

Coronary Heart Disease

Definition: Coronary heart disease is usually caused by atherosclerosis which can result in decreased blood flow through the vessel. This results in decreased oxygen supply to the heart muscle and can cause reduced heart muscle function and destruction of heart muscle cells (myocardial infarction or "heart attack"). ICD-9 codes 410-414, 429.2. ICD-10 codes I20-I25.

Summary

Coronary heart disease is the second leading cause of death in Washington, causing 6,767 deaths in 2011. Older adults, men, American Indians and Alaska Natives, Native Hawaiians and other Pacific Islanders, and people in lower socioeconomic positions experience higher rates of coronary heart disease death than others.

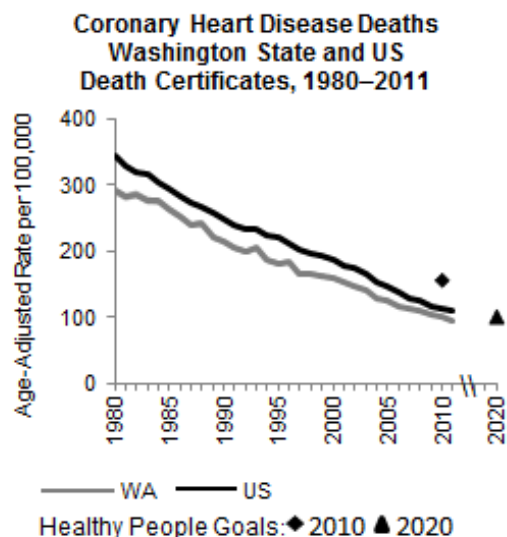
Deaths from coronary heart disease could be prevented or delayed by modifying known risk factors, such as high blood cholesterol, high blood pressure, tobacco use, physical inactivity, obesity and diabetes.

Interventions to prevent and manage coronary heart disease focus on policy, environmental, systems and behavioral changes to:

- Increase physical activity and healthy eating, reduce sodium in the food supply, and prevent smoking and exposure to secondhand smoke.
- Deliver primary care through patient-centered medical and health homes to detect risk factors early and increase the use of effective clinical preventive services, particularly blood pressure control, diabetes management and cholesterol control.
- Improve emergency response and treatment for heart attack and cardiac arrest.
- Promote guideline-based hospital care and cardiac rehabilitation to improve quality of life and reduce risk for another heart attack, heart failure and other complications.

Time Trends

Coronary heart disease death rates have steadily declined in both Washington and the United States. Between 1980 and 2011, the [age-adjusted](#) death rate declined from 291 to 95 deaths per 100,000 people in Washington. In the United States, the age-adjusted rate declined from 345 to 109 deaths per 100,000 people between 1980 and 2011. Since 1980, the age-adjusted rate of death has been lower in Washington than the United States. This difference has been decreasing since around 2000.



Multiple factors have likely contributed to the decline in coronary heart disease deaths.^{1,2} This includes greater control of risk factors, specifically reductions in total cholesterol, systolic blood pressure, smoking and physical inactivity, resulting in declining incidence of diagnosed coronary heart disease despite increases in obesity and diabetes. Improved medical and surgical treatments have also contributed to the decline in deaths.

2010 and 2020 Goals

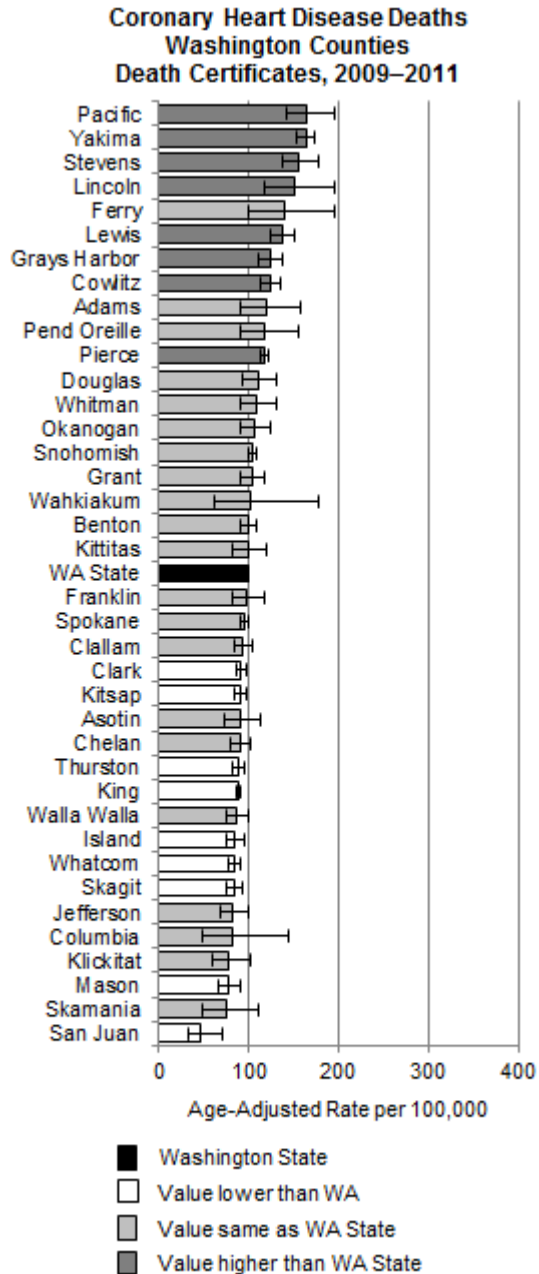
The national *Healthy People 2010* goal was to decrease coronary heart disease deaths to an age-adjusted rate of 156 per 100,000 people. The current goal for *Healthy People 2020* is an age-adjusted rate of 100.8 deaths per 100,000 people. Both Washington and the United States have met the 2010 goal, and Washington has already met the 2020 goal.

