

Oklahoma Drowning Report

CDC Foundation



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Acknowledgements

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Introduction

Oklahoma blends diverse geography and culture, with water playing a significant role in both its natural and human-made landscapes. The state has a population of around 4 million people and boasts more than 200 lakes.[1,2] Oklahoma also has over 78,000 miles[3] of rivers and streams, including the Arkansas and Red Rivers, which contribute to its rich geography. While Oklahoma lacks ocean coastline, its vast reservoirs, including Lake Eufaula, Grand Lake, Lake Texoma, Lake Hefner, Lake Thunderbird, Lake Murray, and many others provide extensive aquatic environments for recreation and industry. These bodies of water collectively support activities like fishing, boating, and tourism while contributing to local economies.

Oklahoma experiences a temperate climate, with hot summers and cold winters,[4] making water activities a cherished seasonal pastime. Recreational aquatic activities include boating, fishing, and swimming, often centered around the state's many lakes and reservoirs. The abundance of public and private swimming pools also reflects Oklahomans' affinity for water-based leisure.

Industries tied to water play an essential role in Oklahoma's economy. Agriculture relies on irrigation systems sourced from the state's numerous rivers and reservoirs. Additionally, water transportation on the McClellan-Kerr Arkansas River Navigation System supports shipping and commerce, linking Oklahoma to the Gulf of Mexico.[5] While the oil and gas industry dominates the state's economy, water resources are equally vital in ensuring sustainable development and growth.

Oklahoma's waterways have deep cultural and historical significance. For indigenous tribes, rivers have always been crucial for sustenance and trade and hold spiritual importance to this day.[6] The state's many man-made lakes are testaments to efforts in water management and flood control, shaping both its geography and cultural identity. From serene lakeside retreats to historic riverbanks, water continues to influence Oklahoma's way of life in profound ways.

Oklahoma is made up of 77 counties. To effectively manage health programs and resources, the Oklahoma State Department of Health (OSDH) has divided the state into 10 community health districts, grouping multiple counties together to provide coordinated services. In addition to these districts, two independent health departments, Oklahoma City-County Health Department and Tulsa Health Department operate separately to serve the largest metropolitan areas.

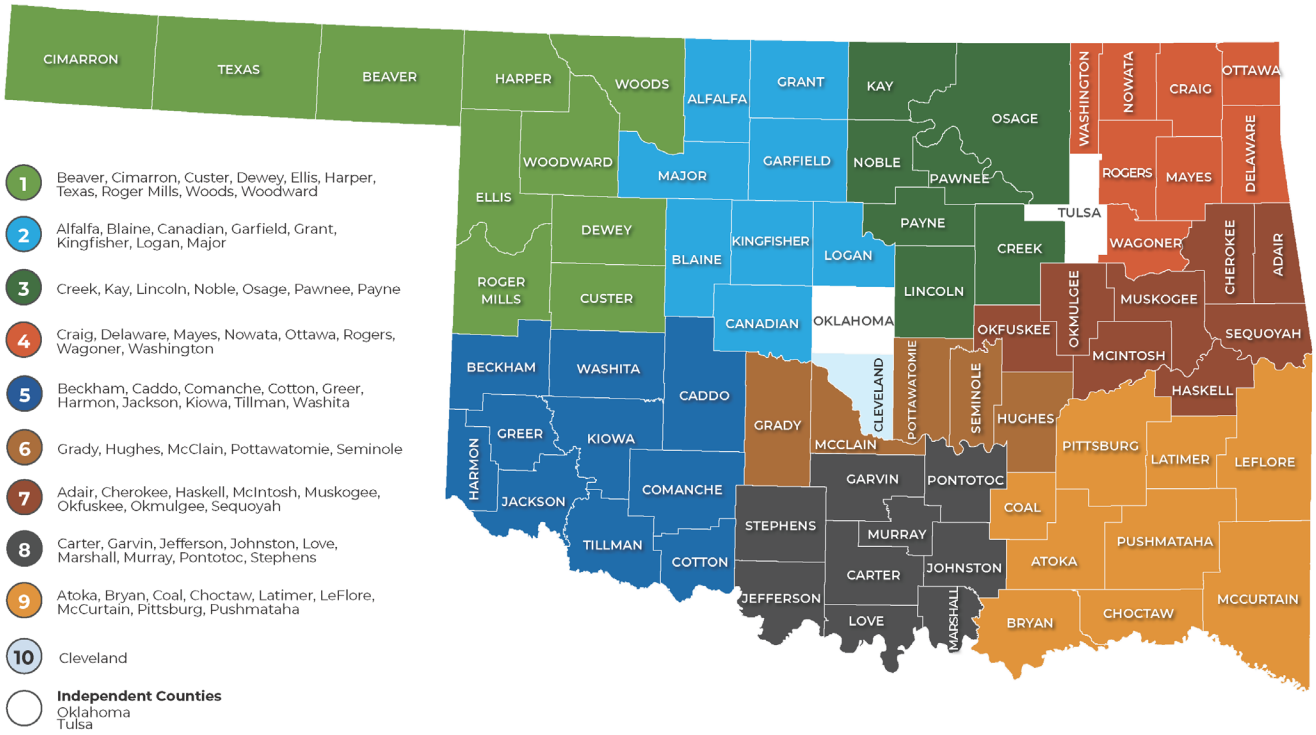
[1] www.census.gov
[2] https://earthsmaps.com/north-america/united-states/oklahoma/
[3] www.Rivers.gov/Oklahoma
[4] https://www.ou.edu/ocs/oklahoma-climate
[5] https://en.wikipedia.org/wiki/McClellan%E2%80%93Kerr_Arkansas_River_Navigation_System
[6] As long as the waters flow: Native American Water Policy in Oklahoma (ojs.library.okstate.edu)

While drowning can occur at any age, it is the leading cause of death among children aged 1–4 years.[7] The Injury Prevention Service (IPS) within the OSDH collects and shares drowning data with partners and the public, through the IPS drowning website and news releases. Despite its importance as the leading cause of death in children aged 1–4, drowning prevention is a low priority for public health initiatives in Oklahoma. While the OSDH supports state and national prevention strategies, there are no dedicated drowning prevention programs due to limited funding, competing priorities, and staffing constraints.

