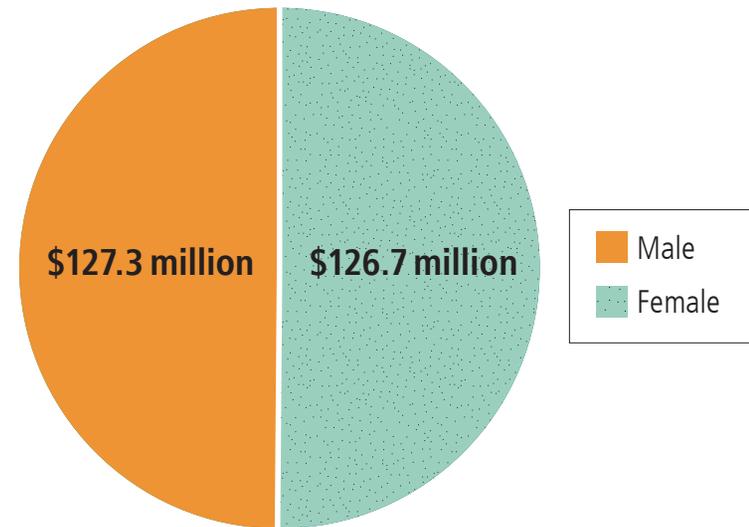
Overall, death from stroke is decreasing over time both in Oregon and nationally. However, further decreases in stroke death are needed to achieve the population health goals outlined in the Healthy People 2020 objectives. Decreases in stroke death are seen among both males and females, all age groups over 64 years old, and all racial and ethnic groups. It is important to note that although all racial and ethnic groups have seen decreases in stroke death rates, non-Latino African American persons still experience a disproportionately high burden of stroke death compared to all other racial and ethnic groups, and this trend has held constant during the last two decades.



## 5.6 Stroke costs

Stroke is the fourth leading cause of death and a leading cause of serious long-term disability in Oregon and nationally.<sup>1,14</sup> Every year, more than 795,000 people in the United States have a stroke, and 130,000 of these strokes result in death.<sup>1,14</sup> Stroke is also among the top five reasons for visits to the emergency department and a leading contributor to hospitalizations.<sup>9</sup> Stroke is an expensive chronic condition due to the associated hospitalizations, deaths and disabilities. The nation spends \$38.6 billion annually on stroke, including the cost of health care services, medications and lost productivity.<sup>15</sup> The average cost of ischemic stroke per person in the United States (87% of strokes are ischemic) is estimated at approximately \$140,000, which includes inpatient care, rehabilitation and follow-up care.<sup>1</sup> In Oregon, the average cost of a hospitalization due to stroke in 2011 was nearly \$33,000, with total medical costs exceeding \$250 million. The costs associated with stroke hospitalizations have steadily increased since 1997. In addition to these direct costs, families who experience stroke not only have to deal with medical bills, but also indirect costs such as lost wages and a decreased standard of living due to serious illness and disability.

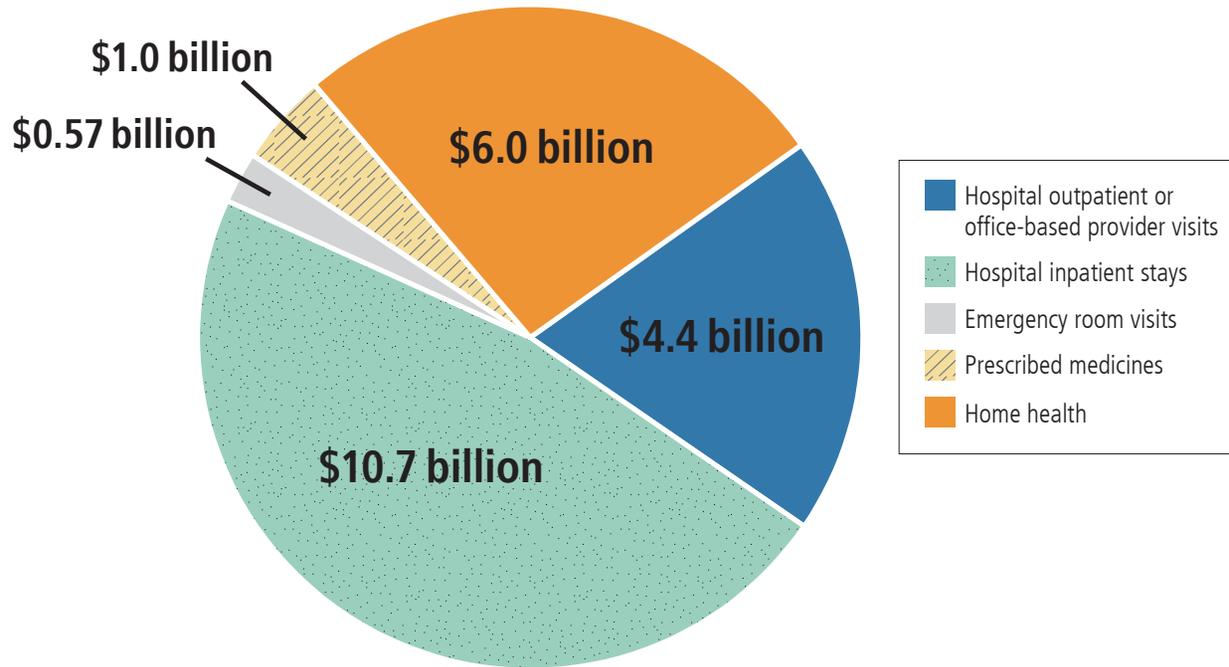
**FIGURE 5.6.1 TOTAL COSTS OF HOSPITALIZATIONS WITH A PRIMARY DIAGNOSIS OF STROKE, BY GENDER, OREGON, 2011**