Geographic Variation

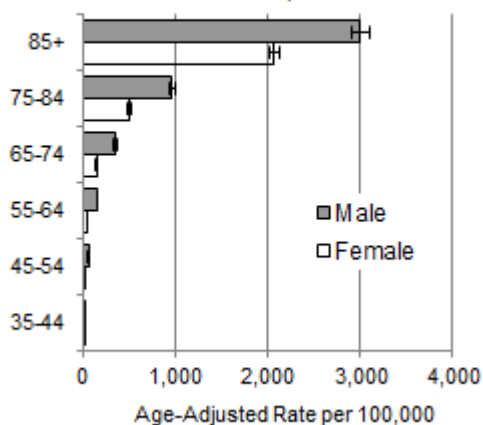
Washington's age-adjusted coronary heart disease death rate during 2009–2011 was 100 deaths per 100,000 people. Age-adjusted rates ranged from 72 deaths per 100,000 people in San Juan County to 195 deaths per 100,000 people in Pacific County. Eight counties had age-adjusted death rates that were higher than the state rate: Pacific, Yakima, Stevens, Lincoln, Lewis, Grays Harbor, Cowlitz and Pierce counties. Nine counties had age-adjusted death rates that were lower than the state rate: Clark, Kitsap, Thurston, King, Island, Whatcom, Skagit, Mason and San Juan counties. The rate of death from coronary heart disease in Garfield County was not included in the chart because there were too few deaths, less than 10 in the three-year period, to report a reliable rate.

Age and Gender

Similar to national patterns,³ the numbers and rates of coronary heart disease deaths in Washington increase with age. In each age group, men have higher rates than women. Nineteen percent of these deaths occur among people less than 65 years of age.



