

Drowning

Definition: Drowning occurs when breathing is impaired because a person's airway is blocked by immersion in water or another liquid. Drowning hospitalizations for 1989–2011 and deaths for 1980–1998 include all records with an ICD 9 code including E830, E832, or E910. For deaths during 1999–2011, the applicable ICD 10 codes include W65–W74, V90 or V92.

Summary

Swimming, boating and other forms of water recreation are among Washington State residents' most popular pastimes. Sometimes, these activities can be dangerous or fatal. In 2011, 93 Washington residents died from drowning, including incidents related to boating. Washington data from 2009–2011 show males and American Indians and Alaska Natives at higher risk for drowning than other groups. Drowning rates by age are difficult to assess in Washington due to large annual fluctuations.

Preventing drowning requires multiple strategies. Isolation fencing of swimming pools is well-established as a method to reduce drowning in pools. Some studies suggest that wearing a life jacket and swimming lessons also reduce the risk of drowning. Alcohol consumption is a risk factor for drowning. Washington's boating under the influence law was strengthened in 2013 to include the ability for law enforcement to require boat operators they suspect to be under the influence of alcohol to do breathalyzer tests or face fines, and increased fines and penalties.

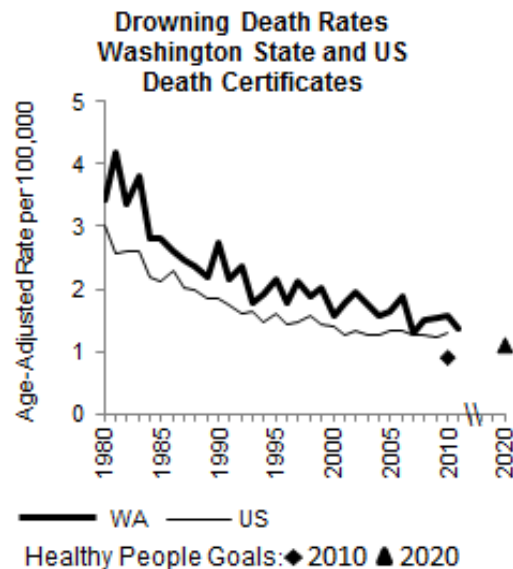
Time Trends

Washington's drowning rate declined significantly from 1980 to 1987. Since 1988, drowning rates have declined only slightly. Historically, Washington's drowning rates have been higher than the nation as a whole although the gap appears to be narrowing.

In 2010, the most recent year for which national data are available, the U.S. age-adjusted drowning rate was 1.3 per 100,000 people,

lower than the Washington rate of 1.6 per 100,000 people.

One study examining the decline in drowning rates in King County between 1975–1995 found that decreased use of alcohol in and around water explained 50% of the decline in unintentional drowning deaths, while improved medical treatment after a submersion did not account for any of the decline.¹