**Data source:** Oregon Hospital Discharge Dataset

- ▶ In 2011, males and females each accounted for 50% of the total cost of stroke hospitalizations; \$126.7 million and \$127.3 million were spent on stroke hospitalizations among females and males, respectively (Figure 5.6.1).
- ▶ This differs from hospitalization with a primary diagnosis of heart disease or heart attack where males accounted for more than 60% of total costs.

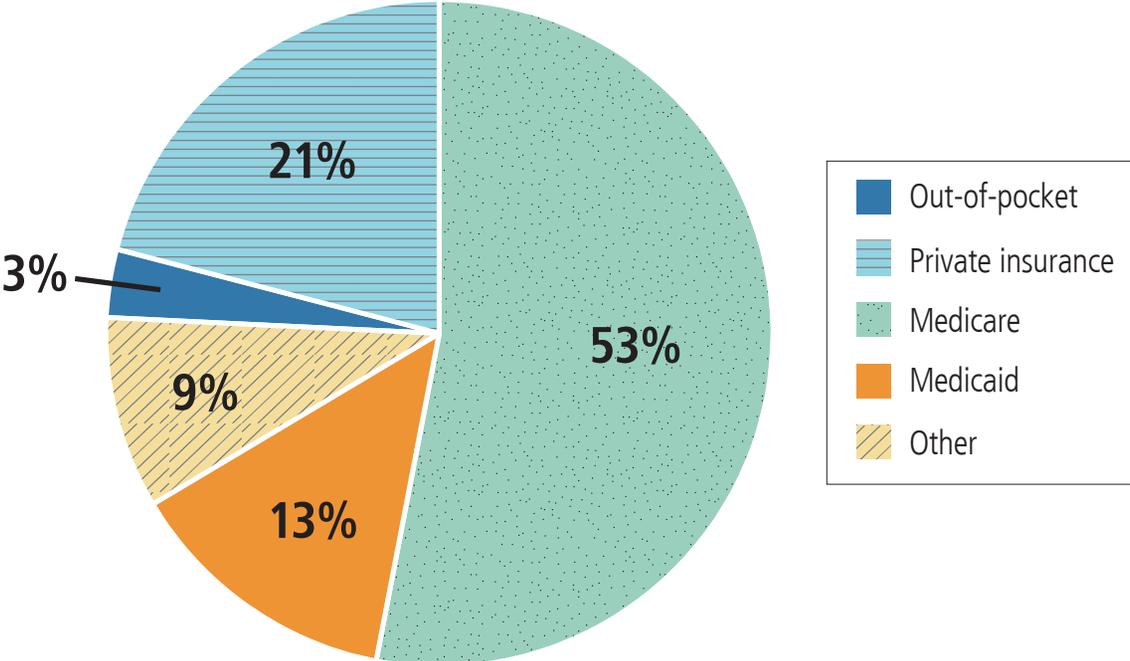
FIGURE 5.6.2 DISTRIBUTION OF DIRECT ECONOMIC COSTS OF STROKE, BY TYPE OF SERVICE, UNITED STATES, 2009