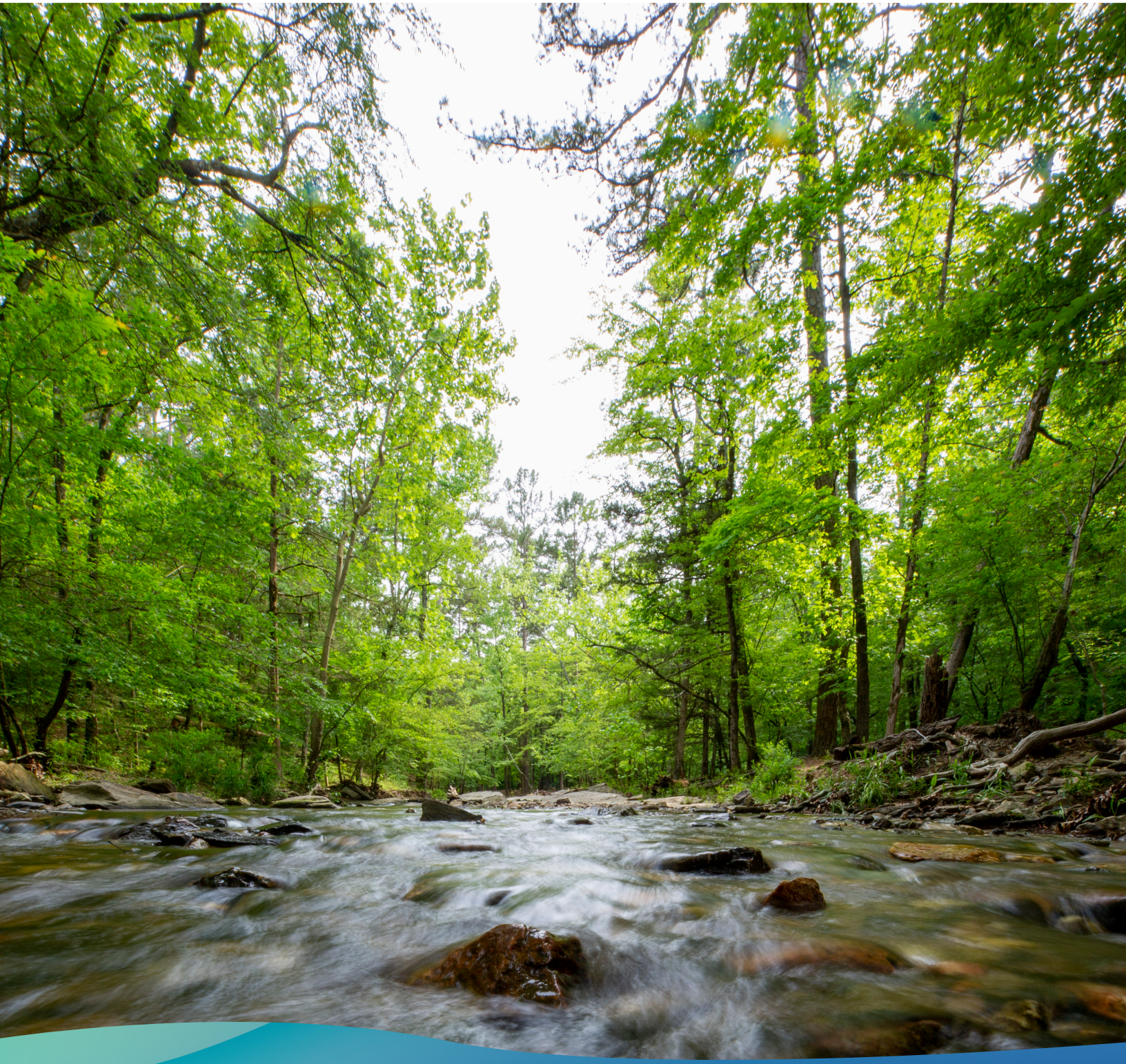
However, organizations such as Safe Kids Oklahoma support the drowning prevention mission by educating communities on water safety, equipping parents and caregivers with the knowledge to prioritize supervision and implement safety precautions, encouraging pool barriers, and promoting personal flotation device use.[8] Many organizations support drowning prevention by offering swimming lessons.

Collaboration among various stakeholders is required to strengthen the state's drowning prevention efforts.

Figure 1. Oklahoma map by county and district.



[7] https://oklahoma.gov/health/health-education/injury-prevention-service/drowning.html
[8] www.safekids.org/poolsafety



Situational assessment of drowning data in Oklahoma

Oklahoma maintains a statewide fatal drowning surveillance database, overseen by the IPS within the OSDH. The database relies on medical examiner (ME) reports. Each day, the Office of the Chief Medical Examiner sends reports of all non-natural deaths, including drowning, to the IPS via email as PDF attachments. These reports provide information such as demographics, location and time of the incident, circumstances surrounding the drowning, rescue and revival attempts, some medical history, water body description, toxicology, and autopsy findings. While death certificate data include additional variables and International Classification of Diseases, Tenth Revision (ICD-10) codes, they do not include details about the circumstances of drowning incidents. IPS personnel review and input information from the ME reports into the fatal drowning surveillance database.

In addition to fatal drowning data, the IPS has access to non-fatal drowning information from hospitalization and emergency department (ED) datasets. Inpatient hospitalization (referred to in this report as hospitalization) data are available from 2006, and ED data are available from 2022. However, these datasets lack details on location and time, circumstances surrounding the drowning, and water body description (Figure 2).

Drowning data are shared in news releases and upon requests with partners and the public. These data have also been included in a comprehensive injury epidemiological profile and drowning fact sheet. Annually, drowning data are submitted to the U.S. Centers for Disease Control and Prevention (CDC) as part of the State Injury Indicators report. Oklahoma currently lacks a statewide syndromic surveillance system, though the two largest counties within the state have established localized systems. The OSDH is actively working to develop a coordinated statewide system. However, existing data are limited to specific counties and are not representative of the entire state. Furthermore, these data have not been utilized for drowning surveillance.

The CDC Foundation created a survey to assess existing drowning data sources, explore their usage, and evaluate the capacity for enhanced surveillance efforts. The questionnaire was distributed to various agencies, partners, and stakeholders potentially connected to drowning prevention efforts in Oklahoma. Its purpose was to gather insights into key data and implementation needs to enhance prevention measures. A total of eight responses were received from seven organizations–River Parks Authority, Grand River Dam Authority, Oklahoma Academy of Family Physicians, Safe Kids Tulsa Area, Oklahoma Department of Wildlife Conservation, Department of Human Services, and Oklahoma State Department of Health.

Figure 2. Percentage of reported variable access by organization type and data source.

