Stroke

Definition: Sudden loss of muscle function, vision, sensation, or speech caused by problems in blood vessels going to or in or around the brain. Ischemic stroke, about 80% of all strokes, is caused by a severe reduction in blood supply to part of the brain. Blood flow becomes obstructed from a blocked artery due to atherosclerosis or by bits of debris (emboli) transported through the bloodstream, usually from the heart. Hemorrhagic stroke occurs when blood vessels break, causing bleeding into or around the brain. ICD-9 codes 430-434, 436-438. ICD-10 codes I60-I69.

Summary

While stroke deaths have been declining in Washington and nationally, stroke is the sixth leading cause of death in Washington, causing 2,554 deaths in 2011. Older adults, American Indians and Alaska Natives, Native Hawaiian and other Pacific Islanders, blacks, and people in lower socioeconomic positions experience higher rates of stroke deaths than other groups. In 2011, about 28,000 hospitalizations of Washington residents included a diagnosis of stroke. About 32% of hospitalizations in 2011 with stroke as the first listed diagnosis were among Washington residents younger than 65 years old.

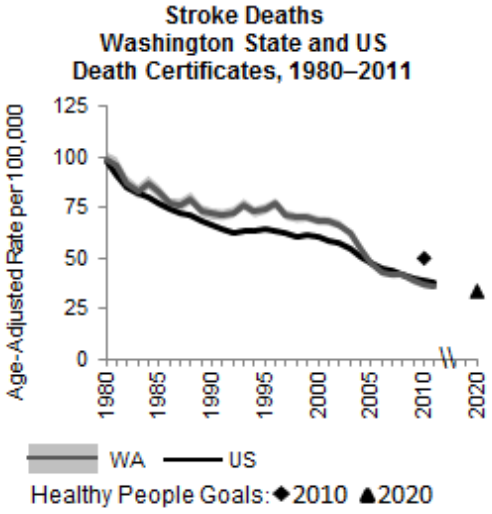
Stroke is a leading cause of serious, long-term disability in Washington and the nation. Disability not only affects the lives of stroke patients, but also their family and caregivers, compounding the impact of stroke on people and communities. On the 2012 Washington Behavioral Risk Factor Surveillance Survey, 56% (±6%) of adults who reported having had a stroke also reported activity limitations compared to 23% (±1%) who had not had a stroke.

Despite improvements in treating stroke, prevention and treatment of the factors that cause stroke are still the best ways to reduce the burden of stroke. Common risk factors include high blood pressure, smoking, diabetes, irregular heart rhythm (atrial fibrillation), high cholesterol leading to narrowing of the arteries, excess body weight, unhealthy diet and physical inactivity.[1]

Effective interventions include prevention of first and second stroke by promoting healthy eating and active, smoke-free living; regular visits with a doctor to diagnose and treat the common risk factors; community education about signs and symptoms and immediately calling 9-1-1; notification and prompt response by emergency medical services; and access to high-quality care and rehabilitation.

Time Trends

Stroke death rates have steadily declined in both Washington and the United States. Between 1980 and 2011, the age-adjusted death rate declined from 99 to 36 deaths per 100,000 people in Washington. In the United States, the age-adjusted rate declined from 97 to 38 deaths per 100,000 people between 1980 and 2011.[2,3] Prior to 2005, the age-adjusted rate of death was higher in Washington than the United States. Since 2005, after changes in coding of stroke on death certificates were implemented, the rates have been similar. (See Technical Notes.)