Data source: National Heart, Lung and Blood Institute, disease statistics

- ▶ Nationally, \$22.8 billion were spent on direct economic costs associated with stroke.<sup>16</sup>
- ▶ Of the direct costs due to stroke, nearly half (47%) were attributable to hospital inpatient stays, which equates to expenditures of more than \$10.7 billion (Figure 5.6.2).
- ▶ More than one-quarter (26%) of direct stroke costs were attributable to home health, 19% to hospital outpatient or office-based provider visits, 4.5% to prescribed medicines and 2.5% to emergency room visits (Figure 5.6.2).<sup>16</sup>

FIGURE 5.6.3 PERCENT DISTRIBUTION OF MEDICAL EXPENSES FOR STROKE, BY SOURCE OF PAYMENT, UNITED STATES, 2010



Data source: Medical Expenditure Panel Survey

- ▶ According to national data from 2010, 53% of stroke medical expenses were paid by Medicare, 21% by private insurance, 13% by Medicaid, 3% out of pocket and 9% from some other source (Figure 5.6.3).<sup>17</sup>

## Conclusions

Lowering the cost of health care is one of the goals of the Triple Aim framework for optimizing health systems' performance.<sup>18</sup> If nothing changes in stroke prevention and treatment trends, the direct medical costs associated with stroke care are projected to increase by 238% over the next 20 years, from \$28.3 billion in 2010 to \$95.6 billion in 2030.<sup>15</sup> In addition, the indirect costs associated with lost productivity due to stroke are projected to increase by 73%, from \$25.6 billion in 2010 to \$44.4 billion in 2030.<sup>15</sup> However, these projections need not become a reality because stroke is largely preventable.

Stroke prevention includes not smoking, eating a diet high in fresh fruits and vegetables and low in sodium and artificial trans fats, getting regular physical activity and managing high blood pressure, high cholesterol and obesity. Our social and physical environments are powerful influencers affecting what we eat, how we live and how healthy we end up. Today in Oregon, nutritious food and places to play and exercise are out of reach for many people. All Oregonians deserve convenient access to foods and activities that help them live better, regardless of their income, education, race or ethnicity. Healthy options should be expected, not something to search out. Communities can support individuals in the prevention and management of stroke by establishing tobacco-free environments, increasing access to fresh fruits and vegetables, increasing opportunities for physical activity and reducing sodium and trans fats in the food supply.



# WAYS TO REDUCE THE BURDEN OF STROKE IN OREGON



Stroke can be prevented by living tobacco-free and limiting exposure to secondhand cigarette smoke, limiting alcohol use, increasing physical activity, and eating a diet high in fruits and vegetables and low in salt and artificial trans fats. Stroke can also be prevented by controlling existing medical conditions such as high blood pressure, high cholesterol, diabetes, and overweight and obesity. In addition, those with a family history of stroke, older adults and men as well as African American, Latino and American Indian/Alaska Native persons have all been identified as being more susceptible to having a stroke. These vulnerable populations should be aware that their predisposition to stroke in combination with an unhealthy lifestyle further increases the risk for having a stroke.



Oregon is committed to the Million Hearts® initiative, preventing heart disease and stroke by addressing the ABCS — appropriate **A**spirin therapy, **B**lood pressure control, **C**holesterol control, **S**moking cessation and reduced **S**odium consumption — through these evidence-based policy strategies:

- ▶ Tobacco-free environments and helping cigarette smokers quit;
- ▶ Improved access to evidence-based quality care;
- ▶ Healthy worksites that encourage healthy eating and offer opportunities for physical activity;
- ▶ Environments with limited access to foods high in sodium and trans fats.

Some programs currently offered by the Oregon Health Authority that help individuals with heart disease and heart attack prevention behaviors include the Oregon Tobacco Quit Line (<https://public.health.oregon.gov/PreventionWellness/TobaccoPrevention/GetHelpQuitting/Pages/oregonquitline.aspx>), Walk with Ease ([www.arthritis.org/resources/community-programs/walk-with-ease/](http://www.arthritis.org/resources/community-programs/walk-with-ease/)) and Living Well with Chronic Conditions (<http://public.health.oregon.gov/diseasesconditions/chronicdisease/livingwell/Pages/Index.aspx>). The Oregon Tobacco Quit Line provides tobacco cessation counseling and increases the chances of quitting successfully. Walk with Ease, a gentle exercise program that addresses the risk factor of physical inactivity by increasing walking among participants, and Living Well with Chronic Conditions and Tomando Control de su Salud — programs that teach people living with chronic conditions the skills to take care of themselves — are offered throughout the state.