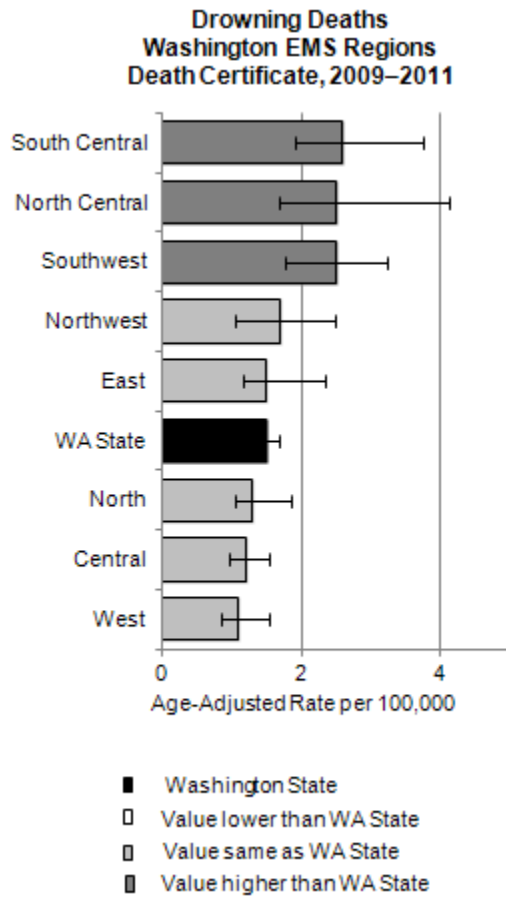


2010 and 2020 Goals

The national *Healthy People 2010* goal was to reduce the drowning rate to 0.9 drowning deaths per 100,000 people. In 2010 the age-adjusted drowning rate in Washington of 1.6 per 100,000 people indicates that we did not meet this goal.

The national *Healthy People 2020* goal is to reduce the age-adjusted rate of drowning to 1.1 per 100,000 people. If current trends continue, Washington will likely meet this national target.

Geographic Variation



For 2009–2011, South Central, North Central and Southwest emergency medical service (EMS) regions had age-adjusted drowning death rates higher than the state rate. These rates are based on where the decedent lived, not where the drowning occurred. For 2009-2011, 62% of drowning deaths occurred in the same county where the person lived. (See the [Department of Health EMS and Trauma Region webpage](#) for a description of these regions.)

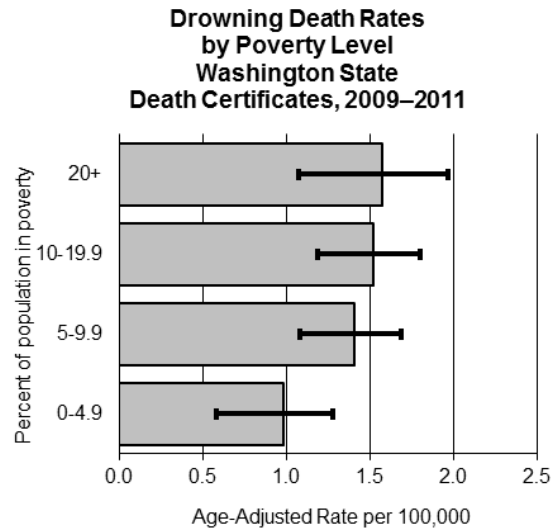
Age and Gender

In Washington as elsewhere, males in all age groups are more likely than females to die from drowning. For 2009–2011 combined, overall rates were 2.0 per 100,000 male residents compared to 0.6 per 100,000 for females. Differences in death rates by age group are difficult to assess in Washington because the relatively small numbers of deaths in each age group can result in large annual fluctuations. Nationally, females four years old or younger,

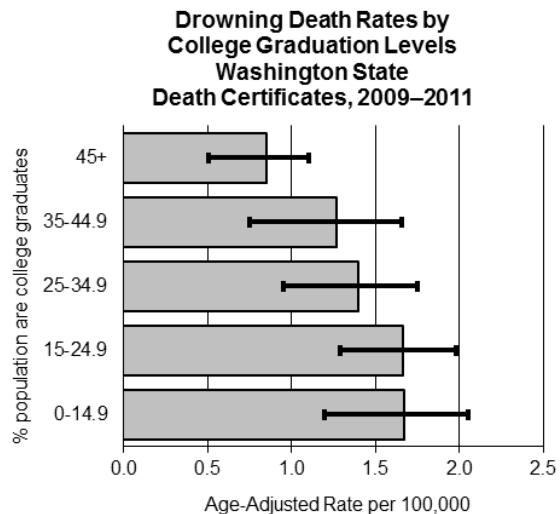
and males from one to four years old and 85 years old and older are at high risk.²

Economic Factors and Education

In Washington for 2009–2011 combined, there was not a clear relationship between neighborhood poverty and drowning. However, drowning death rates were highest among people living in areas where 10% or more of the population lived in poverty and lowest for people in areas where less than 5% lived in poverty.



In Washington for 2009–2011 combined, age-adjusted drowning rates were highest among people living in neighborhoods where less than 25% of adults ages 25 and older graduated from college and lowest for those in neighborhoods where at least 45% graduated from college.