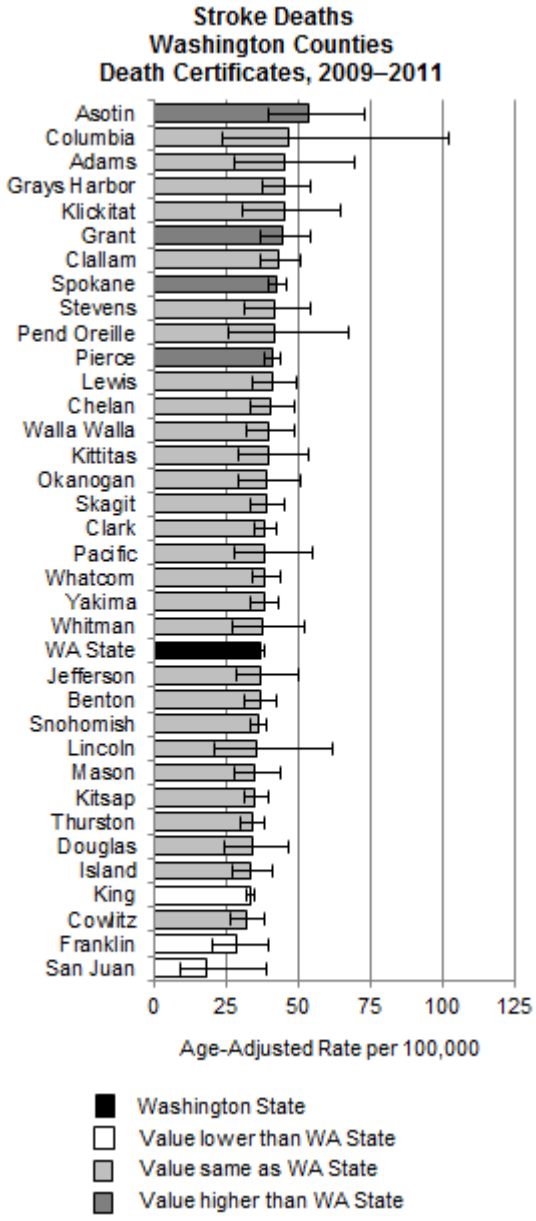


Better stroke prevention through control of high blood pressure and high cholesterol, use of blood thinners to reduce risk of clot formation in patients with atrial fibrillation, reductions in smoking, and improved acute treatment have contributed to the national decline in stroke deaths.[4]

2010 and 2020 Goals

The national *Healthy People 2010* goal was to decrease stroke deaths to an age-adjusted rate of 50 per 100,000 people. Both Washington and the United States have met the 2010 goal. The goal for *Healthy People 2020* is an age-adjusted rate of 33.8 deaths per 100,000 people. At the current rate of decline, Washington will likely meet this goal.

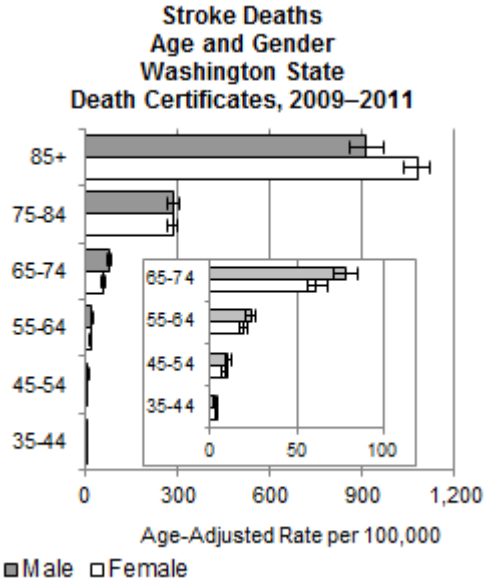
Geographic Variation



Washington's age-adjusted stroke death rate during 2009–2011 was 37 deaths per 100,000 people. Age-adjusted rates ranged from 18 deaths per 100,000 people in San Juan County to 53 deaths per 100,000 people in Asotin County. Four counties had age-adjusted death rates that were higher than the state rate: Asotin, Grant, Spokane and Pierce counties. Three counties had age-adjusted death rates that were lower than the state rate: San Juan, Franklin and King counties. The rate of death from stroke in Ferry, Garfield, Skamania and Wahkiakum counties was not included in the chart because there were too few deaths, less than 12 in the three-year period, to report a reliable rate.