Oregon also promotes and supports strategies to improve delivery and use of quality clinical services to prevent stroke and manage risk factors such as increasing blood pressure screenings and clinical referrals to evidence-based prevention and self-management education and support services.

Visit the Oregon Heart Disease and Stroke Prevention webpage for more information and heart disease prevention resources: <http://public.health.oregon.gov/DiseasesConditions/ChronicDisease/HeartDiseaseStroke/Pages/index.aspx>.



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# APPENDIX A: COUNTY-LEVEL ESTIMATES



**TABLE A.1. AGE-ADJUSTED AND UNADJUSTED PREVALENCE OF DIABETES, HEART ATTACK AND HEART DISEASE AMONG ADULTS, BY COUNTY, OREGON 2008–2011**

	Diabetes		Heart attack		Heart disease	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
<b>OREGON</b>	–	<b>7.2%</b>	–	<b>9.9%</b>	–	<b>3.5%</b>
<b>County</b>						
<b>Baker</b>	11.2%	10.0%†	6.1%†	7.5%	6.0%†	6.4%†
<b>Benton</b>	6.8%	7.5%	2.5%	10.8%	2.5%	2.5%*
<b>Clackamas</b>	8.1%	7.5%	2.9%	9.5%	2.9%	2.6%*
<b>Clatsop</b>	8.7%	7.5%	6.5%	5.9%*	4.9%	3.8%
<b>Columbia</b>	8.4%	7.5%	2.9%	11.3%	3.5%	3.0%
<b>Coos</b>	12.4%	10.9%	7.6%	18.1%*	8.5%	7.3%†
<b>Crook</b>	10.2%	9.1%	4.7%†	6.8%†	2.8%†	2.0%†
<b>Curry</b>	9.7%	6.8%	6.5%	8.8%	7.5%	4.9%
<b>Deschutes</b>	6.6%	5.8%	2.8%	9.2%	3.5%	2.9%
<b>Douglas</b>	12.8%	11.2%*	6.7%	14.2%*	4.4%	3.2%
<b>Grant</b>	8.3%†	5.8%†	3.5%†	12.1%†	4.7%†	2.6%†
<b>Harney</b>	9.0%†	7.7%†	–	15.1%†	–	–
<b>Hood River</b>	6.1%†	5.3%†	–	2.2%†	–	–
<b>Jackson</b>	8.6%	7.8%	3.8%	9.1%	3.8%	3.2%
<b>Jefferson</b>	6.1%†	5.3%†	5.3%†	9.2%†	2.6%†	2.0%†
<b>Josephine</b>	10.3%	7.6%	6.6%	10.6%	6.6%	4.7%
<b>Klamath</b>	8.0%	7.0%	6.4%	14.1%	4.0%	3.3%

TABLE A.1. AGE-ADJUSTED AND UNADJUSTED PREVALENCE OF DIABETES, HEART ATTACK AND HEART DISEASE AMONG ADULTS, BY COUNTY, OREGON 2008–2011, CONTINUED

	Diabetes		Heart attack		Heart disease	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
<b>OREGON</b>	–	7.2%	–	9.9%	–	3.5%
<b>County</b>						
Lake	7.6%†	4.9%†	7.9%†	7.2%†	5.1%†	3.3%†
Lane	7.4%	6.9%	3.9%	11.7%*	3.6%	3.1%
Lincoln	10.4%	7.8%	4.1%	9.6%	3.9%	2.7%
Linn	8.6%	7.3%	4.3%	9.9%	5.4%	4.4%
Malheur	10.5%	10.3%	3.4%†	9.3%	4.1%†	4.0%†
Marion	7.8%	7.6%	3.8%	9.2%	4.4%	4.1%
Morrow	7.3%†	6.6%†	4.1%†	6.6%†	5.8%†	5.6%†
Multnomah	6.5%	6.6%	2.7%	8.9%	3.7%	3.7%
Polk	8.3%	7.5%	6.6%	10.6%	6.2%	5.8%
Tillamook	12.8%	11.2%	5.4%	6.4%*	5.3%	3.3%
Umatilla	9.6%	9.4%	4.0%	9.1%	2.3%	2.1%*
Union	9.1%†	8.6%†	3.8%†	13.5%	4.0%†	3.4%†
Wallowa	7.1%†	5.0%†	4.6%†	6.2%†	6.6%†	4.4%†
Washington	5.8%	6.0%*	2.5%	9.6%	2.9%	3.1%
Wheeler	–	–	–	–	–	–
Yamhill	6.1%	6.0%	4.2%†	9.3%	4.2%	4.0%
Gilliam/Sherman/ Wasco	8.1%	6.6%	6.3%	7.5%†	5.6%	4.9%†

\* Statistically significant difference compared with all other counties (p-value <= 0.05)

† This number may be statistically unreliable and should be interpreted with caution.