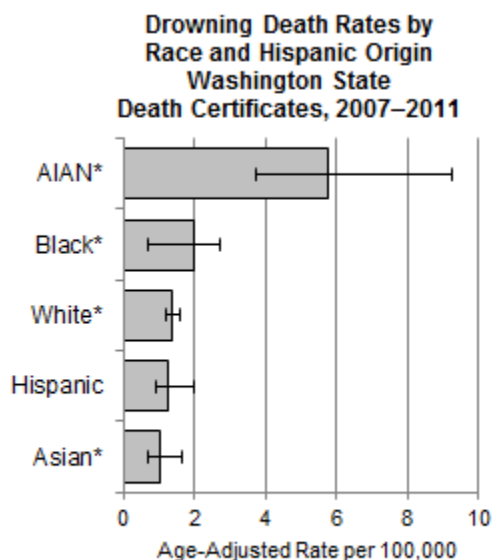


National data describing the relationship of drowning to economic factors and education are not available for comparison.

Race and Hispanic Origin

In Washington during 2009–2011, age-adjusted drowning rates were highest for American Indians and Alaska Natives. Reasons for these high rates need are unknown and need to be explored.

Nationally, American Indians and Alaska Natives have drowning rates about twice as high as whites and Asians.³ National drowning rates for blacks are slightly higher than those for whites and Asians.³



* Non-Hispanic, single race only

Other Measures of Impact and Burden

Hospitalizations. In 2011, 46 people were hospitalized for submersion incidents. A submersion incident often produces extensive brain damage. Nationally, estimated costs of medical care for an initial stay in the hospital for a drowning victim range from \$2,000 to \$80,000. The lifetime costs of long-term care for one submersion incident that results in brain damage can be more than \$4.5 million.⁴ In Washington in 2010 data, 49 unintentional drowning hospitalizations cost an estimated \$17.7 million over the person's lifetime for medical expenses and work loss.⁵

Boating-related deaths. In Washington for 2009–2011 combined, there was an average of 15 boating-related deaths per year, resulting in a rate that is about four times the national rate.⁶ Of the boating-related drowning deaths in Washington during these three years, eight deaths occurred to commercial fishermen. Commercial fishermen have the highest occupational fatality rate, and about 80% of deaths while on the job are due to drowning.⁷

Risk and Protective Factors

Supervision and rescue skills. Lack of adequate supervision and rescue skills are risk factors for drowning among young children and people with pre-existing medical conditions, such as seizure disorders. Among people with seizure disorders, drowning is the most common cause of unintentional injury death, and the bathtub is the site of the highest drowning risk.⁸ In Washington from 2005 to 2011, the bathtub was also the most common location of infant drowning.

In Washington during 2007–2011, half of the drowning deaths of children ages one through four occurred in natural or open water, such as lakes, rivers and the ocean. Most swimming pool deaths also occurred in this age group. Most beach drowning deaths occurred when the beach was not guarded by a lifeguard.⁹ The risk of drowning at a beach with a lifeguard present is estimated at less than one in 18 million people.⁸

Alcohol. Drinking alcohol while engaged in water recreation activities is a major risk factor for drowning.⁸ In 2011, alcohol was involved in about 20% of all reported boating fatalities in the U.S.¹⁰ Alcohol use is also involved in about 25% to 50% of adolescent and adult water recreation deaths.¹¹ The likelihood of drowning death increases with increasing blood alcohol levels. Alcohol influences balance, coordination and risk taking, and any alcohol use increases not only the risk of injury, but also the severity.¹²

Pool barriers. The lack of barriers around all four sides of a pool or improperly designed and maintained barriers, especially around residential pools, increases the risk of drowning for young children.⁸