**Coronary Heart Disease Deaths
Age and Gender
Death Certificates, 2009–2011**

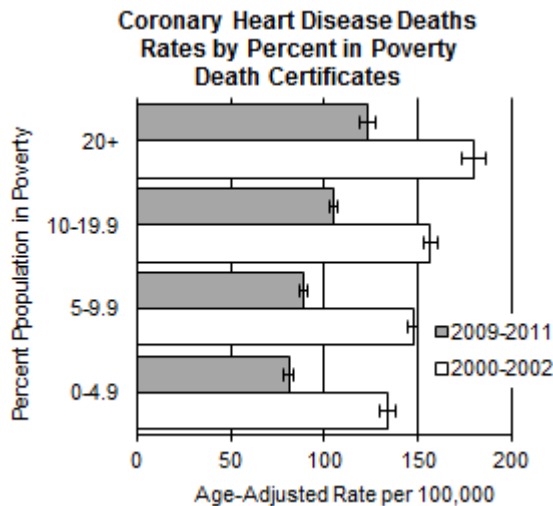


Economic Factors and Education

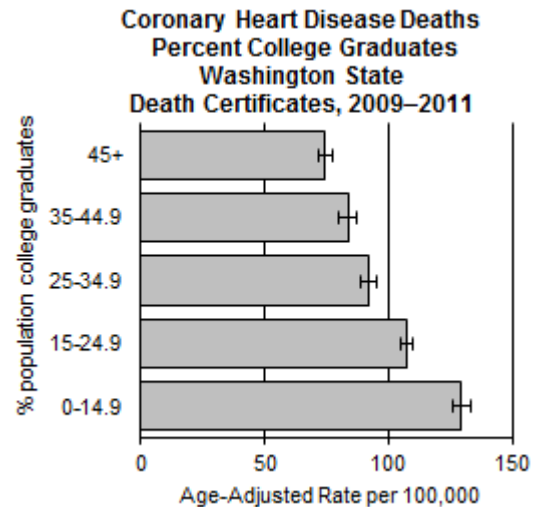
Individuals in lower socioeconomic groups experience higher rates of coronary heart disease deaths than those in higher groups.^{4,5,6} Studies also suggest that increased risk of coronary heart disease death occurs in people living in lower socioeconomic neighborhoods, regardless of individual factors.^{7,8} Differences in hypertension, high blood cholesterol, unhealthy behaviors such as smoking and inactivity, past cardiovascular events, behavior after a heart attack, psychosocial stressors,

and access to care may account for the relationship between socioeconomic position and coronary heart disease deaths.^{9,10}

One measure of neighborhood socioeconomic characteristics is the percent of the population living in poverty. Using this measure, during 2009–2011 combined, age-adjusted coronary heart disease death rates were 1.5 times higher for Washington residents 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 groups has increased. Compared to the highest poverty level, rates in the lowest level were 35% higher in 2000–2002 and 52% higher in 2009–2011.

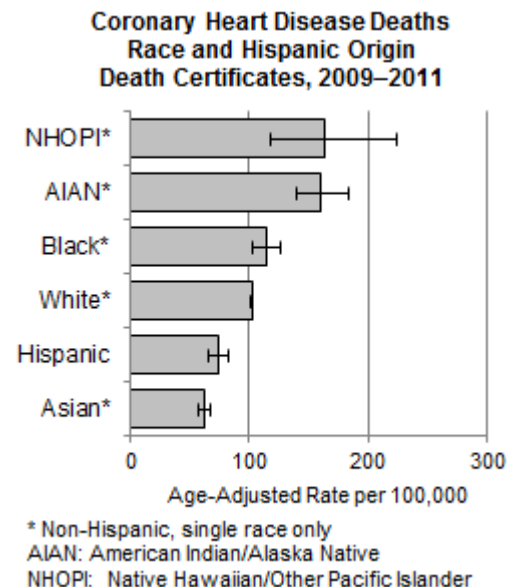


Neighborhood educational level can be measured as the percent of the population ages 25 and older with a college education or more. During 2009–2011 combined, age-adjusted coronary heart disease death rates were 1.7 times higher for Washington residents in census tracts where less than 15% of the population were college graduates compared to rates in census tracts where 45% or more of the population were college graduates.



Race and Hispanic Origin

Washington's age-adjusted coronary heart disease death rate during 2009–2011 was highest among Native Hawaiians and other Pacific Islanders (163 deaths per 100,000 people) and American Indians and Alaska Natives (160 deaths per 100,000 people). Based on age-adjusted coronary heart disease death rates from CDC WONDER, American Indians and Alaska Natives in Washington had a higher age-adjusted coronary heart disease death rate than the United States (106 deaths per 100,000 people in 2010). Age-adjusted rates for blacks, whites and Hispanics were all lower than the national rate. Comparable national rates were not available for Asians or Native Hawaiians and other Pacific Islanders.



Other Measures of Impact and Burden

Hospitalizations. In 2011, 70,050 Washington hospitalizations (11% of all hospitalizations) included a diagnosis of coronary heart disease. For 17,501 of these hospitalizations, coronary heart disease was listed as the primary diagnosis (3% of all hospitalizations). Hospital charges totaled \$1.2 billion for hospitalizations with coronary heart disease as the primary diagnosis.

In Washington, age-adjusted hospitalization rates with coronary heart disease listed as the primary diagnosis moderately declined from 631 hospitalizations per 100,000 people in 1990 to 562 hospitalizations in 1997. Since 1997, rates have sharply declined to 239 hospitalizations per 100,000 people in 2011.

Patterns of hospitalization by age and gender mirror those for coronary heart disease deaths. During 2009–2011, men were 2–3 times more likely to be hospitalized for coronary heart disease as women. While hospitalization rates increase with age, in 2011, 43% of hospitalizations with coronary heart disease as the primary diagnosis were among Washington residents less than 65 years.

Prevalence of coronary heart disease. Self-reported data from the [Behavioral Risk Factor Surveillance System \(BRFSS\)](#) for 2011 showed that 5% ($\pm < 1\%$) of Washington adults were ever told by a doctor, nurse or other health professional they had coronary heart disease, angina or a heart attack. This is only slightly lower than the national prevalence of 6% ($\pm < 1\%$).