– This number is suppressed because it is statistically unreliable.

**Data source:** Oregon BRFSS County Combined Dataset 2008–2011

**Note:** Age-adjusted estimates are adjusted to the 2000 Standard Population using three age groups (18–34, 35–54 and 55+).

TABLE A.2. AGE-ADJUSTED AND UNADJUSTED PREVALENCE OF STROKE, HIGH BLOOD PRESSURE AND HIGH CHOLESTEROL AMONG ADULTS, BY COUNTY, OREGON, 2008–2011

	Stroke		High blood pressure		High cholesterol	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
<b>OREGON</b>	–	2.3%	–	26.6%	–	32.2%
<b>County</b>						
<b>Baker</b>	5.3%†	–	40.4%	32.8%	56.4%	51.7%
<b>Benton</b>	1.5%	1.6%*	20.9%	21.5%	29.1%	27.8%
<b>Clackamas</b>	2.5%	2.2%	28.9%	27.0%	37.1%	33.1%
<b>Clatsop</b>	4.2%	3.1%	35.6%	31.2%	41.3%	28.4%
<b>Columbia</b>	2.7%†	2.5%†	32.7%	29.4%	40.7%	29.8%
<b>Coos</b>	6.2%†	5.9%†	32.9%	26.1%	39.8%	35.2%
<b>Crook</b>	–	–	42.4%	38.3%	48.3%	42.9%
<b>Curry</b>	2.5%†	1.3%†	35.8%	22.7%	44.9%	29.3%
<b>Deschutes</b>	1.8%	1.5%*	24.6%	21.2%*	38.0%	37.8%
<b>Douglas</b>	4.3%	3.3%	36.8%	33.1%*	43.5%	38.4%
<b>Grant</b>	–	–	37.3%	22.8%	54.2%	68.3%*
<b>Harney</b>	–	–	21.3%†	14.4%*	39.1%	37.8%†
<b>Hood River</b>	–	–	23.2%	20.6%	16.2%	12.1%*
<b>Jackson</b>	2.7%	2.1%	32.0%	29.0%	41.6%	34.0%
<b>Jefferson</b>	1.8%†	1.4%†	21.9%	17.6%*	38.6%	24.0%
<b>Josephine</b>	3.2%	2.4%	35.5%	29.7%	38.2%	26%*
<b>Klamath</b>	3.4%	3.2%	33.7%	30.6%	44.0%	39.7%
<b>Lake</b>	–	–	32.2%†	22.1%	58.8%	51.0%
<b>Lane</b>	2.4%	2.1%	28.3%	26.8%	39.1%	33.7%

TABLE A.2. AGE-ADJUSTED AND UNADJUSTED PREVALENCE OF STROKE, HIGH BLOOD PRESSURE AND HIGH CHOLESTEROL AMONG ADULTS, BY COUNTY, OREGON, 2008–2011, CONTINUED

	Stroke		High blood pressure		High cholesterol	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
<b>OREGON</b>	–	2.3%	–	26.6%	–	32.2%
<b>County</b>						
<b>Lincoln</b>	3.7%	2.8%†	39.6%	35.1%	45.4%	34.8%
<b>Linn</b>	3.9%	3.6%	28.8%	26.3%	33.8%	28.4%
<b>Malheur</b>	1.6%†	1.4%†	29.3%	26.0%	30.3%	21.7%*
<b>Marion</b>	3.0%	2.8%	27.9%	27.2%	33.6%	29.8%
<b>Morrow</b>	–	–	29.1%	22.9%	41.6%	27.5%
<b>Multnomah</b>	1.9%	2.0%*	26.1%	26.1%	35.1%	32.4%
<b>Polk</b>	1.5%	1.3%*	25.9%	24.4%	36.4%	30.5%
<b>Tillamook</b>	3.8%†	3.0%†	27.9%	20.4%	47.0%	44.9%
<b>Umatilla</b>	3.7%	3.4%	32.7%	32.1%	47.6%	42.6%*
<b>Union</b>	2.9%†	2.3%†	31.8%	28.8%	41.3%	40.0%
<b>Wallowa</b>	5.8%†	–	43.7%	28.7%	44.6%	35.2%
<b>Washington</b>	2.1%	2.1%	23.5%	24.2%*	32.2%	28.6%*
<b>Wheeler</b>	–	–	–	–	–	–
<b>Yamhill</b>	2.2%	2.0%	27.8%	26.9%	35.3%	32.7%
<b>Gilliam/Sherman/ Wasco</b>	2.4%†	1.6%†	37.8%	34.1%	35.6%	27.3%