Age and Gender

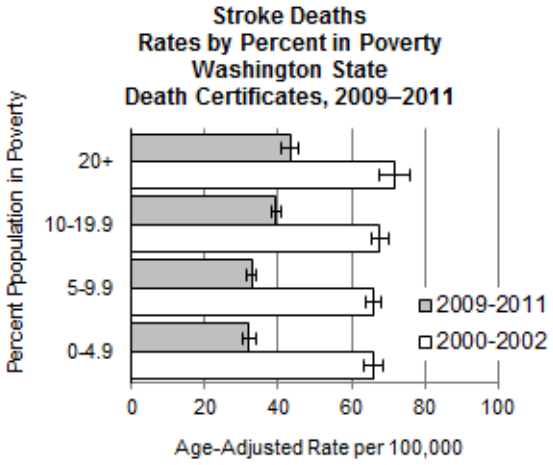
Similar to national patterns,[5] stroke death rates in Washington increase rapidly with age. From rates of less than 100 per 100,000 for men and women ages 65–74, rates increase to about 290 per 100,000 for men and women ages 75–84 and to 1,077 and 914 per 100,000 for women and men, respectively, ages 85 and older. Despite the increase with age, 13% of stroke deaths occur among people younger than 65 years. Men ages 55–74 have higher stroke death rates than women. Women ages 85 and older have higher stroke death rates than men.



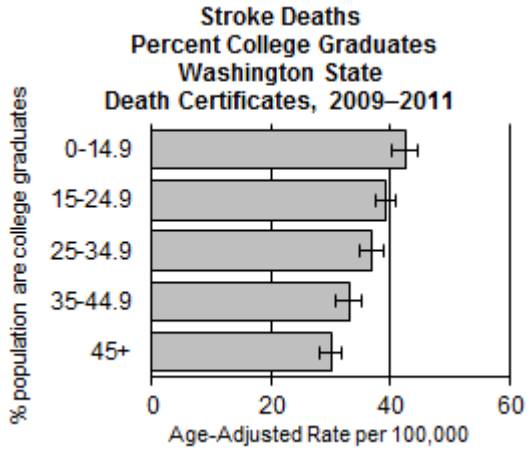
Economic Factors and Education

Individuals in lower socioeconomic groups have higher rates of stroke deaths than those in higher groups.[6,7] Studies also suggest that living in lower socioeconomic neighborhoods is associated with a shorter survival period following a stroke, regardless of individual socioeconomic position or traditional risk factors.[8,9] However, it is not clear how socioeconomic factors influence stroke outcomes.[10]

To measure the relationship between socioeconomic position and stroke death in Washington, we looked at the relationships between stroke death rates and neighborhood measures of economic resources and educational attainment. We defined neighborhood economic resources as the percent of people in a census tract living in poverty. During 2009–2011 combined, age-adjusted stroke death rates were 1.3 times higher for Washington residents living in census tracts with 20% or more of the population living below the federal poverty level compared to rates in census tracts where less than 5% of the population lived in poverty. Since early 2000, rates for all groups have been decreasing; however, the relative difference between the lowest and highest poverty groups increased. Compared to the highest poverty level, rates in the lowest level were 9% higher in 2000–2002 and 35% higher in 2009–2011.

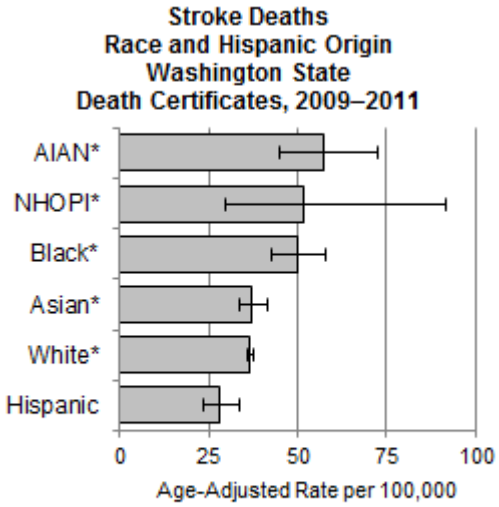


We defined neighborhood educational attainment as the percent of census tract residents ages 25 and older with a college education or more. During 2009–2011, age-adjusted stroke death rates were 1.4 times higher for Washington residents in census tracts where less than 15% of the population were college graduates compared to rates in census tracts where 45% or more of the population were college graduates.