Organization Type	Data Source Type	Activity	Age	Alcohol/Drug Use	Comorbidities	Date of Drowning	Environmental Conditions	Location	PFD Usage	Race/Ethnicity	Rescue Attempted	Sex	Structural Barriers	Supervision	Swim Ability	Time of Drowning	Water Type	Other
		Variables																
State government agency/ department	Child Death Review	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%
	Child welfare	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%	100%	100%	0%
	Civil Registration and Vital Stats	0%	100%	0%	0%	100%	0%	100%	0%	100%	0%	100%	0%	0%	0%	100%	0%	0%
	Emergency Department	0%	100%	0%	100%	0%	0%	0%	0%	100%	0%	100%	0%	0%	0%	0%	0%	0%
	Emergency Medical Services	100%	100%	0%	100%	100%	0%	100%	0%	100%	0%	100%	0%	0%	0%	100%	100%	0%
	Hospital	0%	100%	0%	100%	0%	0%	0%	0%	100%	0%	100%	0%	0%	0%	0%	0%	0%
	Law Enforcement	50%	50%	50%	0%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	50%	100%
	Maritime / Boating	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	0%
	Syndromic Surveillance	0%	100%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%

The results indicated that data from lifesaving drowning prevention organizations, civil registration and vital statistics registers, media reports, ED visits, maritime boating safety, emergency medical services, and syndromic surveillance would be most valuable for informing drowning prevention program needs.

Respondents identified several variables that would be most beneficial to collect for drowning prevention program planning. These included life jacket use, type of body of water, activity at the time of drowning, fatal vs non-fatal, swimming skill, rescue attempt, drug or alcohol use, and weather conditions.

Respondents identified competing priorities, inconsistent funding, limited dedicated staff, and insufficient community engagement as key challenges to drowning surveillance in Oklahoma. The types of support considered most helpful to initiate, continue, or expand drowning prevention work included implementation of state/national drowning prevention strategies, access to technical tools and written guidance, and awareness-raising initiatives.



Lake Murray State Park with the Historic Tucker Tower in the background. Photo courtesy of the Oklahoma Tourism & Recreation Department.

Figure 3. Percentage of reported data usage by organization type and data source.

Organization Type	Data Source Type	Data Usage: Awareness	Linked w/ Other Data	Not Used	Program Implmentation/M&E	Public Facing Reports	Recordkeeping	Report/Data Sharing	Resource Allocation	Surveillance	Other
State government agency/ department	Child Death Review	0%	0%	0%	100%	100%	0%	100%	0%	0%	0%
	Child welfare	0%	0%	0%	100%	100%	100%	100%	0%	0%	0%
	Civil Registration and Vital St..	0%	0%	0%	0%	100%	0%	100%	0%	100%	0%
	Emergency Department	0%	0%	0%	0%	0%	0%	100%	0%	0%	0%
	Emergency Medical Services	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%
	Hospital	0%	0%	0%	0%	100%	0%	100%	0%	0%	0%
	Law Enforcement	50%	0%	0%	0%	50%	50%	50%	0%	0%	50%
	Maritime / Boating	100%	100%	0%	100%	100%	100%	100%	100%	0%	0%
	Syndromic Surveillance	0%	0%	100%	0%	0%	0%	0%	0%	0%	0%



Burden and circumstances of drowning in Oklahoma

The International Classification of Disease 10th revision (ICD-10) codes were used to identify drowning deaths and ICD-10 Clinical Modification (ICD-10-CM) codes were used to identify drowning-related emergency department visits and hospitalizations; Table 1 shows specific ICD-10 and ICD-10-CM codes. To better understand the full burden of drowning, expanded inclusion criteria for drowning deaths and hospitalizations were developed and used throughout this report. Deaths reported through the OSDH Center for Health Statistics from 2009 to 2023 were identified as unintentional drowning if there was an unintentional drowning ICD-10 code in either the underlying cause of death or multiple causes of death fields. This differs from the approach typically used for identifying fatal drowning, which only utilizes the underlying cause of death field. Intentional drowning and drowning deaths of undetermined intent were also identified using the same approach.

Non-fatal drowning data were obtained from the OSDH Center for Health Statistics' Hospital Discharge Data. Over 95% of eligible health care facilities in Oklahoma participate in submitting ED and hospitalization data. ED visit data were limited to visits that did not result in hospitalization or death. Hospitalization data were limited to hospitalizations that did not result in death. Traditionally, hospitalizations are only considered drowning-related if the primary diagnosis is an injury-related code and there is a drowning-related ICD-10-CM code in a subsequent field, while ED visits are considered drowning-related if there is a drowning ICD-10-CM code anywhere in the record.[9] For this report, both ED visits and hospitalizations were identified as unintentional drowning if there was an ICD-10-CM code related to unintentional drowning anywhere in the record. ED visit data were limited to 2022 and 2023 due to completeness of available data and inpatient hospitalization data were limited to 2016 to 2023, due to coding changes from the ninth to 10th revision of ICD clinical modification codes. Intentional and undetermined intent drowning-related ED visits and hospitalizations were also identified using the expanded inclusion criteria.

Rates were calculated as the number of drowning deaths, ED visits or hospitalizations per 100,000 state residents overall and by year, sex, age group, race/ethnicity and region using population estimates from the U.S. Census Bureau (vintage 2023 estimates for 2020 to 2023, vintage 2020 estimates for 2010 to 2019, and intercensal 2010 estimates for 2009 from https://www2.census.gov/programs-surveys/popest/datasets/). Rates were age-adjusted to the 2000 U.S. standard population using the direct method[10], except for rates presented by age group, which were calculated as crude rates. The number of drowning-related deaths, ED visits, and hospitalizations were also calculated for incidents that occurred in Oklahoma among non-residents of Oklahoma. Unless otherwise noted, the focus of this report is on unintentional drowning-related incidents among state residents.

[9] Centers for Disease Control and Prevention. (2024). *State injury indicators: Instructions for preparing 2022 data* (CS348550-A). National Center for Injury Prevention and Control. https://www.cdc.gov/injury-core-sipp/media/pdfs/2024/06/CORRECTED-2022-Injury-Indicator-Instructions.pdf

[10] Anderson RN, Rosenberg HM. Age Standardization of Death Rates: Implementation of the Year 2000 Standard. National vital statistics reports; vol 47 no 3. Hyattsville, Maryland: National Center for Health Statistics,1998.

Table 1. International Classification of Disease 10th revision (ICD-10) and ICD-10-Clinical Modification (ICD-10-CM) codes used to identify drowning deaths (ICD-10) and emergency department (ED) visits and hospitalizations (ICD-10-CM).