\* Statistically significant difference compared with all other counties (p-value <= 0.05)

† This number may be statistically unreliable and should be interpreted with caution.

– This number is suppressed because it is statistically unreliable.

**Data source:** Oregon BRFSS County Combined Dataset 2008–2011

**Note:** Age-adjusted estimates are adjusted to the 2000 Standard Population using three age groups (18–34, 35–54 and 55+).

TABLE A.3. AGE-ADJUSTED AND UNADJUSTED PREVALENCE OF OBESITY, CURRENT SMOKER AND LACK OF PHYSICAL ACTIVITY AMONG ADULTS, BY COUNTY, OREGON, 2008–2011

	Obese		Current cigarette smoker		Lack of physical activity	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
<b>OREGON</b>	–	<b>24.8%</b>	–	<b>16.3%</b>	–	<b>17.5%</b>
<b>County</b>						
<b>Baker</b>	26.6%	26.6%	23.0%	26.4%*	27.7%	31.7%*
<b>Benton</b>	18.1%	18.7%*	10.3%	10.2%*	13.4%	13.9%
<b>Clackamas</b>	24.0%	23.9%	14.0%	14.3%*	15.7%	15.4%*
<b>Clatsop</b>	30.5%	31.4%	19.6%	20.3%	18.3%	17.5%
<b>Columbia</b>	24.7%	23.7%	18.2%	19.2%	19.2%	18.9%
<b>Coos</b>	30.0%	30.0%*	24.8%	28.3%*	21.7%	19.8%
<b>Crook</b>	25.5%	25.6%	16.7%	17.4%	19.4%	18.7%
<b>Curry</b>	30.1%	31.5%	24.5%	32.3%*	25.5%	25.1%
<b>Deschutes</b>	17.4%	17.2%*	13.1%	13.8%	18.1%	18.2%
<b>Douglas</b>	32.5%	33.6%*	23.8%	26.7%*	21.4%	20.9%
<b>Grant</b>	23.1%	21.8%	22.8%	26.2%	16.1%†	20.1%†
<b>Harney</b>	22.8%	22.7%	9.0%†	8.4%†	20.7%	18.5%
<b>Hood River</b>	19.5%	19.7%	9.2%	9.5%†	16.9%	16.9%
<b>Jackson</b>	21.0%	20.7%*	19.7%	21.2%*	15.2%	14.3%*
<b>Jefferson</b>	28.5%	28.7%	14.6%	15.4%	21.4%	20.7%
<b>Josephine</b>	21.7%	19.7%*	19.3%	21.3%*	22.1%	21.4%
<b>Klamath</b>	28.4%	29.4%	19.9%	20.6%	21.9%	21.6%
<b>Lake</b>	28.4%	27.1%	16.8%	19.2%†	21.0%	19.1%
<b>Lane</b>	26.4%	26.5%	17.6%	18.1%	16.8%	16.6%

TABLE A.3. AGE-ADJUSTED AND UNADJUSTED PREVALENCE OF OBESITY, CURRENT SMOKER AND LACK OF PHYSICAL ACTIVITY AMONG ADULTS, BY COUNTY, OREGON, 2008–2011, CONTINUED