Race and Hispanic Origin

Age-adjusted stroke death rates during 2009–2011 were highest among Washington's American Indian and Alaska Native (57 deaths per 100,000 people) and black (50 deaths per 100,000 people) residents. The rate for Native Hawaiian and other Pacific Islander residents is also relatively high (52 deaths per 100,000 people), but subject to greater random variation than rates for other groups because of small numbers. Compared to national age-adjusted stroke death rates,[3] the age-adjusted stroke death rates for American Indians and Alaska Natives in Washington was higher than for this group in the United States (36 deaths per 100,000 people in 2010). Reasons for these differences are unknown. Age-adjusted rates for Washington's black, white and Hispanic residents were all similar to the national rates for these groups. Comparable national rates were not available for Asians or Native Hawaiians and other Pacific Islanders.



* Non-Hispanic
AIAN: American Indian/Alaska Native
NHOPI: Native Hawaiian/Other Pacific Islander

Other Measures of Impact and Burden

***Hospitalizations*.** In 2011, 28,359 Washington hospitalizations (4% of all hospitalizations) included a diagnosis of stroke. For 13,011 of these hospitalizations, stroke was listed as the primary diagnosis (2% of all hospitalizations). Hospital

charges in 2011 totaled $605 million for hospitalizations with stroke as the primary diagnosis.

In Washington, age-adjusted hospitalization rates with stroke listed as the primary diagnosis moderately declined from 227 hospitalizations per 100,000 people in 1990 to 187 hospitalizations in 2004. Between 2004 and 2011, rates remained stable and are now at 183 hospitalizations per 100,000 people.

During 2009–2011 combined, men between the ages of 45 and 84 years were more likely than women to be hospitalized with stroke as a primary diagnosis. While hospitalization rates increase with age, in 2011, 32% of hospitalizations with stroke as the primary diagnosis were among Washington residents younger than 65 years.

Similar to national trends, rates of ischemic stroke hospitalizations have risen among young to middle-aged Washington residents over the last two decades.[11] From 1990 to 2011, rates of ischemic stroke hospitalizations in Washington doubled for males and females ages five through 44 years. It is uncertain how much of this increase is due to increases in stroke risk factors or better awareness and identification of stroke in younger people.[12]

Prevalence of stroke. On the 2012 Behavioral Risk Factor Surveillance System (BRFSS), 2% (±<1%) of Washington adults reported ever being told by a doctor, nurse or other health professional they have had a stroke. This is only slightly lower than the national prevalence of 3% (± <1%).

Washington BRFSS data for 2010–2012 combined showed patterns of stroke with respect to age, economic factors and education were similar to those for death from stroke. Similar to national data, reporting of stroke in Washington was highest among American Indian and Alaska Native adults (6% ±3%).

Disability. Stroke is a leading cause of serious, long-term disability in the United States.[13] In the Framingham Heart Study, stroke survivors older than 64 had the following disabilities six months after stroke: 50% had some one-sided paralysis; 30% were unable to walk without some assistance; 46% had cognitive deficits; 35% had symptoms of depression; 19% had difficulty speaking; 26% required assistance in activities of daily living; and 26% were institutionalized in a nursing home.[14]

Washington BRFSS data for 2012 show that adults who survived a stroke were about two times more likely to report being limited in activities because of physical, mental or emotional problems (56% ±6%) compared to adults who reported they had never had a stroke (23% ±1%). Adults who survived a stroke were also four times more likely to report use of special equipment, such as a cane, a wheelchair, a special bed or a special telephone for health problems (36% ±6%) compared to adults who reported they had never had a stroke (7% ±<1%).