Data for 2009–2011 showed patterns of coronary heart disease with respect to age, gender, economic factors and education were similar to those for death from coronary heart disease. Similar to national data, reporting of coronary heart disease is highest among American Indian and Alaska Native adults (11% $\pm 4\%$).

Risk and Protective Factors

Atherosclerosis, the build-up of a fatty cholesterol plaque inside arteries, is the typical process that leads to coronary heart disease. Atherosclerosis usually develops when one or more risk factors are present. Each of the risk factors discussed below independently

increases the chance of developing coronary heart disease. People with fewer risk factors have a greater life expectancy than those who have more risk factors.¹¹

High blood pressure (hypertension). People with hypertension (blood pressure is 140/90 mmHg or higher) have a two to four times greater risk of developing coronary heart disease than those who do not have high blood pressure.¹² Even those with pre-hypertension (blood pressure levels between 120/80mmHg and 140/90mmHg) are at an increased risk for heart disease.

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% ($\pm 1\%$) 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 coronary heart disease: higher for men than women and increases with increasing age and with decreasing income and education. Similar to national data, reporting of high blood pressure is highest among black adults (40% $\pm 6\%$).

High LDL cholesterol. While cholesterol is an important component of a healthy body, too much low-density lipoprotein (LDL) cholesterol can increase the risk of developing coronary heart disease. High LDL cholesterol is reflected in overall high total cholesterol levels. High LDL cholesterol can be a result of genetic predisposition, or it can be caused by lifestyle, such as diets high in saturated and trans fats. Weight, physical activity and exposure to tobacco smoke also affect cholesterol levels.¹³

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% ($\pm 1\%$) 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 coronary heart disease: higher for men than women and increases with increasing age and with decreasing income and education.

Tobacco use. In Washington, smoking accounted for about 18% of all deaths from coronary heart disease among adults age 35 and older during 2000–2004.¹⁴ In addition, nonsmokers who are exposed to secondhand smoke at home or at work increase their risk of developing heart disease by

25–30%.¹⁵ In 2011, 17% ($\pm 1\%$) of Washington adults reported smoking. (See [Tobacco Use](#).)

Physical inactivity. People who are physically inactive are two times more likely to develop coronary heart disease than those who are physically active. The lack of sufficient physical activity at moderate or vigorous intensity is as important a risk factor for developing coronary heart disease as high blood cholesterol, high blood pressure or cigarette smoking.¹⁶ In 2011, 46% ($\pm 1\%$) of Washington adults did not get enough aerobic physical activity. (See [Physical Activity](#).)

Obesity. Excess weight is associated with increased risk of risk of coronary heart disease among men and women, both alone and in combination with comorbid conditions. A study in 2010 suggests that more than a third of newly diagnosed coronary heart disease may be attributed to excess weight.¹⁷ In 2011, 27% ($\pm 1\%$) of Washington adults had a body mass index indicating obesity (based on their self-reported heights and weights). (See [Obesity and Overweight](#).)

Diabetes. Adults with diabetes have coronary heart disease death rates that are about two to four times higher than those for adults without diabetes.¹⁸ In 2011, 9% ($\pm 1\%$) of Washington BRFSS respondents reported having diabetes. (See [Diabetes](#).) 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 cardiovascular disease.¹⁹

Other factors. Psychosocial stress and depression increase risk for heart disease and heart attack, and can also make it more difficult to manage the conditions and lifestyles that cause heart disease.²⁰ A diet low in fruits and vegetables and exposure to air pollution also increase risk for heart attack.^{21,22}

Knowledge of signs of heart attack. Reducing time to treatment for heart attack and cardiac arrest saves lives and reduces disability by minimizing damage to the heart and brain.^{23,24,25} Most people recognize a “Hollywood” heart attack characterized by crushing chest pain and shortness of breath. But for many, especially women, the symptoms can be less obvious.²⁶ Many people delay seeking treatment, not understanding their symptoms or that time is critical to survival and minimizing disability.

In 2011, only 24% ($\pm 1\%$) of BRFSS respondents were able to recall at least four signs and symptoms of a heart attack out of eight. Most respondents (92% $\pm 1\%$) correctly reported calling 911 as the first thing to do if they witnessed someone having a heart attack. Despite this, the median delay time from symptom onset to hospital arrival ranges from 1.5 to 6.0 hours,²⁷ and many people arrive by car rather than ambulance.

Protective factors. In addition to living a healthy lifestyle, and preventing and managing risk factors described above, studies show appropriate aspirin therapy²⁸ and light to moderate alcohol consumption²⁹ are associated with reduced risk of coronary heart disease.

Intervention Strategies

Environmental and policy changes to promote healthy eating and active, smoke-free living.