Personal flotation devices (PFDs). In 2011, 84% of boating-related fatalities in the United States involved victims who were not wearing a PFD or life jacket.¹⁰ In 2010, about 30% of Washington residents in small boats wore PFDs. Children 12 years old or younger were four times more likely to wear a PFD compared to teens and adults. Children

of all ages were more likely to wear a PFD while on a boat if the adults wore PFDs. PFD use was highest among those in personal watercrafts and kayaks, and about five times higher than among motor boat occupants, who had the lowest PFD use. PFD use was highest among those legally mandated to do so (i.e. those riding personal watercraft or while water skiing) and children.¹³ In the 2012 Washington State [Healthy Youth Survey](#), 54% ($\pm 2\%$) of 8th grade students, 41% ($\pm 2\%$) of 10th grade students, and 35% ($\pm 2\%$) of 12th grade students reported always wearing a PFD when boating. The percentage of students in all three grades who report always wearing a PFD when boating has increased since the 2002 Healthy Youth Survey.

Environmental factors. Cold water increases risk for drowning because it can cause a 'cold shock response,' which leads to inability to control breathing. Eventually hypothermia can occur, leading to decreased mental and physical performance. Both of these make it difficult to swim.¹⁴ Washington State lakes and rivers are cold enough to cause cold water shock 9–10 months of the year. When boating, risk of death is higher when boating on rough water, in a fast current, or in strong wind or storm conditions. However, the majority of boating accidents resulting in death occur during good water and weather conditions.¹⁵

Intervention Strategies

To date there have been few systematic evaluations of interventions designed to limit risk factors linked with drowning. The only well-researched effective intervention is isolation fencing of swimming pools.^{8,16} Other interventions need more rigorous evaluation to assure that they are effective and to identify the best methods for implementation. Strategies that have been attempted or considered include the following:

Promote installation and maintenance of pool barriers. Four-sided pool fencing with self-closing or self-latching gates significantly reduces the risk of drowning. Isolation fencing, which isolates the pool from the house, is superior to perimeter fencing (three-sided fencing with the house as the fourth side), because the latter allows access to the pool via the home.¹⁶

In support of this strategy, the department works with the building industry to enforce the federal

Virginia Graeme Baker Pool & Spa Safety Act and provides information on pool safety, barriers, supervision, and needed rescue skills and equipment when selling and installing pools.

Promote the use of life jackets. One study found that wearing a life jacket while boating reduced the risk of drowning by 49%.¹⁷ Another unpublished study in Washington State noted that boaters who died were 60% less likely to be wearing a life jacket compared to those who were non-fatally injured.¹⁸ The Washington State Open Water Drowning Prevention Policy Strategies include:

- Improving the Washington State child life jacket law to require children age 17 and under to wear life jackets while in boats. The current law applies to children younger than 13 years old on boats less than 19 feet long.
- Developing, passing and implementing policies requiring mandatory use of life jackets when on high-risk, high-use waterways, such as during springtime when rivers have higher than normal glacial melting or in a small fishing boat on the mouth of the Columbia River.
- Increasing the number of life jacket loaning programs at open water sites used by swimmers and boaters.
- Passing and implementing policies at the local level allowing life jackets in pools and at bathing beaches.¹⁹

Encourage policies and regulations that emphasize water safety. The Washington State Open Water Drowning Prevention Policy Strategies include:

- Developing and passing safer water recreation site standards for Washington State bathing beaches and swim areas. Guidelines being developed include safety recommendations for bather capacity and how to manage peak use times; removal of underwater obstructions; recommendations for floating platforms; hiring, training and staffing for lifeguards; and operating without lifeguards and recommended safety equipment.
- Promoting access to lifeguarded beaches during summer recreational months.
- Developing and implementing standards for water safety signs and symbols.
- Promoting open water safety rescue and training standards for group supervision settings, such as licensed child care providers and summer camp leaders.¹⁹