Fatal

Unintentional drowning: Underlying cause of death = V90, V92, W65-W74 OR multiple cause of death = V90, V92, W65-W74 and the underlying cause of death ≠ X60-X99, Y00-Y34, Y87, U01-U03.

Intentional drowning: Underlying cause of death = X71, X92 OR underlying cause of death = X60-X99, Y00-Y09, Y87.0, Y87.1, U01-U03 and multiple cause of death = V90, V92, W65-W74, Y21, OR multiple cause of death = X71, X92 and underlying cause of death ≠ V90, V92, W65-W74, Y21.

Undetermined intent drowning: Underlying cause of death = Y21 OR underlying cause of death = Y10-Y34, Y87.2 and multiple cause of death = V90, V92, W65-W74, X71, X92 OR multiple cause of death = Y21 and underlying cause of death ≠ V90, V92, W65-W74, X71, X92.

T75.1: In the multiple cause of death field, T75.1 is considered unintentional drowning if there are no intentional or undetermined injury codes present in the record: X60-X99, Y00-Y38, Y87, U01-U03. If intentional or undetermined injury codes are present in the record, T75.1 is coded as intentional or undetermined intent.

Nonfatal (ED visits and hospitalizations): All codes have a 7th character of A or missing.

Unintentional drowning: V90, V92, W16 with 6th character=1, W16.41, W16.91, W22.041, W65-W74 anywhere in the record.

Intentional drowning: X71, X92 and no other drowning codes present.

Undetermined intent drowning: Y21 and no other drowning codes present.

Primary diagnosis of injury (only traditional hospitalizations): S00-S99, T07-T34, T36-T50 with a 6th character of 1, 2, 3, or 4 except T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 with fifth character of 1, 2, 3, or 4, T51-T76, T79, O9A.2-O9A.5, T84.04, M97.

T75.1: Considered unintentional drowning if there are no intentional or undetermined intent injuries anywhere in the record: X71-X83, X92-X99, Y00-Y09, Y21-Y33, Y38, R45.88, T14.191, T36–T50 with 6th character=2,3,4 except T36.9, T37.9, T39.9, T41.4, T42.7, T43.9, T45.9, T47.9, and T49.9 where fifth character=2,3,4, T51–T65 with 6th character=2,3,4 except T51.9, T52.9, T53.9, T54.9, T56.9, T57.9, T58.0, T58.1, T58.9, T59.9, T60.9, T61.0, T61.1, T61.9, T62.9, T63.9, T64, and T65.9 where the fifth character = 2,3,4, T71 with sixth character=2,3,4, T74, T76. If there are intentional or undetermined intent injuries in the record, drowning was coded as intentional or undetermined intent.

Fatal

Death certificates

From 2009 to 2023, there were 1,200 drowning deaths of all intents among state residents (age-adjusted death rate: 2.04 per 100,000 population) (Table 2). Of these, 1,124 (94%) were unintentional (1.91 per 100,000 population). Unintentional fatal drowning also accounted for the majority of incidents among non-state residents, comprising 97% of such cases. On average, 75 state residents and 10 non-state residents lost their lives to unintentional drowning each year.

Males accounted for 56% of deaths (2.94 per 100,000 population), while females accounted for 44% of deaths (0.88 per 100,000 population) (Table 7, page 22). Fatal drowning rates were 3.34 times higher among males than females.

Children aged 1–4 years had the highest death rate (4.95 per 100,000 population) followed by adults aged 75+ years (2.17 per 100,000 population) and adolescents aged 15–19 years (2.07 per 100,000 population) (Figure 4). Adolescents aged 10–14 years had the lowest death rate (0.53 per 100,000 population).

Non-Hispanic (NH) Black or African American individuals had the highest age-adjusted death rate (2.26 per 100,000 population), followed by NH American Indian or Alaska Native individuals (2.11 per 100,000 population) and NH White individuals (1.90 per 100,000 population). Hispanic or Latino individuals had the lowest age-adjusted death rate (1.47 per 100,000 population).

District 9 had the highest age-adjusted death rate (3.15 per 100,000 population), followed by District 7 (2.69 per 100,000 population) and District 8 (2.52 per 100,000 population). District 1 had the lowest age-adjusted death rate (1.10 per 100,000 population).

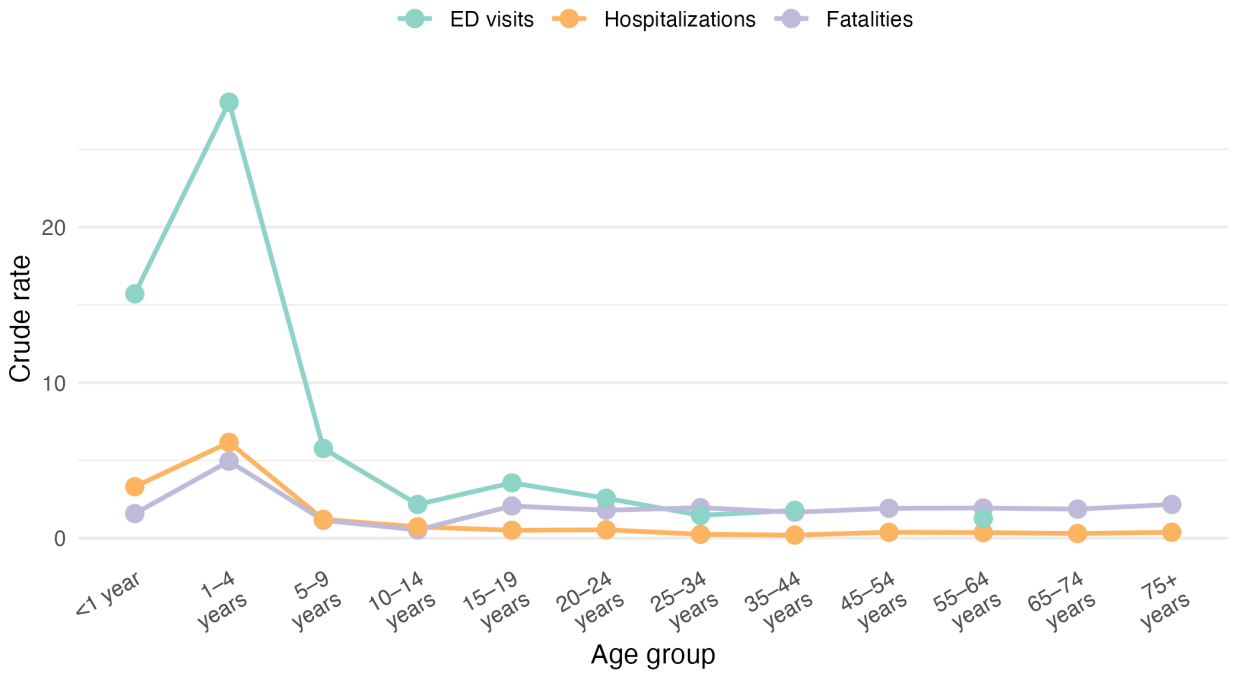
From 2009 to 2023, the unintentional drowning death rates fluctuated each year, showing periods of increase and decrease without a consistent upward or downward trend.