Public health strategies to prevent the conditions that cause heart disease 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 and low in salt, saturated and trans fats, and cholesterol;³⁰ being physically active; and not smoking. Specific strategies are covered in the [Tobacco Use](#), [Physical Activity](#), [Nutrition](#) and [Obesity and Overweight](#) chapters.

Increase the use of clinical preventive services.

Four preventive services, known as the ABCS, are particularly effective in reducing deaths from heart disease:³¹

- **A**ppropriate aspirin therapy. For people who have experienced a heart attack or stroke, aspirin can help control heart disease and prevent a second heart attack. Aspirin can also prevent heart disease and stroke in some individuals who have not experienced these events.²⁸ However, aspirin therapy is not recommended for everyone. People should ask their doctor before taking aspirin for prevention.
- **B**lood pressure control. Numerous studies have shown that lowering blood pressure reduces risk for heart attack by 20–25%, stroke by 35–40%, and heart failure by 50%.³²
- **C**holesterol management. Maintaining low levels of low density lipoprotein (LDL or “bad” cholesterol) significantly reduces the risk of developing or dying from coronary heart

disease.³³ Lifestyle changes and cholesterol-lowering medications are effective in reducing LDL levels, but too often, people do not follow their treatment plans. Using a multidisciplinary team to help patients follow treatment on a long-term basis has been shown to increase adherence.³⁴

- **Smoking cessation.** The risk of heart disease is cut in half one year after quitting smoking and continues to decrease over time. Quitting smoking can lower heart disease risk as much as, or more than, common medicines used to lower heart disease risk, including aspirin, and medications to control cholesterol (statins) and blood pressure (beta-blockers and ACE inhibitors).³⁵

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.³⁶ 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. Medical and health homes can be effective in increasing access to care, and helping people reduce cholesterol, blood pressure and blood sugar levels.³⁷ They may also help patients manage depression and other mental health conditions. This is essential because treating depression can help manage heart disease and improve overall health.³⁸

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.

Reduce sodium intake. Reducing salt in the diet can help prevent and control hypertension, a major risk factor for coronary heart disease. 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.³⁹

The main strategy to reduce salt consumption recommended by the Institute of Medicine is to have the Food and Drug Administration set mandatory national standards for the sodium content in foods. 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.⁴⁰

Diabetes prevention and control. Diabetes is a major risk factor for coronary heart disease. Many of the interventions listed in this section are also important for diabetes prevention and control. (See [Diabetes](#) for strategies for preventing and controlling diabetes.)

Coordinated system of emergency response and treatment. Fast treatment for heart attack and cardiac arrest improves patient outcomes by reducing damage to the heart and brain.^{23,24}

Washington State's Emergency Cardiac and Stroke System is designed to reduce the time it takes to get heart attack and cardiac arrest patients to treatment through a comprehensive, coordinated systems approach. Internal and regional quality improvements, as well as secondary prevention to address coronary heart disease risk factors, are part of the system. Several hospitals in Washington have shown large reductions in time to treatment for heart attack.⁴¹ (See [Trauma and Emergency Cardiac and Stroke Systems](#) chapter.)

Cardiopulmonary resuscitation (CPR) and therapeutic hypothermia. Campaigns to teach the public to perform CPR and make automatic defibrillators more available have been effective in increasing survival from sudden cardiac arrest or a stopping of the heart that is often caused by coronary heart disease. Such efforts in King County increased cardiac arrest survival rates to 52% in 2011 compared to around 10% for the nation.⁴² In 2013, SB 1665 was signed into law requiring that high school students receive training in CPR as part of state-mandated health classes before graduation.

Therapeutic hypothermia, or "cooling" a patient who has survived cardiac arrest, is another effective but underused intervention. It improves brain function, which can be impaired due to lack of oxygen when a person's heart stops beating.²⁵ In an effort to

increase the use of this intervention, hospitals participating in the Emergency Cardiac and Stroke System are required to have a therapeutic hypothermia protocol in place.

Cardiac rehabilitation. People who have had a heart attack or heart surgery, or who suffer from angina (chest pain from coronary heart disease) or congestive heart failure can benefit from cardiac rehabilitation. It is a comprehensive intervention that includes nutritional counseling, weight management, blood pressure control, cholesterol and diabetes management, tobacco cessation, physical activity, and medication management to manage coronary heart disease and prevent a second heart attack or other complications.⁴³ In 2009, only 25% ($\pm 8\%$) of Washington adults who had a heart attack reported going to any kind of outpatient rehabilitation. Insurance coverage and co-payments influence use of rehabilitation services.⁴⁴

Evidence shows cardiac rehabilitation is cost-effective; reduces mortality, symptoms, hospitalizations and use of medical resources; increases ability to exercise, perform activities of daily living, return to work and participate in leisure activities; improves psychosocial symptoms (reversal of anxiety and depression, increased self-efficacy) and health-related quality of life.^{45,46,47}

See Related Chapters: [Stroke](#), [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.

Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999–2010 on CDC WONDER Online Database, released January 2013. Data are compiled from Compressed Mortality File 1999–2010 Series 20 No. 2P, 2013. Accessed at <http://wonder.cdc.gov/cmfi-icd10.html>.

Washington 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.

Oregon 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.

Oregon 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 and 2001–2009 intercensal and 2011 post-censal estimates; Washington State Office of Financial Management, Forecasting Division (OFM), released January 25, 2013; 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: 1987–2011. Olympia, WA: Washington State Department of Health, under federal cooperative agreement numbers: U58/CCU002118 (1987–2003), U58/CCU022819 (2004–2008), U58/DP001996 (2009–2010), or U58/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, GA [1991–2011]; 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 ICD10, see the department's Center for Health Statistics ICD-10 Information Page at <http://www.doh.wa.gov/DataandStatisticalReports/VitalStatistics/Data/DeathData/ICD10.aspx>.

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

Hospitalization data does not include hospitalizations for Washington residents from U.S. Department of Veterans Affairs 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 coronary heart disease would be larger. Data from Oregon hospitals serving Washington residents of border counties are included.

For More Information

Washington State Department of Health, Heart, Stroke, and Diabetes Program: (360) 236-3799.

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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Endnotes

¹ Wijeysondera HC, Machado M, Farahati F, et al. Association of temporal trends in risk factors and treatment uptake with coronary heart disease mortality, 1994–2005. *JAMA*. 2010;303(18):1841-1847.

² Ford ES, Ajani UA, Croft JB, et al. Explaining the decrease in U.S. deaths from coronary disease, 1980-2000. *N Engl J Med*. 2007;356(23):2388-2398.

³ Keenan NL, Shaw KM: Centers for Disease Control and Prevention (CDC). Coronary heart disease and stroke deaths – United States, 2006. *MMWR Surveill Summ*. 2011;60(Suppl):62-66.

⁴ Keil JE, Sutherland SE, Knapp RG, Tyroler HA. Does equal socioeconomic status in black and white men mean equal risk of mortality? *Am J Public Health*. 1992;82(8):1133-1136.

⁵ Kucharska-Newton AM, Harald K, Rosamond WD, Rose KM, Rea TD, Salomaa V. Socioeconomic indicators and the risk of acute coronary heart disease events: comparison of population-based data from the United States and Finland. *Ann Epidemiol*. 2011;21(8):572-579.

⁶ Pollitt RA, Rose KM, Kaufman JS. Evaluating the evidence for models of lifecourse socioeconomic factors and cardiovascular outcomes: a systematic review. *BMC Public Health*. 2005;5:1-13.

⁷ Steenland K, Henley J, Calle E, Thun M. Individual- and area-level socioeconomic status variables as predictors of mortality in a cohort of 179,383 persons. *Am J Epidemiol*. 2004;159(11):1047-1056.

⁸ Foraker RE, Rose KM, Kucharska-Newton AM, Ni H, Suchindran CM, Whitset EA. Variation in rates of fatal coronary heart disease by neighborhood socioeconomic status: the atherosclerosis risk in communities surveillance (1992–2002). *Ann Epidemiol*. 2011;21(8):580-588.

⁹ Alter DA, Chong A, Austin PC, et al. Socioeconomic status and mortality after acute myocardial infarction. *Ann Intern Med*. 2006;144(2):82-93.

¹⁰ Lang T, Lepage B, Schieber AC, Lamy S, Kelly-Irving M. Social determinants of cardiovascular diseases. *Public Health Rev*. 2012;33:601-622.

¹¹ Stamler J, Stamler R, Neaton JD, et al. Low risk-factor profile and long-term cardiovascular and noncardiovascular mortality and life expectancy: findings for 5 large cohorts of young adult and middle-aged men and women. *JAMA*. 1999;282(21):2012-2018.

¹² Brownson R, Remington P, Davis J. *Chronic Disease Epidemiology and Control*. 2nd ed. Washington, DC: American Public Health Association; 1998.

¹³ American Heart Association. *Prevention and Treatment of High Cholesterol*. Dallas, TX: American Heart Association; 2012. http://www.heart.org/HEARTORG/Conditions/Cholesterol/PreventionTreatmentofHighCholesterol/Prevention-and-Treatment-of-High-Cholesterol_UCM_001215_Article.jsp. Accessed October 22, 2012.