Risk and Protective Factors

Many factors that increase risk of stroke cannot be changed, including age, sex, low birth weight and some genetic factors. Factors that can be changed are discussed below and provide many opportunities for prevention.[1]

High blood pressure (hypertension). Hypertension [blood pressure 140 (systolic)/90 (diastolic) mm Hg or higher] is the leading risk factor for stroke and is the only one found consistently for all types of stroke.[1] Studies have also shown that higher values within the pre-hypertensive range (blood pressure 130–139/85–89 mm Hg) increase risk for stroke.[15] Lowering systolic blood pressure by 10 mm Hg or diastolic blood pressure by 5 mm Hg reduces risk of stroke by about one-third.[16] This reduction is the same regardless of the presence or absence of existing heart disease or high blood pressure before treatment.[16]

The percent of Washington BRFSS respondents who reported ever being told by a doctor, nurse or other health professional they had high blood pressure was 30% (±1%) in 2011. This is similar to the national percent.

Data for 2009 and 2011 combined showed patterns of high blood pressure were similar to patterns for death from stroke: higher for men than women; with increasing age and with decreasing income and education. Similar to national data, reporting of high blood pressure was highest among black adults (40% ±6%).

Tobacco use. Cigarette smoking nearly doubles a person's risk for stroke and is estimated to contribute to 12–14% of all stroke deaths.[17,18,19] Combined with some other risk factors, the risk can be more than doubled. For example, using oral contraceptives and smoking increases stroke risk sevenfold.[20] In addition, people exposed to secondhand smoke have a 25% higher risk of stroke compared to those not exposed.[21,22] In 2012, 17% (±1%) of Washington

adults reported smoking. (See Tobacco Use chapter.)

Diabetes. The risk of stroke is two to four times higher among people with diabetes compared to those without diabetes.[23] While people with diabetes are more likely to have other risk factors that can cause stroke, such as atherosclerosis (buildup of fats and cholesterol on artery walls which can restrict blood flow and cause blood clots), high blood pressure, obesity and high cholesterol, having diabetes without these other factors also increases the risk of stroke.[1] In 2012, 9% (±<1%) of Washington BRFSS respondents reported having diabetes. (See Diabetes chapter.) Studies have also shown that pre-diabetes (generally defined as impaired fasting glucose or impaired glucose tolerance) is associated with modest increases in the risk for stroke.[24]

Atrial fibrillation. An irregular heart rhythm called atrial fibrillation is associated with a four- to fivefold increased risk of stroke because this condition can lead to blood clots forming in the heart and travelling to the brain.[25] In the United States Framingham Heart Study, atrial fibrillation accounted for about 1.5% of strokes in individuals ages 50–59 and 23.5% in those ages 80–89.[26]

High blood cholesterol. Most studies show higher cholesterol levels are associated with ischemic stroke.[1] The opposite is true for hemorrhagic stroke where lower cholesterol levels are associated with increased risk. National stroke guidelines still recommend treating high cholesterol to prevent ischemic stroke, especially for people with coronary heart disease, diabetes and other high-risk conditions.[1]

Among Washington BRFSS respondents who reported having had their cholesterol checked, the percent who reported ever being told by a doctor, nurse or other health professional they had high cholesterol was 40% (±1%) in 2011. This is similar to the national percent.

Data for 2009 and 2011 combined showed patterns of high blood cholesterol were similar to patterns for death from stroke: higher for men than women; with increasing age and with decreasing income and education.

Obesity and body fat distribution. Increased adiposity (abdominal body fat) is associated with increased risk of stroke.[1] Studies have shown that for people with heights and weights indicating overweight or obesity, each five kg/m^2 increase is associated with a 40% increased risk of stroke death.[27] In 2012, 27% (±1%) of Washington adults reported heights and weights indicating obesity. (See Obesity and Overweight chapter.)