Table 2. Number of fatal and non-fatal drowning incidents that occurred in Oklahoma by data source, intention and individual residency, 2009–2023.*

	Death certificates†		Hospitalizations‡		Emergency department visits§		Total
Intent	State residents	Non-state residents	State residents	Non-state residents	State residents	Non-state residents	
Unintentional	1,124	155	243	13	268	302	1,825
Intentional	36	<5	17	<10	<10		66
Undetermined	40	<5					‖
Total	1,200	160	260	‖	‖		‖

* Blank cells indicate a zero count or no data.
† Includes data from 2009–2023
‡ Includes data from 2016–2023
§ Includes data from 2022–2023
‖ Data suppressed to prevent reverse calculation.

Figure 4. Fatal and non-fatal drowning rates by age group, Oklahoma, 2009–2023.*



* Proportions represent emergency department (ED) visits from 2022–2023, hospitalizations from 2016–2023 and fatalities from 2009–2023.

Medical Examiner reports

The IPS began statewide surveillance for fatal and non-fatal drowning in 1987, when the Commissioner of Health declared these injuries reportable for special study. From 1987 to 2011, the IPS conducted active surveillance of drowning injuries using death certificates, ME reports, and medical records. Due to staffing and grant requirement changes, detailed surveillance of drowning injuries was not feasible after 2011. However, the IPS continued to use hospitalization data and selected variables from death certificates and ME reports to track drowning injuries over time.

Drowning cases were identified from ME reports. Oklahoma has a centralized statewide ME system, and the Office of the Chief Medical Examiner is mandated to conduct medicolegal investigations on all sudden, violent, unexpected, and suspicious deaths in the state. The IPS maintains a longstanding partnership with the Office of the Chief Medical Examiner and receives ME reports for all non-natural deaths in Oklahoma. The Center for Health Statistics (CHS), within the OSDH, is the state entity authorized to issue and store death certificates and collect hospitalization and ED visit data. For more than 30 and 20 years respectively, the IPS has received death certificate and hospitalization data for injury surveillance from the CHS. The IPS has direct access to death certificate data through the agency's intranet. Cases identified from ME reports were linked to death certificates using last name, first name, month and year of death, and age. Death certificate data were used to determine the decedent's sex, age, race/ethnicity, and county of residence.

The IPS utilized the previously created detailed surveillance variables to review all drowning deaths that occurred in Oklahoma from 2014 to 2023. These variables include where the drowning occurred, if the decedent was seen at a hospital prior to death, contributing factors to the incident, decedent drug/alcohol use, if the decedent was retrieving an object or attempting to rescue a person or animal, decedent life jacket use, etc. A total of 793 deaths were identified during this

period. Detailed information on sex, age, and race/ethnicity can be found in Table 7 (page 22). This review will focus on decedent, geographic, and circumstance information to help identify potential areas to target drowning prevention efforts.

The most common locations of fatal drowning were lakes (28%), swimming pools (15%), bathtubs (15%), rivers (11%), and ponds (11%). Among drownings that occurred in swimming pools, 57% occurred at the decedent's home, 29% at someone else's home, and 7% at an apartment complex pool. For drowning incidents that occurred in bathtubs or hot tubs, the majority (89%) occurred at the decedent's home. The most common locations of fatal drowning varied by age group (Table 3).

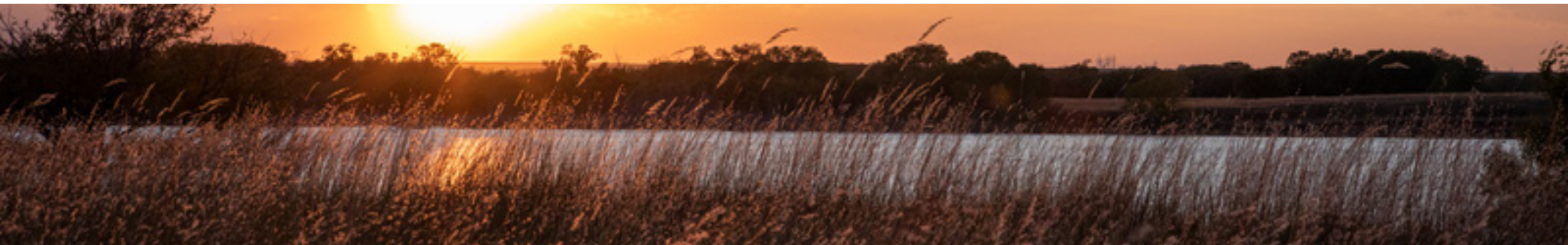


Black Mesa State Park in Oklahoma's panhandle along the tri-state border with Colorado and New Mexico. Photo by Kim Baker.

Table 3. Most common drowning locations by age group, Oklahoma, 2019–2023.

	Age (in years) (n, %)											
Rank	**<1**	**1–4**	**5–9**	**10–14**	**15–19**	**20–24**	**25–34**	**35–44**	**45–54**	**55–64**	**65–74**	**75+**
1	*	Swimming pool (56, 60%)	Lake (9, 35%)	Lake (6, 55%)	Lake (26, 45%)	Lake (22, 40%)	Lake (35, 31%)	Lake (25, 28%)	Lake (34, 34%)	Lake (26, 25%)	Lake (23, 28%)	Bathtub (15, 24%)
2		Pond (9, 10%)	Swimming pool (5, 19%)		Creek (9, 16%)	Creek (8, 15%)	River (22, 20%)	Bathtub (19, 22%)	Bathtub (15, 15%)	Bathtub (23, 23%)	Bathtub (19, 23%)	Swimming pool (13, 21%)
3		Lake (8, 9%)			River (7, 12%)	River (8, 15%)	Bathtub (13, 12%)	River (14, 16%)	Creek (11, 11%)	Pond (13, 13%)	Swimming pool (10, 12%)	Pond (12, 19%)
4		Creek (6, 6%)				Pond (10, 9%)	Swimming pool (10, 9%)	Creek (11, 13%)	River (10, 10%)	River (13, 13%)	Creek (9, 11%)	Lake (11, 17%)
5		Bathtub (5, 5%)					Pond (10, 9%)	Pond (8, 9%)	Swimming pool (10, 10%)	Creek (10, 10%)	Pond (9, 11%)	Other (6, 10%)

* Less than five deaths



Boating was involved in 14% of drowning deaths. Of these 114 deaths, 18 (16%) were crash-related while 96 (84%) were not crash-related. When the type of boat was known (n=69), the most common types involved were motorboats (36%), kayaks (13%), and pontoon boats (10%). For 8% of boating-related drowning deaths, the decedent was fishing at or near the time of injury.