	Obese		Current cigarette smoker		Lack of physical activity	
	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted	Unadjusted	Age-adjusted
<b>OREGON</b>	–	<b>24.8%</b>	–	<b>16.3%</b>	–	<b>17.5%</b>
<b>County</b>						
<b>Lincoln</b>	27.5%	26.6%	22.8%	27.4%*	21.3%	20.1%
<b>Linn</b>	30.5%	30.6%*	18.2%	19.0%	24.4%	24.6%*
<b>Malheur</b>	27.7%	27.9%	22.0%	22.9%	19.2%	18.3%
<b>Marion</b>	28.0%	28.0%*	14.2%	14.4%	18.1%	18.0%
<b>Morrow</b>	29.5%	29.7%	14.5%	14.7%	32.0%	31.3%*
<b>Multnomah</b>	22.4%	22.5%*	14.6%	14.5%*	14.9%	15.0%*
<b>Polk</b>	27.4%	27.2%	13.2%	14.2%	16.8%	16.4%
<b>Tillamook</b>	29.1%	27.9%	19.8%	23.0%	17.9%	15.3%
<b>Umatilla</b>	34.4%	34.8%*	20.6%	21.0%*	26.2%	26.2%*
<b>Union</b>	27.4%	28.1%	10.8%	11.6%	16.0%	16.3%
<b>Wallowa</b>	18.3%	18.1%	14.9%†	16.9%†	32.6%	35.1%†
<b>Washington</b>	21.9%	21.9%*	12.7%	12.6%*	16.7%	16.7%
<b>Wheeler</b>	22.6%†	–	12.1%†	–	–	–
<b>Yamhill</b>	34.8%	35.0%*	18.4%	18.5%	28.4%	28.2%*
<b>Gilliam/Sherman/ Wasco</b>	35.2%	35.3%*	13.7%	14.4%	19.6%	18.1%

\* Statistically significant difference compared with all other counties (p-value <= 0.05)

† This number may be statistically unreliable and should be interpreted with caution.

– This number is suppressed because it is statistically unreliable.

**Data source:** Oregon BRFSS County Combined Dataset 2008–2011

**Note:** Age-adjusted estimates are adjusted to the 2000 Standard Population using three age groups (18–34, 35–54 and 55+).

# APPENDIX B: DATA SOURCES

The data sources used in this report are listed below.  
Data sources are described with brief limitations.

## **Behavioral Risk Factor Surveillance System (BRFSS)**

Description: The BRFSS is a random-digit dialed telephone survey that is conducted year-round among Oregon adults aged 18 years or older. The BRFSS includes questions on health behavior risk factors such as diet, weight control, tobacco and alcohol use, physical activity, preventive health screenings, and use of health care services. The data are weighted to represent all adults aged 18 years and older. A core set of questions is asked annually, and other topics are surveyed on a rotating basis.

Every few years, Oregon conducts additional BRFSS surveys among under-represented races and ethnicities.

The results of these surveys are combined with statewide BRFSS data to provide more stable estimates for chronic diseases and related risk factors among these groups of Oregonians. The most recent race/ethnicity oversamples were conducted in 2010–2011. In addition, BRFSS surveys from 2008–2011 were aggregated to produce more reliable county-level prevalence estimates.

Starting in 2010, Oregon began collecting data from those who use cell phones, causing the method for adjusting (weighting) the data to the demographics of the state to change. This new method is called “raking.” Because of these changes, data prior to 2010 are not directly comparable to the data from 2010 forward. In addition, the national BRFSS also made these changes but did not implement the changes until 2011.

**Limitations:** BRFSS estimates pertain only to the adult population aged 18 years or older living in households. Respondents are identified through telephone-based methods. The survey started collecting data for cell phones in 2009. Cell phone data were incorporated for analysis in Oregon in 2010. According to a recent publication from the National Center for Health Statistics, in 2011 more than 38% of households in Oregon were wireless-only. Finally, results obtained through BRFSS surveys also are limited in that they represent self-reported responses. Not all questions in the BRFSS have been validated.





## Hospital Discharge Dataset

**Description:** The Hospital Discharge Dataset provides information on hospital discharges from all acute care hospitals in Oregon except two Veterans Administration hospitals. The dataset includes admit and discharge dates, diagnosis and procedural codes, financial charges, primary payer, and patient demographic information.

**Limitations:** Prior to 2008, the Hospital Discharge Dataset did not include identifying information that would allow us to ascertain when a single person had multiple hospitalizations; therefore, the calculated rate was the number of hospitalizations per the Oregon population rather than number of different people hospitalized per the Oregon population. In addition, prior to 2008, the dataset did not include information on race or ethnicity. Starting in 2008, the data necessary for investigating repeat hospitalizations for chronic diseases and hospitalizations by race/ethnicity were available and reported.