Prior stroke and transient ischemic attack (TIA). Prior stroke and TIAs are significant risk factors for stroke.[28] A TIA, often called a mini-stroke, has symptoms similar to a stroke. A TIA usually lasts less than an hour and does not cause permanent damage. However, TIAs are an important warning sign of stroke. Studies have shown the short-term risk of having a stroke after TIA is 3–10% at two days and 9–17% at 90 days.[29,30]

Other risk factors. Heart conditions, including coronary heart disease, heart failure and an enlarged heart, can cause blood clots to form. This increases stroke risk since blood clots that form in the heart can travel to the brain to cause a stroke. People with narrowing of the carotid arteries, the main blood vessels to the brain, have a higher risk of stroke than the general population.[1]

Sickle cell disease, some forms of postmenopausal hormone therapy, and using oral contraceptives if accompanied by other risk factors such as smoking or hypertension may increase stroke risk. Poor diet and physical inactivity are associated with stroke because of their contribution to more direct risk factors such as high blood pressure.[1]

Knowledge of symptoms of stroke. Studies show that reducing the amount of time for someone having a stroke to get into treatment can save lives.[31] Faster treatment also reduces disability by minimizing brain damage and preserving functional abilities in patients. Ischemic stroke is treated most effectively when treatment begins within 3–4.5 hours of symptom onset.[32] Hemorrhagic stroke also requires prompt medical attention, as there may be a need for urgent surgical intervention. (See Trauma and Emergency Cardiac and Stroke Systems chapter.)

Knowing the symptoms of stroke and seeking prompt medical care can reduce stroke-related impairment in individuals and the overall burden of stroke for society.[33] In 2011, only 12% (±1%) of BRFSS respondents were able to spontaneously recall at least four signs and symptoms of a stroke out of the following eight: weakness and numbness in face, arm or leg; confusion or difficulty understanding; dizziness; loss of balance or coordination; severe headache; difficulty speaking; blurred or decreased vision; and trouble walking. Most respondents (92% ±1%) correctly reported

calling 9-1-1 as the first thing to do if they witnessed someone having a stroke. Despite this, fewer than half of 9-1-1 calls for stroke are made within an hour of symptom onset, further delaying arrival to hospital for treatment.[34] Although arrival by ambulance is associated with prompt treatment and higher level of care, a national study shows that almost 50% of people with stroke do not arrive by ambulance.[35]

Intervention Strategies

Environmental and policy changes to promote healthy eating and active, smoke-free living. Public health strategies to reduce the likelihood of stroke focus on fostering environmental and behavioral changes to increase physical activity and healthy eating, and to prevent smoking or exposure to secondhand smoke through individual and community-based interventions. These interventions promote eating a diet rich in fruits and vegetables; reducing intake of sodium and saturated fat; being physically active; and not smoking.[1] The dietary interventions impact a number of risk factors for stroke including reducing blood pressure by decreasing dietary sodium and increasing dietary potassium.[1] Specific strategies are covered in the Tobacco Use, Physical Activity, Nutrition and Obesity and Overweight chapters.

Increase the use of clinical preventive services. Aspirin therapy, blood pressure control, cholesterol management and smoking cessation (known as the ABCS) are preventive measures that are particularly effective in preventing a first and second stroke[1,33,36] and reducing deaths from stroke.[37] Appropriate aspirin therapy,[38] lowering blood pressure,[39] maintaining low levels of low-density lipoprotein (LDL or "bad" cholesterol),[40] and quitting smoking can lower stroke risk.[41]

To implement the ABCS, the U.S. Department of Health and Human Services, in collaboration with private organizations, launched the Million Hearts initiative in 2011. Million Hearts aims to align policies, programs and resources to improve access to care; focus attention on the ABCS and health information technology; increase public awareness about risk factors; improve medication adherence; promote healthier behaviors and environments; and enhance surveillance and monitoring.[42] Not all strategies in this initiative have been evaluated for effectiveness.