Alcohol or drug use during swimming, boating, or other water activities can impair judgment, balance, and coordination. Nearly one-third (32%) of decedents aged 17 and older were definitely or likely drinking alcohol at the time of injury. Of these, 154 had a blood alcohol concentration of 0.08 g/dL (the national legal blood alcohol concentration limit for driving) or higher, and 88 had a blood alcohol concentration of 0.20 g/dL or higher. More than one-third (38%) of decedents aged 17 and older had a positive toxicology test for drugs at the time of death. Decedents may have tested positive for multiple substances (Table 4).

Motor vehicle crashes were involved in 12% of drowning deaths (n=95), most often in situations where individuals attempted to drive through high water and were swept away. There were 73 deaths that were definitely or probably related to flooding and 51 definitely or probably related to wind. Other contributing factors in drowning deaths included attempting to rescue another person or an animal (n=30, 4%) and attempting to retrieve an item at the time of injury (n=30, 4%). Thirteen drowning deaths were reported to be occupation related. Only six decedents were reported as wearing a life jacket at the time of injury, accouting for less than 1% of all decedents who drowned.

Available documentation and data sources limited the ability to assess and quantify the degree of supervision at the time of injury and the status/condition of physical barriers around swimming pools. For most deaths among children, bystanders were distracted, unaware of a drowning occurring, or physically not in the immediate area. Additionally, Oklahoma does not have regulations regarding private pool fencing. However, most deaths did not include mention of a physical barrier to prevent access to a swimming pool.

Table 4. Most common types of substances involved in drowning of decedents aged 17 and older, Oklahoma, 2014–2023.

Substance type*	Number of deaths	Percent
Alcohol	208	32%
Any stimulant	125	19%
Amphetamine/methamphetamine	112	17%
Antidepressant	64	10%
Respiratory medications	57	9%
Opioids	46	7%
Anti-anxiety medications	33	5%
Anticonvulsants	23	4%
Cardiovascular medications	21	3%

* Categories are not mutually exclusive. A decedent could be counted in more than one row.

The IPS created variables to track other factors that may have contributed to death, including cold water shock/hypothermia, physical disabilities, autism spectrum disorder, and seizures. However, the number of deaths involving these factors was relatively small. Other possible contributing factors were identified, and these are also noted within the table below (Table 5). Of note, half of drowning deaths associated with seizures occurred in a bathtub.

Drowning is different from other injuries because there are more deaths than hospitalizations each year. With the exception of firearm injury, all other mechanisms of injury have many more hospitalizations than deaths.[11] During the 10-year period, 38% of drowning decedents were seen at a hospital prior to death. Of those, 79% were treated for one day or less. Resuscitation was attempted for one-third of decedents (n=265) (Table 6).



Lake Tenkiller, one of Oklahoma's top scuba diving destinations. Photo courtesy of the Oklahoma Tourism & Recreation Department.

Table 5. Contributing factors to drowning deaths, Oklahoma, 2014–2023.

Contributing factor*	Number of deaths	Percent
Cardiovascular disease	139	18%
Seizures (history of or shortly before drowning)	52	7%
Cold water shock/hypothermia	39	5%
Lung issues (e.g., asthma, chronic obstructive pulmonary disease (COPD))	26	3%
Mental health problems	24	3%
Physical disabilities	20	3%
Autism spectrum disorder	12	1.5%
Dementia/Alzheimer's disease	10	1.3%
Diabetes	7	0.9%

* Decedents could have multiple contributing factors. Categories are not mutually exclusive.

[11] https://www.health.state.ok.us/stats/

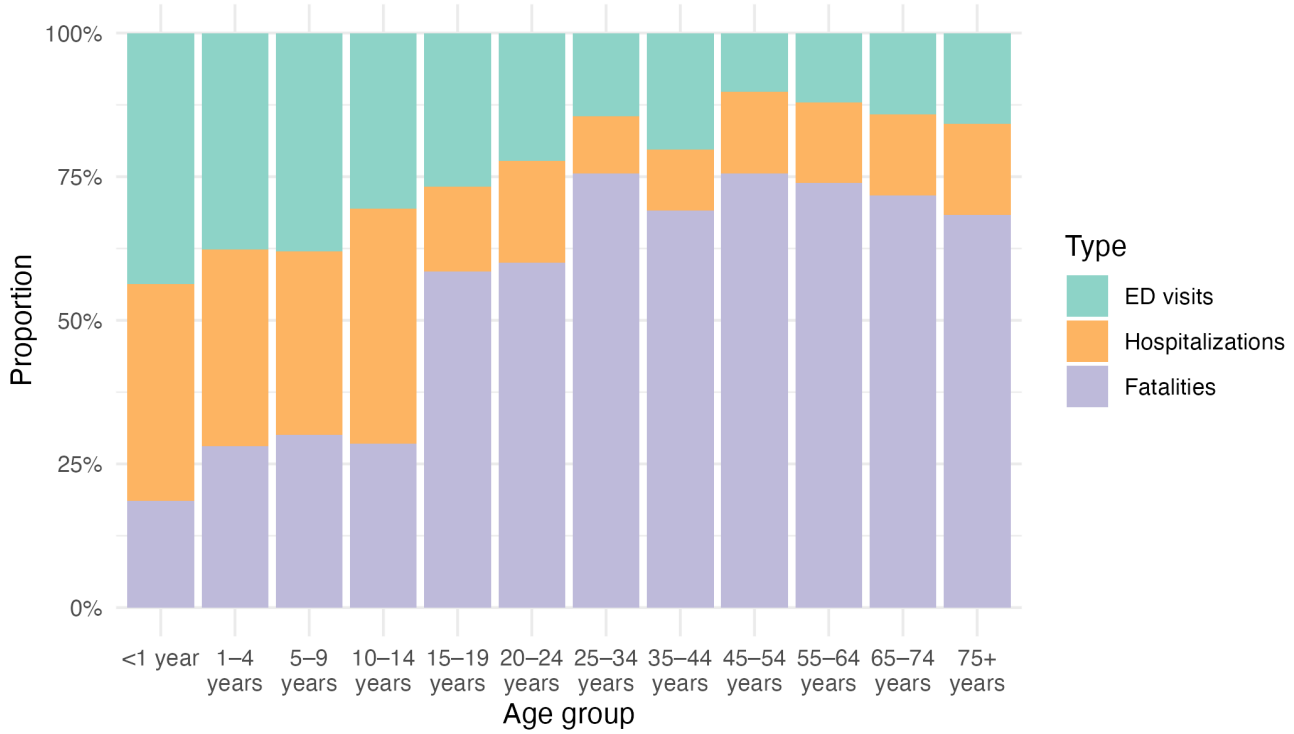
Figure 5 shows the proportion of drowning incidents by outcome and age group. Hospitalizations and ED discharges account for the majority of drowning incidents in younger children, whereas, for age 15 or above, fatal drowning incidents account for the majority of drowning incidents.