¹⁴ Centers for Disease Control and Prevention. *Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC)*. <https://apps.nccd.cdc.gov/sammec/index.asp>. Accessed August 21, 2013.

¹⁵ U.S. Department of Health and Human Services. *The Health Consequences of Involuntary Exposure to Tobacco Smoke: A Report of the Surgeon General*. Atlanta, GA: U.S. Department of Health and Human Services, Centers for Disease Control and Prevention, Coordinating Center for Health Promotion, National Center for Chronic Disease Prevention and Health Promotion, Office on Smoking and Health, 2006.

¹⁶ Warburton DE, Nicol CW, Bredin SS. Health benefits of physical activity: the evidence. *CMAJ*. 2006;174(6):801-809.

¹⁷ Flint AJ, Hu FB, Glynn RJ, et al. Excess weight and the risk of incident coronary heart disease among men and women. *Obesity (Silver Spring)*. 2010;18:377-383.

¹⁸ Centers for Disease Control and Prevention. *National diabetes fact sheet: national estimates and general information on diabetes and prediabetes in the United States, 2011*. Atlanta, GA: U.S. Department

of Health and Human Services, Centers for Disease Control and Prevention, 2011.

¹⁹ Ford ES, Zhao G, Li C. Pre-Diabetes and the Risk for Cardiovascular Disease: A Systematic Review of the Evidence. *J Am Coll Cardiol*. 2010;55(13):1310-1317.

²⁰ Lichtman JH, Bigger JT Jr, Blumenthal JA, et al. Depression and coronary heart disease: recommendations for screening, referral, and treatment: a science advisory from the American Heart Association Prevention Committee of the Council on Cardiovascular Nursing, Council on Clinical Cardiology, Council on Epidemiology and Prevention, and Interdisciplinary Council on Quality of Care and Outcomes Research: endorsed by the American Psychiatric Association. *Circulation*. 2008;118(17):1768-1775.

²¹ Yusuf S, Hawken S, Ounpuu S, et al. Effect of potentially modifiable risk factors associated with myocardial infarction in 52 countries (the INTERHEART study): case-control study. *Lancet*. 2004;364(9438):937-952.

²² Brook RD, Franklin B, Cascio W, et al. Air pollution and cardiovascular disease: a statement for healthcare professionals from the Expert Panel on Population and Prevention Science of the American Heart Association. *Circulation*. 2004;109(21):2655-2671.

²³ Rokos IC, Larson DM, Henry TD, et al. Rationale for establishing regional ST-elevation myocardial infarction receiving center (SRC) networks. *Am Heart J*. 2006;152(4):661-667.

²⁴ Jacobs AK, Antman EM, Faxon DP, Gregory T, Solis P. Development of systems of care for ST-elevation myocardial infarction patients: executive summary. *Circulation*. 2007;116(2):217-230.

²⁵ Nichol G, Aufderheide TP, Eigel B, et al. Regional systems of care for out-of-hospital cardiac arrest: A policy statement from the American Heart Association. *Circulation*. 2010;121(5):709-729.

²⁶ Canto JG, Rogers WJ, Goldberg RJ, et al. Association of age and sex with myocardial infarction symptom presentation and in-hospital mortality. *JAMA*. 2012;307(8):813-822.

²⁷ Moser DK, Kimble L, Alberts MJ, et al. Reducing delay in seeking treatment by patients with acute coronary syndrome and stroke: a scientific statement from the American Heart Association Council on Cardiovascular Nursing and Stroke Council. *Circulation*. 2006;114:168-182.

²⁸ U.S. Preventive Services Task Force. *Aspirin for the Prevention of Cardiovascular Disease*. Rockville, MD: U.S. Preventive Services Task Force; 2012. <http://www.uspreventiveservicestaskforce.org/uspstf/uspasmim>. Accessed October 22, 2012.

²⁹ Hvidfeldt UA, Tolstrup JS, Jakobsen MU, et al. Alcohol intake and risk of coronary heart disease in younger, middle-aged, and older adults. *Circulation*. 2010;121(14):1589-1597.

³⁰ Mente A, de Koning L, Shannon HS, Anand SS. A systematic review of the evidence supporting a causal link between dietary factors and coronary heart disease. *Arch Intern Med*. 2009;169(7):659-669.

³¹ Farley TA, Dalal MA, Mostashari F, Frieden TR. Deaths preventable in the U.S. by improvements in use of clinical preventive services. *Am J Prev Med*. 2010;38(6):600-609.

³² Neal B, MacMahon S, Chapman N; Blood Pressure Lowering Treatment Trialists' Collaboration. Effects of ACE inhibitors, calcium antagonists, and other blood-pressure-lowering drugs: results of prospectively designed overviews of randomised trials. Blood Pressure Lowering Treatment Trialists' Collaboration. *Lancet*. 2000;356(9246):1955-1964.