Improve access to effective care. Nationally and in Washington State, delivering primary care through patient-centered medical or health homes is a leading strategy to improve access to effective care and increase the use of clinical preventive services, including the ABCS. The Washington Healthcare Improvement Network (WHIN) is a Department of Health initiative to work with healthcare organizations and providers to develop and support patient-centered health homes and achieve more effective care transitions and care coordination across healthcare settings and providers.

Medical and health homes can be effective in increasing access to care, and helping people reduce cholesterol, blood pressure and blood sugar levels.[43] They may also help patients manage depression and other mental health conditions. This is essential because treating depression can help improve overall health after stroke.[44]

Coordinated system of emergency response and treatment. Fast treatment for stroke saves lives and reduces disability by minimizing brain injury and preserving functional abilities in patients.[31] Washington State's Emergency Cardiac and Stroke System aims to reduce the time to transport stroke patients to a hospital that can provide the most effective stroke treatment through a comprehensive, coordinated systems approach. The system identifies standard procedures for pre-hospital assessment, transport and hospital care; has hospitals self-designate according to their level of stroke care; requires hospitals to participate in quality improvement activities; and provides education resources to staff and the general public. (See Trauma and Emergency Cardiac and Stroke Systems chapter.)

Reduce sodium intake. Reducing sodium in the diet can help prevent and control hypertension, a major risk factor for stroke. A decrease in average daily consumption, from 3,400 mg to 2,300 mg, could reduce hypertension by as many as 11 million cases nationally. Further reductions in sodium intake to 1,500 mg/day could reduce hypertension by 16 million cases nationally.[45]

The Institute of Medicine's recommended strategy to reduce sodium consumption is for the Food and Drug Administration to set mandatory national standards for systematically lowering the sodium content in foods over time. Evidence shows that a decrease in sodium can be accomplished without affecting consumers' enjoyment of food products if it is done systematically and gradually across the food supply.[46]

Diabetes prevention and control. Because diabetes is a major risk factor for stroke, interventions to prevent and control diabetes can also successfully reduce stroke incidence. All of the interventions listed in this section, except coordinated system of emergency response and stroke rehabilitation, are also important for diabetes prevention and control. (See Diabetes chapter for strategies for preventing and controlling diabetes.)

Stroke rehabilitation. A majority of stroke survivors need rehabilitation because of resulting impairments. Stroke rehabilitation has been shown to reduce deaths, likelihood of institutional care and long-term disability, and to improve independence in activities of daily living and quality of life.[47]

Stroke rehabilitation includes rehabilitation assessment, and inpatient, outpatient and community-based rehabilitation. Rehabilitation guidelines[48] focus on early assessment and intervention; use of standardized evaluations and valid tools in the development of treatment plans; evidence-based interventions that focus on functional goals; access to an experienced multidisciplinary rehabilitation team that includes the patient and patient's family members or caregivers; utilization of patient and family education and community resources; and secondary stroke prevention.

According to the 2009 BRFSS, only 26% (±8%) of Washington adults who had survived a stroke reported going to any kind of outpatient rehabilitation. It is estimated that more than 50% of stroke survivors would receive outpatient rehabilitation if clinical practice guidelines were followed.[49]

See Related Chapters*:* Coronary Heart Disease, Tobacco Use, Obesity and Overweight, Physical Activity, Diabetes, Access to Primary Healthcare Services, Alcohol Abuse and Dependence, Nutrition, Trauma and Emergency Cardiac and Stroke Systems, and Social and Economic Determinants of Health

Data Sources (For additional detail see Appendix B)

Washington State Death Certificate Data: Washington State Department of Health, Vital Registration System Annual Statistical Files, Deaths 1980–2011, released October 2012; data prepared by Washington State Department of Health, Center for Health Statistics.

WA Hospital Discharge Data, Comprehensive Hospitalization Abstract Reporting System (CHARS) 1987–2011, Washington State Department of Health, Center for Health Statistics, July 2012; data prepared by Washington State Department of Health, (Office of Healthy Communities).