Table 6. Relationship of person attempting to resuscitate drowning decedents, Oklahoma, 2014–2023.

Relationship*	Number of deaths	Percent
Medical professional	248	31%
Family member	50	6%
Stranger	19	2%
Friend	13	1.6%

* Multiple people may have attempted resuscitation. Categories are not mutually exclusive.

Figure 5. Proportion of drowning incidents by outcome and age group, Oklahoma, 2009–2023.*



* Hospital data are from 2016–2023 and ED data are from 2022–2023.

Non-fatal

Hospitalizations

From 2016–2023, there were 260 drowning-related hospitalizations of all intents among state residents (age-adjusted hospitalization rate: 0.85 per 100,000 population) (Table 2, rate not shown). Of these, 243 (93%) were unintentional drowning-related hospitalizations (0.79 per 100,000 population). Non-fatal drowning-related hospitalizations in Oklahoma were predominantly unintentional, accounting for 93% of drowning-related hospitalizations among state residents. On average, there were 30 unintentional drowning-related hospitalizations among state residents each year. Hospitalizations that resulted in death were excluded in these numbers.

Males accounted for 60% of hospitalizations (age-adjusted hospitalization rate: 0.94 per 100,000 population), whereas females accounted for 40% (0.63 per 100,000 population) (Table 7). Overall, the hospitalization rate for males was 1.49 times higher than females.

Children aged 1–4 years had the highest hospitalization rate (6.16 per 100,000 population), followed by infants (<1 year) (3.31 per 100,000 population) and children aged 5–9 years (1.21 per 100,000 population). Adults aged 35–44 years had the lowest rate (0.20 per 100,000 population).

Non-Hispanic (NH) Black or African American individuals had the highest age-adjusted hospitalization rate (0.95 per 100,000 population) followed by NH White individuals (0.89 per 100,000 population) and NH American Indian or Alaska Native individuals (0.64 per 100,000 population). Hispanic or Latino individuals had the lowest age-adjusted rate (0.36 per 100,000 population).

Tulsa County had the highest age-adjusted hospitalization rate (1.20 per 100,000 population) followed by Oklahoma County (0.97 per 100,000) and District 10 (0.88 per 100,000 population). District 2 had the lowest age-adjusted rate (0.58 per 100,000 population).

The age-adjusted drowning-related hospitalization rates increased from 2016 to 2017, followed by a steady decline that reached its lowest point in 2020. Rates then rose again from 2020 to 2022, with a slight drop in 2023. Overall, the trend from 2016 to 2023 suggests a modest decline.

Emergency department visits

From 2022 to 2023, there were 276 drowning-related ED visits of all intents among state residents (age-adjusted ED rate: 3.73 per 100,000 population) (Table 2, rate not shown). Of these, 268 (97%) were unintentional drowning (3.56 per 100,000 population). On average, there were 134 unintentional drowning-related ED visits among state residents each year. ED visits that resulted in deaths were excluded from these numbers.

Males accounted for 56% of ED visits (3.88 per 100,000 population), while females accounted for 44% (3.20 per 100,000 population) (Table 7). Drowning-related ED rates for males were 1.21 times higher than females.

Children aged 1–4 years had the highest ED rate (28.03 per 100,000 population) followed by infants (<1 year) (15.71 per 100,000 population) and children aged 5–9 years (5.77 per 100,000 population). Adults aged 55–64 years had the lowest rate (1.27 per 100,000 population).

Non-Hispanic (NH) White individuals had the highest age-adjusted ED rate (4.53 per 100,000 population), followed by NH American Indian or Alaska Native individuals (3.07 per 100,000 population) and NH Black individuals (2.85 per 100,000 population). Hispanic or Latino individuals had the lowest age-adjusted rate (2.54 per 100,000 population).

District 3 had the highest age-adjusted ED rate (5.74 per 100,000 population), followed by District 7 (5.54 per 100,000 population) and District 2 (4.12 per 100,000 population). District 10 had the lowest

rate (2.40 per 100,000 population).
Age-adjusted ED rates decreased from 3.67 per 100,000 population in 2022 to 3.45 per 100,000 population in 2023. However, because of the limited number of years available for comparison, this observed trend may not yet be definitive.

Table 7. Annual average count and rate of drowning incidents by demographics, Oklahoma, 2009–2023.

Variable		Fatalities*		Inpatient hospitalizations†		Emergency department visits‡	
		Annual average count	Rate per 100,000 residents§	Annual average count	Rate per 100,000 residents§	Annual average count	Rate per 100,000 residents§
Sex	Male	57.27	2.94	18.12	0.94	18.62	3.88
	Female	17.67	0.88	12.25	0.63	14.75	3.20
Age	<1 year	0.80	1.58	1.62	3.31	1.88	15.71
	1–4 years	10.33	4.95	12.62	6.16	13.88	28.03
	5–9 years	3.07	1.15	3.25	1.21	3.88	5.77
	10–14 years	1.40	0.53	2.00	0.73	1.50	2.17
	15–19 years	5.47	2.07	1.38	0.51	2.50	3.56
	20–24 years	5.07	1.80	1.50	0.54	1.88	2.57
	25–34 years	10.47	1.96	1.38	0.25	2.00	1.47
	35–44 years	8.13	1.67	1.25	0.20	2.38	1.79
	45–54 years	9.27	1.92	1.75	0.38	1.25	
	55–64 years	9.20	1.94	1.75	0.36	1.50	1.27
	65–74 years	6.33	1.87	1.25	0.30	1.25	
	75+ years	5.40	2.17	1.25	0.38	1.25	
Race and ethnicity	American Indian or Alaska Native	6.93	2.11	2.25	0.64	2.50	3.07
	Asian	1.20	1.60	1.25		1.25	
	Black or African American	6.73	2.26	2.75	0.95	2.12	2.85
	Native Hawaiian or other Pacific Islander	0.33					
	White	49.13	1.90	31.75	0.89	22.25	4.53
	Hispanic or Latino	6.60	1.47	2.38	0.36	4.38	2.54
	Multiracial	3.73	1.75				
	Unknown	0.33		2.25		1.50	
	Other	0.33		1.25		1.25	