Promote swimming lessons for young children. Formal swimming lessons and water-safety skills

training can start at a young age. The American Academy of Pediatrics supports swimming lessons for children as young as one year old. The decision to begin swimming lessons should be based on the individual child's exposure to water, emotional maturity, physical limitations and health concerns.²⁰ Participation in formal swimming lessons may reduce the risk of drowning by as much as 88% among young children 1–4 years old.²¹ Other studies have also demonstrated reduced drowning risk for children ages 1–4, but it is unclear from studies if there are certain aspects of swimming instruction or water-survival skills that might be most beneficial.²⁰ Swimming lessons reduced drowning deaths among children ages 4–12 years in rural Bangladesh compared to children who did not receive swimming lessons.²² In contrast, one study of children 5–19 years old in the United States did not find an association between swimming lessons and drowning risk. In the same study, family members reported poorer survival skills and less comfort jumping into and playing in water over their heads for children who drowned compared to children of similar age, sex and county of residence who did not drown.²¹

Discourage the use of alcohol while in or around water. Alcohol consumption is a risk factor for drowning. The Washington State Open Water Drowning Prevention Policy Strategies includes a strategy to strengthen Washington State's current boating under the influence law. The law was strengthened in 2013 to include the ability for law enforcement to require boat operators they suspect to be under the influence of alcohol to do breathalyzer tests or face fines, and increased fines and penalties.¹⁹

Increase surveillance. The Washington State Open Water Drowning Prevention Policy Strategies includes:

- Developing and implementing standards for collecting data on drowning deaths to include toxicology screening, and for criteria for autopsy.
- Supporting the continuation of local and state child death reviews to identify risk factors for drowning deaths.
- Developing a comprehensive database to track all fatal and nonfatal drowning.¹⁹

Other education and health promotion measures. The effectiveness of drowning awareness education is unclear.⁸ Promising

approaches are focused on counseling for parents of young children by physicians or during home visits.^{23,24} Counseling focuses on supervision during bath time and swimming pool safety as well as encouraging swimming lessons.²⁰

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 November 2012.

Washington Hospitalization Data: Dataset compiled by the Washington State Department of Health, Center for Health Statistics from the Washington Comprehensive Hospitalization Abstract System, Oregon Hospital Discharge data, and Veterans Hospital Administration datasets, December 2012.

Washington Healthy Youth Survey: Office of Superintendent of Public Instruction, Washington State Departments of Health, Social and Health Services, and Community, Trade, and Economic Development, the Family Policy Council, and RMC Research, 2013.

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.

National data: U.S. Centers for Disease Control and Prevention, National Center for Health Statistics. Compressed Mortality File 1999–2010. CDC WONDER On-line Database, compiled from Compressed Mortality File 1999–2010 Series 20 No. 2P, 2013. Accessed at <http://wonder.cdc.gov/cmfi-icd10.html>.

For More Information

Department of Health Injury and Violence Prevention Program, (360) 236-2800
<http://www.doh.wa.gov/YouandYourFamily/InjuryandViolencePrevention.aspx>

Drowning Prevention and Water Safety Prevention for All Ages, prepared by the Washington State Drowning Prevention Network and by Seattle Children's Hospital,
<http://www.seattlechildrens.org/classes-community/community-programs/drowning-prevention/>

Centers for Disease Control and Prevention,
<http://www.cdc.gov/HomeandRecreationalSafety/Water-Safety/index.html>