OR State Hospital Discharge Data 1987–1999. Office for Oregon Health Policy and Research; data prepared by Washington State Department of Health, (Office of Healthy Communities).

OR State Hospital Discharge Data 2000–2011. Nationwide Inpatient Sample (NIS), Healthcare Cost and Utilization Project (HCUP), Agency for Healthcare Research and Quality; data prepared by Washington State Department of Health, (Office of Healthy Communities).

Washington State population counts: 2000 and 2010 U.S. Census, 2001–2009 intercensal estimates, 2011–2012 post-censal estimates, Washington State Office of Financial Management, Forecasting Division (OFM), released January 2014; 1990 U.S. Census and 1991–1999 OFM intercensal estimates, Vista Partnership and Krupski Consulting, released October 2007; 1980 U.S. Census and 1981–1989 OFM intercensal estimates.

Washington State Behavioral Risk Factor Surveillance System (BRFSS) Data: 1987–2012. Olympia, Washington: Washington State Department of Health, under federal cooperative agreement numbers: U58/CCU002118 (1987-2003), U58/CCU022819 (2004-2008), U58 DP001996 (2009-2010), US58 SO000047 (2011–2013); data prepared by Washington State Department of Health, (Office of Healthy Communities).

United States Behavioral Risk Factor Surveillance System: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention (CDC). Atlanta, Georgia, [1991–2012]; data prepared by Washington State Department of Health, (Office of Healthy Communities).

Technical Notes

In January 1999, the United States began using the International Classification of Diseases, Tenth Revision (ICD-10) to classify causes of death reported on death certificates. Counts and rates for years coded with ICD-9 are multiplied by the age-specific comparability ratios (only apply to underlying causes of death). The standard errors and confidence intervals incorporate the variance of the age-specific comparability ratios. For more information on the change from ICD-9 to ICD-10, see the department's Center for Health Statistics ICD-10 Information Page at http://www.doh.wa.gov/DataandStatisticalReports/VitalStatisticsData/DeathData/ICD10.aspx.

United States death certificate data are preliminary for 2011. Hoyert DL, Xu JQ. Deaths: Preliminary Data for 2011. *Natl Vital Stat Rep.* 2012;61(6). Hyattsville, MD: National Center for Health Statistics. 2012.

For many decades, stroke was always the third leading cause of death in Washington State and stroke deaths rates were

consistently higher than rates in the United States. In 2005, the National Center for Health Statistics instructed states to code multi-infarct dementia (ICD-10: F011) and vascular dementia (ICD-10: F019) as mental disorders in death certificates instead of as death from stroke (ICD-10: I60-I69) where it had been coded previously. After this coding change, a large decline in stroke deaths occurred between 2004 and 2005 and the rate of death became (and continues to be) similar to the national stroke death rate.

Hospitalization data does not include hospitalizations for Washington residents from U.S. Department of Veterans Affair Hospitals (VA), federal hospitals (e.g., Bremerton, Madigan, Oak Harbor), or out-of-state hospitals in Idaho serving Washington residents of border counties. If these hospitalizations were added, the count of hospitalizations with stroke would be larger. Data from Oregon hospitals serving Washington residents of border counties are included.

For More Information

Washington State Department of Health, Office of Healthy Communities:
http://www.doh.wa.gov/AboutUs/ProgramsandServices/PreventionandCommunityHealth/OfficeofHealthyCommunities.aspx.

Washington State Patient-Centered Health Home Program:
http://www.doh.wa.gov/PublicHealthandHealthcareProviders/HealthcareProfessionsandFacilities/PatientCareResources/DiabetesManagementResources/HealthHome.aspx.

Washington State Emergency Cardiac and Stroke System:
www.doh.wa.gov/ecs.

Healthy People 2020, Heart Disease and Stroke:
http://www.healthypeople.gov/2020/topicsobjectives2020/overview.aspx?topicid=21.

Million Hearts Initiative:
http://millionhearts.hhs.gov/index.html.

Acknowledgments

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