* Includes data from 2009–2023
† Includes data from 2016–2023
‡ Includes data from 2022–2023
§ Rates per 100,000 residents for age, sex, and race/ethnicity (adjusted for age). Blanks indicate small cell counts or unstable rates.



Lessons and considerations

Lessons and considerations for strengthening drowning prevention strategies and data systems in Oklahoma

Lesson 1. Comprehensive surveillance of fatal and non-fatal drowning circumstances requires time- and personnel-intensive data abstraction.

Consideration. Oklahoma does not have dedicated funding for drowning surveillance. Detailed data on fatal and non-fatal drowning incidents were collected from 1987 to 2011. However, since 2011, data collection has been limited due to funding and staffing changes. A dedicated funding stream and capacity building are needed to increase drowning surveillance capacity.

Lesson 2. Increased collaboration and data sharing among data owners would provide a more comprehensive understanding of drowning circumstances.

Consideration. Oklahoma has a statewide centralized medical examiner system. The IPS receives medical examiner reports for all non-natural deaths and has access to death certificate and ED/hospitalization data (for non-fatal drowning incidents). However, detailed circumstance data might be better documented through law enforcement and emergency medical services. Agencies collecting data on drowning circumstances should work together to share data and develop standardized data collection tools.

Lesson 3. Inadequate supervision and lack of physical barriers are contributing factors to childhood drowning.

Consideration. Community and public health leaders should actively promote strategies to minimize distractions for parents and caregivers. In Oklahoma, most drowning deaths of children aged 1–4 years occurred in pools while the parent/caregiver either did not realize the child was outside or was distracted by another activity. Encouraging the use of physical barriers around pools can help prevent young children from accessing a pool unsupervised.

Lesson 4. Alcohol and drug use are contributing factors to drowning deaths in Oklahoma.

Consideration. Alcohol and drug use are contributing factors to drowning deaths in natural bodies of water, but also in pools and bathtubs, in Oklahoma. Increasing awareness of the dangers of substance use during water-based activities may help reduce drowning deaths across the state.

Lesson 5. Lack of life jacket or personal flotation device (PFD) use contributes to/increases risk of drowning.

Consideration. Of the nearly 800 drowning deaths during the last decade in Oklahoma, only six decedents were known to be using a life jacket or PFD at the time of the incident. Encouraging the use of life jackets, especially in pools for non-swimmers and for all individuals in natural bodies of water, could significantly reduce drowning deaths. Even experienced swimmers may tire while swimming in lakes and rivers, experience a seizure or cardiac event, or encounter an unexpected current or drop-off.

Lesson 6. Increased funding and staffing would greatly impact drowning prevention efforts, including evaluation of programs.

Consideration. There are very few partners working on drowning prevention in Oklahoma. Additional funding and staffing are needed to expand efforts statewide and raise awareness of drowning as a preventable injury. Evaluation of prevention efforts would support the implementation and expansion of programs across the state.



Conclusions

Oklahoma's lakes, rivers, and reservoirs touch every part of life in the state. They provide water for farms and industry; support fishing, boating, and swimming; hold deep cultural meaning for Native tribes; and help drive the economy, recreation, and public well-being. These natural resources also pose notable safety risks, reminding us that water safety must be prioritized alongside access and enjoyment.

Drowning continues to be a major health and safety issue in Oklahoma, affecting both children and adults. Young kids, especially those aged 1–4 years, and males are at higher risk, and certain communities and regions experience more incidents than others. Hospital visits and emergency care show that drowning is not only fatal, but it also causes serious health emergencies. Although annual numbers fluctuate, data over the last two decades support the need for ongoing prevention efforts, increased safety awareness, and support for those most at risk.

Drowning incidents in Oklahoma most commonly occur in lakes, pools, bathtubs, rivers, and ponds—often close to home. Boating, fishing, and exposure to severe weather can contribute to risk. Among older teens and adults, alcohol and drug use are common contributing factors, and life jackets are rarely worn. Certain medical conditions, such as heart disease, seizures, and physical disabilities, can increase drowning risk, even in settings like bathtubs. Unlike most other injury mechanisms, drowning results in more deaths than hospitalizations each year. These patterns highlight the need for safe behaviors, including closely supervising children around water, avoiding substance use during water activities, and wearing life jackets.

Efforts to prevent drowning in Oklahoma require increased funding, improved staffing, and stronger partnerships. Without dedicated resources, detailed tracking of fatal and non-fatal incidents has been limited for over a decade, making it difficult to understand risk factors and trends. Sharing data between agencies, including medical examiners, hospitals, law enforcement, and emergency medical services, can improve data collection and analyses which in turn inform prevention strategies. Promoting supervision, physical pool barriers, life jacket use, and awareness about substance risks around water are key areas where simple changes could save lives.

Oklahoma's current drowning prevention efforts face major gaps due to insufficient funding, staffing, and collaboration. Strengthening data collection and analyses requires time and trained personnel to collect and analyze detailed data. Agencies must work together to standardize reporting and share drowning-related information to better understand the fuller picture of drowning. Prevention programs should emphasize proven safety measures, such as installing and maintaining physical barriers around pools, using life jackets in open water, and staying sober during water activities. With very few organizations actively engaged in drowning prevention statewide, expanding partnerships and evaluating program effectiveness are essential for future success. The IPS within the OSDH would be willing to provide leadership by offering valuable resources and guidelines designed to reduce drowning incidents if consistent funding becomes available.



Lake Eufaula, a 102,000 acre reservoir, is Oklahoma's largest lake.
Photo courtesy of the Oklahoma Tourism & Recreation Department.

Oklahoma Drowning Report

CDC Foundation