U.S. Coast Guard—Boating Safety <http://www.uscgboating.org/>

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Endnotes

- ¹ Cummings P, Quan L. Trends in unintentional drowning. The role of alcohol and medical care. *JAMA*. 1999;281:2198-2202.
- ² Xu, J. Average Annual Death Rates from Drowning, by Sex and Age Group — United States, 1999–2010. *MMWR Morb Mortal Wkly Rep*. 2013; 62(34):706.
- ³ Centers for Disease Control and Prevention. *Fatal injury data, 2008–2010*. Web-based Injury Statistics Query and Reporting System. http://www.cdc.gov/injury/wisqars/fatal_injury_reports.html. Accessed December 20, 2012.
- ⁴ Ellis AA, Trent RB. Hospitalization for near drowning in California: incidence and costs. *Am J Public Health*. 1995;85(8):1115-1118.
- ⁵ Centers for Disease Control and Prevention. *Cost of injury reports*. Web-based Injury Statistics Query and Reporting System. <http://wisqars.cdc.gov:8080/costIT/>. Accessed July 11, 2013.
- ⁶ Centers for Disease Control and Prevention, National Centers for Injury Prevention and Control. CDC Wonder. *2009–2010 detailed mortality data*. <http://wonder.cdc.gov/>. Accessed February 11, 2013.
- ⁷ Lucas D, Lincoln J. Fatal and Nonfatal Injuries Involving Fishing Vessel Winches – Southern Shrimp Fleet, United States, 2000–2011. *MMWR Morb Mortal Wkly Rep*. 2013;62(09):157-160.
- ⁸ Quan L, Bennett E, Branche C. Interventions to prevent drowning. In Doll L, Bonzo S, Mercy J, Sleet D, eds. *Handbook of injury and violence prevention*. New York, NY: Springer; 2006:81-96.
- ⁹ Washington State Department of Health. Child Death Review Database, Maternal and Child Health Assessment, includes deaths reviewed as of June 2006.
- ¹⁰ U.S. Coast Guard. *Recreational Boating Statistics 2011*. www.uscgboating.org/statistics/accident_statistics.aspx. Accessed on February 11, 2013.
- ¹¹ Driscoll TR, Harrison JA, Steenkamp M. Review of the role of alcohol in drowning associated with recreational aquatic activity. *Inj Prev*. 2004;10:107-113.
- ¹² Guillemont J, Girard D, Arwidson P, Basset B. Alcohol as a risk factor for injury: lessons from French data. *Int J Inj Contr Saf Promot*. 2009;16(2):81–87.
- ¹³ Quan L, Kemic M, Bennett E, et al. *Washington State Boating Personal Floatation Device (PFD) Use Report*. Seattle, WA: Seattle Children's Hospital, Harborview Injury Prevention and Research Center; April 2011. <http://www.seattlechildrens.org/pdf/2010-washington-state->

[personal-floatation-device-use-report.pdf](#). Accessed February 11, 2013.

- ¹⁴ Giesbrecht GG. Cold stress, near drowning and accidental hypothermia: a review. *Aviat Space Environ Med*. 2000;71(7):733-752.
- ¹⁵ Schiff M, Quan L, Stempksi S, et al. *Washington State Boating Accident Report*, 2011.
- ¹⁶ Thompson DC, Rivara FP. Pool fencing for preventing drowning in children. *Cochrane Database Syst Rev*. 2000;CD001047.
- ¹⁷ Cummings P, Mueller BA, Quan L. Association between wearing a personal floatation device and death by drowning among recreational boaters: a matched cohort of United States Coast Guard data. *Inj Prev*. 2010;17(3):156-159.
- ¹⁸ Quan L. Unpublished data provided by email correspondence. Seattle, WA: Seattle Children's Hospital, July 2013.
- ¹⁹ Bennett E, Williams K. *Washington State Open Water Drowning Prevention Policy Strategies for Children and Youth, 2011–2016*. Seattle, WA: Seattle Children's Hospital; 2013. <http://www.doh.wa.gov/Portals/1/Documents/Pubs/971010.pdf>. Accessed April 25, 2013.
- ²⁰ Weiss J, American Academy of Pediatrics Committee on Injury, Violence, and Poison Prevention. Prevention of drowning. *Pediatrics*. 2010;126(1):253-262.
- ²¹ Brenner RA, Taneja GS, Haynie DL, et al. Association between swimming lessons and drowning in childhood: A case-control study. *Pediatrics*. 2009;163(3):203-210.
- ²² Rahman F, Bose S, Linnan M, et al. Cost-effectiveness of an injury and drowning prevention program in Bangladesh. *Pediatrics*. 2012;130(6):e1621-1628.
- ²³ Bass J, Christoffel KK, Widome M, et al. Childhood injury prevention counseling in primary care settings: a critical review of the literature. *Pediatrics*. 1993;92(4):544-550.
- ²⁴ Kendrick D, Barlow J, Hampshire A, Stewart-Brown S, Polnay L. Parenting interventions and the prevention of unintentional injuries in childhood: systematic review and meta-analysis. *Child Care Health Dev*. 2008;34(5):682-695.