³³ National Cholesterol Education Program (NCEP) Expert Panel. *Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)*. Third Report, no. 02-5215. Bethesda, MD: National Institutes of Health, National Heart, Lung, and Blood Institute; 2002:II-4.

³⁴ National Cholesterol Education Program (NCEP) Expert Panel. *Detection, Evaluation, and Treatment of High Blood Cholesterol in Adults (Adult Treatment Panel III)*. Third Report, no. 02-5215. Bethesda, MD: National Institutes of Health, National Heart, Lung, and Blood Institute; 2002:II-54.

³⁵ National Heart Lung and Blood Institute. *What Are the Benefits of Quitting Smoking?* Bethesda, MD: U.S. Department of Health and Human Services, National Institutes of Health, National Heart, Lung, and Blood Institute; 2011. <http://www.nhlbi.nih.gov/health/health-topics/topics/smo/benefits.html>. Accessed December 21, 2012.

³⁶ Centers for Disease Control and Prevention. Million hearts: strategies to reduce the prevalence of leading cardiovascular disease risk factors--United States, 2011. *MMWR Morb Mortal Wkly Rep*. 2011;60(36):1248-1251.

³⁷ Nielsen M, Langner B, Zema C, Hacker T, Grundy P. *Benefits of implementing the primary care patient-centered medical home: A review of cost & quality results, 2012*. New York: Patient-Centered Primary Care Collaborative; 2012.

³⁸ National Institute of Mental Health. *Depression and Heart Disease*. Bethesda, MD: National Institute of Mental Health (NIMH); 2011. <http://www.nimh.nih.gov/health/publications/depression-and-heart-disease/complete-depression-and-heart-disease.shtml>. Accessed October 22, 2012.

³⁹ Centers for Disease Control and Prevention. Vital signs: prevalence, treatment, and control of hypertension--United States, 1999-2002 and 2005-2008. *MMWR Morb Mortal Wkly Rep*. 2011;60(4):103-108.

⁴⁰ Institute of Medicine of the National Academies. *Strategies to Reduce Sodium Intake in the United States*. Report Brief. Washington, DC: National Academy of Sciences; 2010:1-4.

⁴¹ Clinical Outcomes Assessment Program (COA), Foundation for Health Care Quality/CathPCI® Registry, American College of Cardiology (ACC) Foundation.

⁴² Division of Emergency Medical Services (EMS). *EMS 2012 Annual Report*. Seattle, WA: Public Health—Seattle and King County; 2012.

⁴³ Leon AS, Franklin BA, Costa F, et al. Cardiac rehabilitation and secondary prevention of coronary heart disease: an American Heart Association scientific statement from the Council on Clinical Cardiology (Subcommittee on Exercise, Cardiac Rehabilitation, and Prevention) and the Council on Nutrition, Physical Activity, and Metabolism (Subcommittee on Physical Activity), in collaboration with the American association of Cardiovascular and Pulmonary Rehabilitation. *Circulation*. 2005;111(3):369-376.

⁴⁴ Balady GJ, Ades PA, Bittner VA, et al; American Heart Association Science Advisory and Coordinating Committee. Referral, enrollment, and delivery of cardiac rehabilitation/secondary prevention programs at

clinical centers and beyond: a presidential advisory from the American Heart Association. *Circulation*. 2011;124(25):2951-2960.

⁴⁵ Papadakis S, Oldridge NB, Coyle D, et al. Economic evaluation of cardiac rehabilitation: a systematic review. *Eur J Cardiovasc Prev Rehabil*. 2005;12(6):513-520.

⁴⁶ Balady GJ, Williams MA, Ades PA, et al. Core components of cardiac rehabilitation/secondary prevention programs: 2007 update: a scientific statement from the American Heart Association Exercise, Cardiac Rehabilitation, and Prevention Committee, the Council on Clinical Cardiology; the Councils on Cardiovascular Nursing, Epidemiology and Prevention, and Nutrition, Physical Activity, and Metabolism; and the American Association of Cardiovascular and Pulmonary Rehabilitation. *J Cardiopulm Rehabil Prev*. 2007;27(3):121-129.

⁴⁷ American Association of Cardiovascular and Pulmonary Rehabilitation. *About Cardiovascular & Pulmonary Rehabilitation*. Chicago, IL: American Association of Cardiovascular and Pulmonary Rehabilitation; 2012.

<https://www.aacvpr.org/About/AboutCardiacPulmonaryRehab/tabid/560/Default.aspx>. Accessed October 22, 2012.