## Oregon Health Panel Survey (OHPS)

**Description:** The Oregon Health Panel Survey was conducted in 2012 among non-institutionalized adults aged 18 years or older. Panel members were recruited using random digit dialing sampling based on landline telephone numbers and/or address-based sampling methodologies. A sample of panel members was then drawn at random for the survey. Topics on the survey include knowledge and attitudes toward colorectal screening, trans fats, sugary drinks, and other tobacco products. The data are weighted to represent all adults aged 18 years and older.

**Limitations:** OHPS estimates pertain only to the adult population aged 18 years or older living in households.

## Oregon Healthy Teens (OHT) Survey

**Description:** Since 2000, the Youth Risk Behavior Survey (developed by the CDC) and the Oregon Public School Drug Use Survey were combined for Oregon into a single annual survey called Oregon Healthy Teens (OHT) Survey. The sample size varies from 1,600 to 32,000 per year, and the final data are weighted to more accurately represent Oregon eighth- and 11th-graders. The survey assesses health topics such as tobacco and alcohol use, HIV knowledge and attitudes, eating behaviors, nutrition and exercise.

**Limitations:** One limitation is that participation by school systems in the OHT is voluntary. However, participation rates have been high thus far. Another limitation is that the OHT questionnaire is not currently available in non-English versions except for a Spanish booklet that can be used as a reference when filling out the English version of the survey. A third limitation is that 3% of surveys were eliminated due to combinations of “dubious” answers and another 5% were eliminated because the student did not fill out grade or gender information.

## Vital records data (full count data)

### Birth Certificate Statistical File

The Birth Certificate Statistical File includes all births occurring in Oregon and births occurring out of state to Oregon

residents. This database includes parental demographic information, conditions of the newborn, congenital abnormalities, medical factors of pregnancy, method of delivery, and complications of labor and delivery. It also includes tobacco, alcohol or illicit drug use during pregnancy. Information about maternal diabetes and gestational diabetes is also included.

### **Death Certificate Statistical File**

The Death Certificate Statistical File includes all deaths occurring in Oregon and deaths occurring out of state to Oregon residents. Data are obtained from death certificates that are collected from the state registrar. The data are used to examine trends in mortality and causes of death. This database includes cause of death, date and place of death, and decedent demographic information. The mortality data analyzed for this report consists of deaths among Oregon residents.

**Limitations of birth and death files:** The accuracy of the data depends on the accuracy with which the birth attendant, certifying physician or medical examiner describes the circumstances surrounding the birth or the underlying causes of death.

### **CDC Wonder database**

The CDC Wonder database provides National Center for Health Statistics (NCHS) national statistical analysis and reporting of deaths from specific diseases.



# APPENDIX C: RELIABILITY AND SUPPRESSION GUIDELINES



In this report, some numbers include a warning that they are potentially unreliable or they are unreliable and suppressed (not shown). In general, reliability refers to the stability of a number being reported.

The guidelines used to gauge reliability differ depending on the type of data used. Some data sources include all events under study (such as births, deaths or hospitalizations). These will be referred to as “full count.” Other data sources are from surveys of randomly selected individuals, adjusted to represent the full population. These will be referred to as “survey.” The text below briefly describes the methods used to determine if the information in this report includes a warning for reliability or is suppressed.

## Full count

Determine the number of events ( $n$ ).

- ▶  $n \geq 12$ : Report the estimate.
- ▶  $n \geq 5$  and  $n < 12$ : Report the estimate and include a warning regarding reliability.
- ▶  $n < 5$ : Do not report the estimate and state that it is suppressed.

## Survey

Determine the total number of persons surveyed ( $x$ ) for a particular question and calculate the standard error (SE) for the reported number. Use the SE to calculate a statistic called the relative standard error (RSE). RSE is a measure of the variability of an estimate compared with the estimate itself.



1. Determine if the estimate is being calculated on a full population (i.e., everyone) or a subpopulation (i.e., a smaller group of all people surveyed who share a common trait such as race, county or medical condition).
2. If the full population, determine if the denominator is  $\geq 50$ . If yes, proceed; if not, suppress.
3. If a subpopulation, determine if the denominator is  $\geq 20$ . If yes, proceed; if not, suppress.
4. Apply the following logic to each RSE:
  - RSE  $< 30\%$ : Report the estimate.
  - RSE  $\geq 30\%$  and RSE  $< 50\%$ : Report the estimate and include a warning regarding reliability.
  - RSE  $\geq 50\%$ : Do not report the estimate and state that it is suppressed.





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